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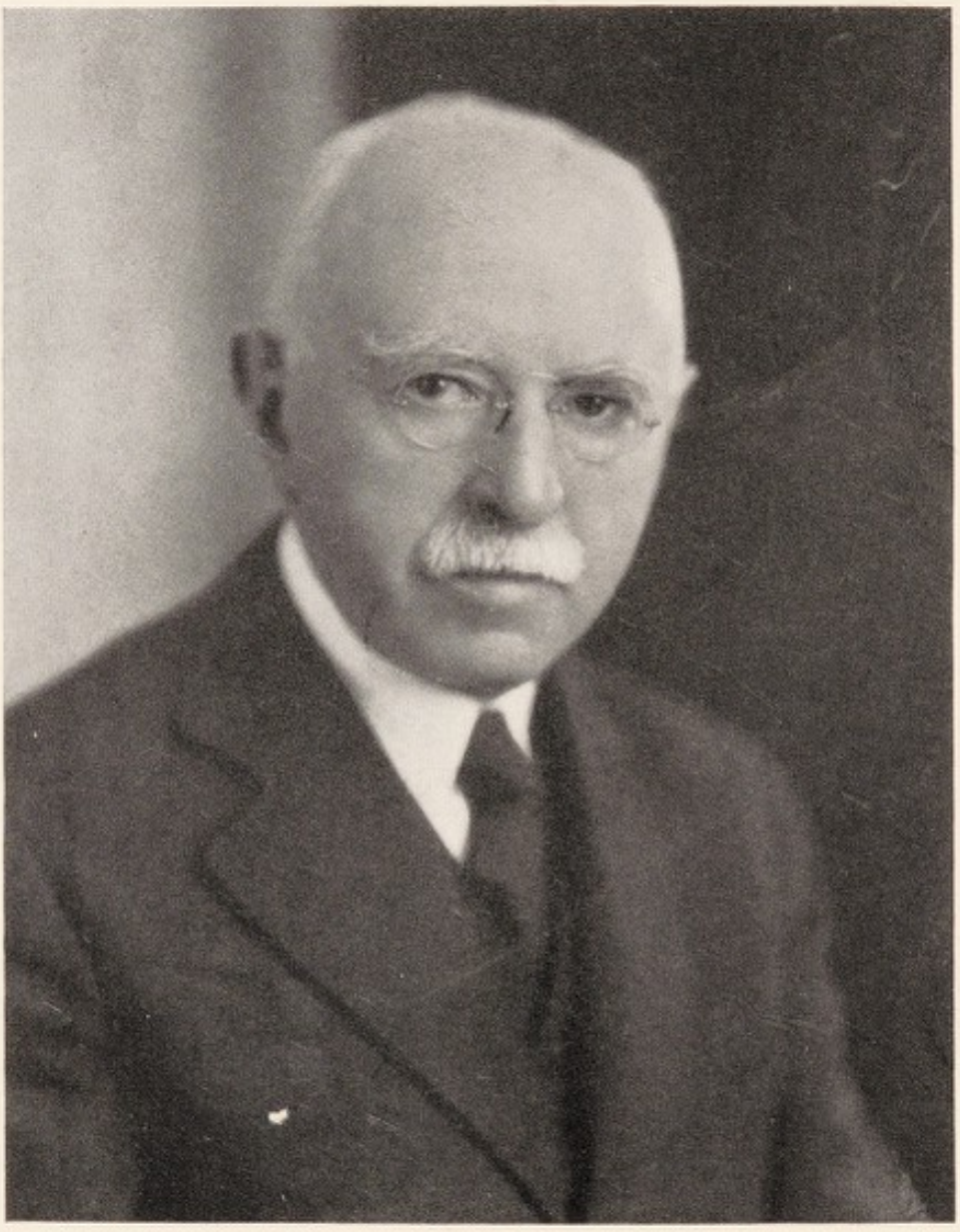

Dr. David Riesman

HIGH BLOOD PRESSURE
and LONGEVITY

and

Other Essays

Selected From the Published Writings

of

DAVID RIESMAN
M.D., Sc.D., LL.D.

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This volume is published
in
celebration of the
Seventieth Birthday Anniversary
of
Dr. David Riesman
which occurred on
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and is made possible through
the kind co-operation
of Dr. Riesman's many friends

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FOREWORD

"Happy is the man that findeth wisdom, and the man that getteth understanding."—Proverbs III, 13.

Ten thousand people had gathered in the Field House of the University of Wisconsin, June 21, 1937, to attend the Commencement exercises which reached their fitting climax in the granting of the honorary degrees. In response to the summons a slight but arresting figure in turn occupied the center of the stage. For the faculty Professor Weaver declaimed the following citation: "Upon the recommendation of the faculty and by vote of the Regents, I present to you for the honorary degree of Doctor of Laws, David Riesman, Professor of Clinical Medicine in the University of Pennsylvania. Profound scholar; active member of many learned societies; skillful physician; master clinician; inspiring teacher; humanist of wide influence outside and within his own profession."

In a felicitous vein President Dykstra concluded, "David Riesman, statesman in the field of medicine, whose lectures and clinics have been the source of deep and abiding values to multitudes of students, among them members of our own medical staff, by virtue of the authority vested in me by the Regents, I admit you to the degree of Doctor of Laws, honoris causa."

At that moment came the poignant realization that Doctor David Riesman must live for posterity through his spoken and written words as disseminated by his devoted students, house officers and associates. To future generations will be lost the engaging personality, the charming intimacy and the sustaining force of his friendship that no painter nor biographer may hope to capture for the canvas or the printed page. Gone, too, will be the quiet assurance of the ideal clinician, the unobtrusive dignity of his every word and act, and the calm voice of authority that is never raised in fruitless argument. Missing also the deeply sympathetic understanding and the intuitive human touch that characterize his every contact with the sick and the afflicted, putting to shame a counterfeit bedside manner. Further will his saving grace of humor, droll rather than robust, escape them. Withal the encom-

passing kindliness and devotion to his students and friends will probably be the most elusive of his personal attributes.

The breadth of his activities and the catholicity of his interests amaze even his most intimate friends. Abreast of every advance in medical science he nevertheless finds relaxation in astronomy and atomic physics. Medical history, particularly relating to the medieval period and the Dublin School, has received his close attention. He is a student of Shakespeare and yet finds time to delve into papal history and the Italian renaissance. Even admitting Doctor Riesman's superior intellect one must look to other sources to explain such an unusual measure of cultivation. To those fortunate enough to enjoy the hospitality of the Riesman home a partial explanation is immediately forthcoming, for the dinner table always carries the stimulating mental pabulum of enlightened conversation as well as the accustomed articles of calorific value. To his brilliant and engaging wife then Doctor Riesman owes much of his mental breadth. Into his advice that a young physician "should choose an understanding wife, for no man needs one more," may be read his personal experience. With characteristic insight he added that he wondered "why any woman would want to marry a doctor."

Fortunately Doctor Riesman will live through his teachings. Indeed, it would be impossible to draw a picture of the man without this relationship. No man of our period has more adequately fulfilled the Hippocratic pledge, "By precept, lecture, and every other mode of instruction, I will impart a knowledge of my art to my own sons; and those of my teachers, and to disciples bound by a stipulation and oath according to the law of medicine, but to none others."

Doctor Riesman's qualities as a teacher (and teacher he will be to the end) combine many fundamental attributes that may with profit be analyzed. Disdaining all tricks of pedagogics he relies almost exclusively upon a fine mastery of his subject. Yet there is not the slightest semblance of pedantry in his clinics or lectures. Students of every station, undergraduate or graduate, are held attentively by a master in organization. Citations from his vast clinical experience enrich every presentation and their effectiveness is greatly enhanced by the naturalness of their introduction. Here many are for the first time introduced to the fine heritage of medicine. Insidiously the fascinating story of our medical past is woven into the clinical presentation and almost imperceptibly the student is induced to extend his vista into the cultural aspect of medicine. Encyclopedic though his general and medical information upon a given subject may be, Doctor Riesman holds his teach-

ing responsibilities too seriously to attempt the spectacular extemporaneous approach. Never would his native caution and keen sense of propriety stoop to the fickle appeal of such demonstrations; hence the telephone call of the evening prior to each clinic to arrange all details. Nor is this practice a mark of clinical ineptitude or of a lack of assurance, for his bedside opinion based upon a logical and analytical approach is respected through the length and breadth of the land.

Deeply grounded in pathology Doctor Riesman has not allowed this advantage to warp his clinical approach. As a part of his singular mental endowment a curiosity as to the newer developments in medical science has made each new method a part of his own diagnostic and therapeutic armamentarium. It follows that his presentations lack the dogmatism of the pragmatic instructor, but the thinking listener soon senses a sounder philosophy in the contemplative teacher who has more than one string to his bow. Gifted with a faculty of apt expression his bedside discussions have a lasting quality. As the years pass one is struck by the frequence with which lessons learned by strikingly clear demonstrations at Doctor Riesman's hands have become an integral part of one's practice. The bruit over the eye balls in Graves' disease, the soft eye ball of diabetic ketosis, the tachypnoea and delirium in rheumatic pericarditis, the preicteric pruritus of the eyelids, and the absence of herpes in typhoid fever are among the gems that are quickly "recalled from the mental pigeon-hole" where he placed them years before. As a mark of his influence almost forgotten drugs, such as apocynum and aspidospermin, are still rescued by his former students to bridge therapeutic gaps. His instruction is at one time both practical and profound. Moreover its provocative quality excites a desire for a greater familiarity with the subject under discussion and recourse to the literature is inevitable. This end is facilitated by his kindly interest in all men.

Unstintingly Doctor Riesman has given of his time and energy to several institutions in Philadelphia, but a lion's share of his interest has always been diverted to the Philadelphia General Hospital. "Every great institution is the lengthened shadow of a single man." It would be hyperbolic to attribute such a relation for Doctor Riesman to so ancient an institution as Blockley; but the fact remains that much of the soundness of its present medical service may be clearly traced to his devotion to its welfare. When his vision of semi-private pavilions for the sick of moderate means is here consummated through public or private support, they should in propriety bear his name.

At the complimentary dinner to Doctor Riesman on the occasion of his seventieth birthday he remarked in explanation of his sustained mental vigor, "I have maintained contact with 'young men' of all ages." There flashed to mind an episode of some years past. A senior medical student at Pennsylvania had written to Doctor Riesman suggesting a deviation of the arterial blood from the diseased kidney through the inferior suprarenal branches of the renal arteries to the adrenal bodies in explanation of the hypertension of nephritis. The reply (May 19, 1911) is so typical of the inherent thoughtfulness and kindliness of the man that it is reproduced to essential detail:

"Your theory is very ingenious. I am sorry that you did not advance it during one of my ward classes or public clinics, as I should have been much interested to have had it discussed by the other students." (Then follow several pertinent quotations from the literature.)

"It would be interesting to follow the question up experimentally and at the autopsy table. I do not know whether anyone besides yourself has fully appreciated the significance of the vascular relation between the kidney and the suprarenal gland. Come and see me some morning, and let us talk the matter over."

The idea itself proved fruitless; but another medical student came under Doctor Riesman's spell. The favored group that has felt the stimulus of his friendship and the warmth of his guiding hand, is relatively large. Students, interns and associates swell the number. Then, too, Doctor Riesman has been one of the most effective speakers in medical gatherings throughout the country, but unfortunately these contacts lack the intimacy that fully measures the man. In widely scattered journals and text books some two hundred articles on a host of medical topics have been published by Doctor Riesman. All of them bear the mark of clinical insight and some are medical classics of lasting merit. A representative group of these publications is herein assembled to preserve them for posterity.

To you, our highly beloved Chief, this volume is dedicated by your "professional children" in the hope that it may carry some measure of your beneficent influence to a wider circle of medical men of the present and the future.

WILLIAM S. MIDDLETON.

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THE FAILING HEART OF MIDDLE LIFE[1]

Many men lead active professional and business lives; they may even live reasonably well according to our present standards, but when they reach the age of fifty or thereabouts something happens that was not foreseen by them or by their medical advisors. In ordinary parlance they go to pieces. Upon analysis the disintegration will usually be found due to some change in the heart or circulation. The man who up to the moment of the appearance of the symptoms was active and in the possession of all the energy of the best years of life suddenly becomes an old man.

What is the nature of this process which plays such havoc among useful men, more rarely among women, and in a time of life that we like to call the prime? To be sure there is no definite agreement as to what should be called the prime of life or middle life—youth sets the date early, age postpones it. One day not long ago a student presenting a case before my class began, "Mr. X is a middle-aged man of 40." My heart sank within me. Does middle life begin at 40 or at 50 or, as I like to think, at 55 or 60, partly with reference to the fact that the average span of life has been prolonged to about the age of 56? Women surely are pushing the date farther and farther onward—in dress, in general activity, even in the onset of the menopause, the women of today at 50 are much younger than their mothers were at the same age period. Perhaps instead of taking a particular year, middle life should be dated from a time when a change in function manifests itself from which a beginning wearing down of the machinery can be definitely inferred. Middle life is thus rather a physiologic than a chronologic period.

The disease of the heart to which in the majority of cases the physical breakdown is due is not one affecting the valves—it is as Christian has called it, non-valvular heart disease. Whatever we may know about the clinical manifestations, as to the causes of this condition we are very much in the dark. Sometimes there is an associated hypertension which may be looked upon as the cause. But since we do not know much about the causes of hypertension we are only pushing the problem one step farther back. In other

[1] Read before the American College of Physicians, Boston, April 10, 1929.
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instances the tension is normal or even low. In such cases the changes are usually primary in the heart—a coronary endarteritis or, more often than we think, some functional change for which at present we have no anatomic substratum.

Like Christian (South. Med. Jour., Jan. 1927, p. 28) I have stood more than once in perplexed wonder at the autopsy table when I found an apparently normal heart in a case in which death had been due to cardiac failure. The converse was also not unusual, namely, the finding in a case of accidental death extreme disease of the heart wall though during life there had been no symptoms whatever of a cardiac nature. Such observations prove conclusively that the diseased heart often possesses large factors of safety and suggest that the symptoms are expressions of functional disturbances rather than of anatomic defects.

Failing heart and heart disease are convenient terms, but in their strict meaning they are not sufficiently inclusive. They are largely anatomic concepts—the time has come for a more physiologic interpretation of heart failure. Our conception of the failing heart must encompass the whole circulatory system, including the capillaries. It must also include those obscure metabolic changes arising from defective circulation in the organs and especially in the body musculature.

Some insight into the physiologic disturbances accompanying or produced by heart disease, is gained through recent biochemical and metabolic studies. Among other things these have shown that in many cases of heart disease there is an increase in the minute-volume of blood and that with improvement, especially under the action of digitalis, there is a diminution of the total circulation, of the minute-blood volume (Harrison and Leonard; Cohn and Stewart). It has been found, furthermore, that owing to an oxygen deficiency in cardiac cases more lactic acid is formed than under normal conditions. While in health a large part of the lactic acid is resynthetized to glycogen, in diseases of the circulation a good deal of the lactic acid formed undergoes destruction by conversion into carbon dioxide and water which entails a distinct loss to the system. Owing to the increased lactic acid production cardiac cases at times present a tendency to acidosis which shows itself in a highly acid urine and in a lowered urinary pH and which may be responsible for certain forms of cardiac dyspnea. To what extent the heart as muscle tissue participates in the altered lactic acid metabolism is not yet known. Many cardiac cases also show a high basal metabolic rate.

The great increase in deaths from heart disease is I believe due to the type of middle life myocardial failure of which I am speaking. Disease of the heart has risen to first place in mortality tables. The Metropolitan Life Insurance Company's statistics for 1928 show a death rate of 143.4 per 100,000 insured, while that from tuberculosis was exactly 90, the lowest ever attained. This marks a drop in tuberculosis of 34.7% during the present decade while the death rate from heart disease has risen from 117.4 in 1921 to the above-mentioned figure. In the United States Registration Area the cardiac mortality was 111.2 per 100,000 in 1910 and nearly 160 in 1924.

To a certain degree the increased death rate from heart disease is not a debit but a credit, since owing to the enhanced longevity and to the fact that fewer persons die of tuberculosis and other communicable diseases, more individuals reach the age period at which the liability of death from heart disease attains high figures. Nevertheless there is also an actual increase irrespective of the foregoing facts. It is this increase that should be investigated and combated by education of the people and of the medical profession.

When we come to look for the causes of myocardial disease we find certain outstanding facts which while not precisely explanatory of the cause throw considerable light upon the origin of the trouble. Syphilis and rheumatic fever in my experience play only a small part in the myocardial disease coming on at middle life. Worry, overeating, sexual excess, intense ambition and striving for success, in other words, the strenuous life, are antecedent conditions.

Not only overeating, but irregular and hasty eating, and insufficient sleep are important etiologic factors, especially in the lives of professional men. Focal infection in all probability plays a role but it is difficult in the majority of cases to trace a direct connection because when a focal infection is discovered it has probably been operative so long that its removal though indicated has but little effect. The conclusion is likely to be drawn that the focus played no part in the development of the cardiac disease.

Over-indulgence in exercise is undoubtedly a cause of cardiac damage. There are many whose economic circumstances in early life precluded systematic exercise, but when they get to be 45, 50, or older then are in a position to indulge in golf—some do so with impunity, others pay a heavy penalty. Men who want to take up golf in middle life ought not to do so without a thorough physical examination which ought to be repeated after they have played a little.

The various exciting causes that I have enumerated are operative in the majority of Americans that have reached the mid-period

of life. Why do they not all succumb to myocardial or cardiovascular disease? Because something else is required—an underlying condition which is given in a large number of cases by heredity.

Heredity: During the past ten years there has been an evident swing of the pendulum away from the environmental factors in disease, including the micro-organismal agents, toward the constitutional factors. Some perhaps are permitting the pendulum to swing too far but no one who has practiced medicine with an open eye can overlook the fact that the bacterial or other environmental influences are scarcely sufficient by themselves to cause disease, barring of course trauma and semi-traumatic agents, such as poisons and harmful dust.

During the period when Philadelphia was one of the worst typhoid-infected cities in the land, a period coinciding with my early years in practice, I was struck by a singular circumstance in two families of my acquaintance. Nearly every member of the one at some time had typhoid fever, while in the other family, comprising individuals in a number of separate households, there was not a single case of typhoid fever, although the same contaminated drinking water was consumed by all. That observation it seems to me warrants the conclusion that a constitutional factor protected the second family, that factor being absent in the first; or to put it another way, the members of the typhoid family inherited from generations back a high susceptibility.

Now when we come to study myocardial disease or diseases of the circulation a somewhat similar fact emerges. We find families that seem to be entirely or almost entirely immune to mid-life circulatory diseases. I have gathered statistics of a family related to me by marriage—in two generations there were 56 members all born in Philadelphia and belonging to several different households. Of the 56, 11 have died, not one of myocardial disease. Those living range in age from 40 to 85 years. By contrast I know a family in which two out of four have died of angina pectoris; in another of five members one has died of angina pectoris, another is seriously ill with coronary disease.

The familial circulatory taint need not assume the identical form in the different members—it may be angina pectoris in one, coronary thrombosis in another, apoplexy in a third, and ordinary myocardial degeneration in a fourth. When such related diseases affect the same family we are warranted in inferring that a constitutional anomaly exists, a taint of the genotype without which whatever external factors may exist are inoperative or at least incapable of doing the same degree of harm. I shall today not enter into the

possible anthropologic features that might lead to a recognition of the abnormal genotype. George Draper, Julius Bauer, F. Kraus and others have indicated the pathways to be followed in this difficult field. What I want to emphasize is the importance of a study of the family history. It will be found that short life is as much an hereditable trait as longevity, which is undoubtedly a family characteristic. That there are exceptions in any given family does not disprove the truth of the statement. I am sure the myocardial disease of middle life of which I am speaking is preëminently a familial or hereditary affair, a fact of which anyone can convince himself by studying the family trees of his patients.

Obesity is another possible etiologic factor. I am not sure whether my experience tallies with that of other men but I have come to believe that the hydrolipemic type, the excessively fatty individual, does not as a rule fall a victim to presenile myocardial disease. It is the overweight solid type, men and women whose fat is firm, who are not very far above the ideal weight, not grotesque in their obesity, among whom we find myocardial disease most frequent. It can not however be said that there is a characteristic physical type liable to myocardial disease. All physiques are met with, the tall and lank, the shortnecked and solid.

Pathology. The actual pathologic conditions vary widely and are, as I have indicated, at times disproportionate to the symptoms during life. Eppinger reports two cases that are of interest in this connection. Both had advanced decompensation, in one the heart at autopsy was markedly diseased, in the other very little could be found.

Many use the term myocarditis for the diseased condition I am discussing. In a strict sense that word is not always applicable, for the criteria of inflammation are frequently wanting. We meet with the same complication in our nomenclature of kidney affections. Because of the similarity of concepts and of morbid states, I believe we might use the terms myocarditis and myocardosis as we use those of nephritis and nephrosis.

The distribution of myocardial disease is often more important than the type. When it attacks the conductive system, it may produce striking conditions out of proportion to the extent of the lesion. In many instances, in more than is usually imagined, the basis of myocardial disease is an endarteritis of the coronary vessels.

Symptomatology: Patients with myocardial disease present, in the beginning at least, four principal types of symptoms that might be called:

I. The respiratory.
II. The digestive.
III. The painful.
IV. The oppressive.

The respiratory is the most common type. An individual previously well, perhaps fifty or fifty-five years old, experiences shortness of breath on effort or he finds himself seized with paroxysms of air hunger, especially at night, which compel him to sit up and gasp for breath. I have seen this latter type as the very first manifestation of serious structural disease of the heart, in the entire absence of any valvular defect or of any previous suspicion that the heart might be diseased. The patient, and sometimes the physician, attributes the shortness of breath to lack of exercise, to obesity, to indigestion, the last especially if there is considerable gaseous distention. A careful examination in the way I shall later detail will guide the physician to the vitally important correct diagnosis.

Sometimes in addition to a slight shortness of breath the myocardial patient has a racking cough usually out of proportion to the signs found in the lungs. Such patients are looked upon as having chronic bronchitis or asthma, the myocardial cause being overlooked.

II. The digestive type:

This is perhaps the most important to understand as errors in diagnosis are more frequent than under other conditions. Elsewhere I have spoken of the gastric masquerades of myocardial disease (Journal of the American Medical Association, November 17, 1928, Volume 91, 1521). A case report will illustrate this phase of the subject. Mr. T., a successful and somewhat opinionated financier, complained of poor appetite, gaseous distension, constipation and insomnia. His case had been diagnosed as one of stomach and liver trouble and he had been sent to Vichy on the basis of that diagnosis. Under a rigid regime which excluded all meat from the dietary, he lost a good deal of flesh and came back to Philadelphia much worse than he had been. On examination I found a tall spare man of pale sallow complexion with labored breathing, which he said was due to "gas." The heart was markedly enlarged to the left, the liver extended three fingers' breadth below the costal margin. I placed the patient on a liberal diet and gave him digitalis, a laxative and a mild hypnotic with the result that all his symptoms disappeared, the liver returned to normal size, and he was able about the middle of January to go to Florida.

The gastric disturbances are often so marked—anorexia, nausea, even vomiting—that malignant disease may be suspected and yet the whole syndrome harks back to a myocardial defect.

Failure to make the proper interpretation is usually due to the absence of a cardiac murmur which needs must be present to induce some physicians to diagnose chronic heart disease. Yet there are more non-valvular than valvular cases of chronic heart trouble.

III. The painful type:

Little need be said about the anginal type—the pain in location, severity and psychic concomitants, is usually suggestive or pathognomonic of cardiac disease. Variations occur, however, and require careful study, particularly those in which the pain is referred to the gall bladder region or to the epigastrium. I have seen quite a number of cases in which it was difficult at first sight to tell whether the patient had angina pectoris or gall-bladder colic. It must also be remembered that chronic cholecystitis or gall stone may in its turn cause cardiac disease.

Under the anginal type I include coronary thrombosis, an increasingly common cause of failure of the heart in middle life. The growing frequency may be due to a better acquaintance with the disease, although I have come to think that there is an absolute increase in cases of coronary occlusion.

IV. The oppressive type:

Perhaps it is not justifiable to make a separate class of this, yet it is sufficiently common and distinctive, although it soon merges with one of the others. The patient on walking experiences a sense of oppression either across the upper or mid-sternal region or in the epigastrium. If he stops it passes off, sometimes with a little belching, sometimes without any gastric element. The trouble appears to be mild, yet it involves the possibility of sudden death. It has been called angina sine dolore but there is no angor animi and the patient unless he is a doctor rarely considers the symptom significant.

Many persons, especially men of prominence, die according to the newspapers of acute indigestion. The additional statement is often made that the dead man had not complained of heart trouble before. Apart from the probable fact that death was not due to indigestion but to disease of the heart, I always doubt whether the attack was not preceded by symptoms which were of a cardiac nature but were not interpreted either by the patient who failed to have himself examined or by the doctor if an examination was made. To illustrate: Mr. S., 54 years of age, was passed for life insurance for $150,000 one month before I saw him in an attack of coronary thrombosis that ended fatally in 48 hours. When the agent came with the policies he brought policies for an additional $150,000 which the patient declined. Within one month after paying a single premium, Mr. S. was dead. Now here is the interesting point in the history. It appears that for some time prior to taking out the insurance Mr. S. had complained of a little mid-sternal oppression unaccompanied by pain. He thought it was indigestion or something of that sort, and as he was not seriously handicapped

otherwise, he made nothing of it. His blood pressure, urine, and physical condition during the various insurance examinations were all found normal. Of course, when I saw him, his ashen appearance, his low blood pressure, the terrific pain, and the action of the heart all testified to the approaching dissolution. Could such a catastrophe have been foreseen or suspected as a possibility if note had been taken of the oppressive seizures and a more thorough purposive examination had been made? Would it not be well in all such cases, if the physical signs are negative or equivocal, to make an electrocardiographic examination? I am inclined to think that in such a way the insurance companies might save themselves heavy losses and, what is more important, any defects in the patient's mode of life might be corrected.

Common to nearly all forms of myocardial disease except the anginal are subnormal temperature, a tendency to emaciation, easy fatiguability and a general lack of mental and physical endurance. These symptoms may be associated with emotional instability and a hair-trigger temperament previously not present in the patient.

Neither singly nor in their totality do the aforementioned symptoms justify a diagnosis of myocardial disease, but they suggest such a possibility even if the signs are not conspicuous.

Diagnosis: Aside from the symptoms the diagnosis of myocardial disease is based upon the following objective criteria:

The most important is increase in the size of the heart. This is rarely absent. It is determined:

a. By locating the apex beat by palpation or inspection although this is sometimes impossible because of its faintness.

b. By careful percussion of the cardiac outline. While some clinicians have no faith in percussion for the purpose of determining the cardiac boundaries, I personally believe it is a useful method provided a proper technique is employed, namely, light percussion upon a finger held firmly against the chest wall. The X-ray is the final arbiter in this matter.

Auscultation is less informing. In the early stages when the diagnosis is most essential it may show very little to which exception can be taken. But if one carefully examines such cases he may find a dulling of the first sound at the apex or perhaps a treble sound—an apparent doubling of the first sound—the anapest type of gallop. Such a rhythm in a case presenting an otherwise unexplained dyspnea or failure of strength or ill-defined gastric symptoms is to my mind very suggestive of myocardial disease. This particular change in the heart sounds has helped me many times to a correct differential diagnosis as between a purely gastro-intes-

tinal affection and myocardial disease. I want to emphasize that I am not speaking of the gallop commonly heard in mitral stenosis in which the second sound appears to be split or reduplicated, but of the one which is more like the canter of a horse, or as I have said, the anapest type of gallop.

What about arrhythmia?

The significance of this abnormality depends somewhat upon the kind but also upon other factors not always discoverable by physical examination. What I have in mind in this connection is the following: A persistent total arrhythmia is indicative of auricular fibrillation but not every case of this warrants a serious prognosis; much depends upon associated conditions, particularly upon the presence or absence of mitral valve disease. I know individuals who have lived for years with a constant total arrhythmia and are leading active lives. There may be a small patch of myocardial disease that upsets the rhythm without in any way disturbing the main functions of the heart.

Extrasystoles may be significant yet there are cases in which extracardiac factors, toxic causes, seem to produce the arrhythmia. The heart behaves otherwise in a normal manner.

The blood pressure has no constant characteristics—it may be high and hypertension is perhaps most common, or it may be normal or low. Usually it falls in the coronary thrombosis cases precipitously, in other cases more or less slowly. A considerable fall in a patient who has no pain but either the respiratory, digestive, or oppressive type of symptoms adds to the gravity of the prognosis.

The electrocardiograph as a rule is very helpful in the diagnosis and in the prognosis of myocardial cases, but it may lead us into error. My experience has been that when the instrument reveals myocardial disease then that disease is present. But when the electrocardiogram is negative a serious myocardial affection may nevertheless exist. I have at the present time under observation three patients in whom the electrocardiogram is normal but in whom everything else points to a definite myocardial damage.

While myocardial disease as such produces no murmur, a murmur may be present, which however in no way vitiates the belief that the disease is non-valvular in origin. Such a murmur is often heard at the aortic area and is transmitted upwards to the clavicles over which it is sometimes heard more loudly with a Bowles stethoscope than over the aortic area itself. This murmur is not due to stenosis of the aortic orifice; it may be due to sclerotic changes in the root or arch of the aorta or to dynamic factors connected with an hypertrophied heart or a dilated aortic arch.

A systolic murmur may also be heard at the mitral valve. Many on hearing such a murmur diagnose mitral disease, mitral insufficiency. That is a wrong interpretation if it implies that the murmur or the regurgitation is due to an old valvulitis. The murmur is a secondary feature of no great moment in the diagnosis but of some importance in prognosis, as it indicates a weakening of the mitral ring or is evidence of extension of the sclerotic process to the valve leaflets.

Treatment: When an individual consults his doctor, whether for the purpose of a health examination or for other reasons, the physician should carefully go into the family history and estimate the pathologic load upon the family tree. The discovery of an inherited taint, especially of the heart and circulation, should lead to regulation of the man's or woman's life in the direction of conserving the integrity of that system.

Foci of infection should be removed if their removal does not entail any undue risk and if a reasonable connection can be conjectured between the infection and the cardiovascular disease.

Perhaps the most important point to bring to the attention of the people in connection with myocardial disease is the desirability of regular physical examinations which the profession has been preaching, but so far not with much success. The public must realize that to pay for a physical examination in apparent health is money well spent.

Treatment must always concern itself not only with the relief of the immediate distress but especially with the prevention of further attacks. The primary essential in treatment is rest—physical and mental. If the evidence indicates definite coronary artery involvement, which, it should be remembered, can exist without causing pain of any sort, then the rest must be absolute and prolonged. Four weeks is the irreducible minimum. During that time the patient must use the bed pan unless as not uncommonly happens, the strain is too great; then the sentence may be commuted to the commode. The doctor must use judgment.

Those in whose families cardiovascular disease has occurred should either not smoke at all or should use tobacco with great moderation.

The meals should be small, especially the evening meal, and the food simply prepared. Unless there are complications, no special dietetic restrictions are necessary except that pastry, fried food, fresh bread, etc., should be omitted.

One of the bugbears of myocardial patients is gas, which is usually attributed to some article of the diet. I have however observed just as much distress, often even more, after a light meal

such as a cup of broth, a glass of milk, or even a glass of water as after a mixed meal. Fluids in excess cause discomfort—I limit my patients to 1200 or 1500 cc., which includes water, milk, broths, orange and other fruit juices, all measured as liquids. There are particular cases that may have to be put on a milk diet or upon butter milk or acidophilus milk for a few days in the beginning of treatment but after improvement, cereals, dry or cooked, with sugar rather than with salt, chicken, chops, oysters, cooked green vegetables, stewed fruit, especially apple sauce, orange juice, thin toast (Melba toast) may be added.

I am very partial to the use of sugar in some form in myocardial cases and sometimes prescribe pure cake chocolate—not milk chocolate.

If patients complain of a bad taste or have a dry tongue I order the chewing of gum, an all too popular habit that I despise in health but encourage in sickness

If the gas is not controlled by diet, an enema will usually give relief. Hot compresses, flaxseed poultices, the rectal tube, pituitrin are measures to combat the severer cases of distension.

Insomnia is often the most distressing of all symptoms. Sometimes the bromides suffice although usually stronger remedies must be given—allonal, medinal, etc. But in the majority of cases nothing is so helpful as the opiates, preferably codein, but there should be no hesitation in giving morphin sulphate hypodermically in grains ⅛ to ¼ with a little atropin. When morphin is used there is of course some danger of habituation but by gradually reducing the dose or occasionally substituting distilled water one can guard against this.

Digitalis: In the severe coronary cases I prefer to wait with the use of digitalis until the hyperacute symptoms have abated. Then and in other myocardial cases from the beginning digitalis may be given in moderate doses. It will be found beneficial whether fibrillation exists or not. I shall not say much about the other cardiac stimulants except that my preference is for caffein sodiobenzoate.

Psychotherapy: This is the most important part of the treatment. In no condition is the influence of mind over matter so clearly exhibited. An encouraging word or gesture makes the patient eat and sleep better with all the good results that ensue therefrom.

Nauheim Treatment: I have seen good results from treatment at spas, especially Nauheim, and from similar treatment at home. It is unnecessary however to go into details.

Exercise: In the severe cases, especially in those dependent upon coronary disease, exercise is forbidden for a long time. As Sir Clifford Allbutt has said, "The patient must crawl before he

can walk." The passion for golf often drives men to over-exert themselves, to do more than the circulation can stand.

The first thing the patient does when he is better is to sit up in bed, then he sits in a chair for increasing periods, then he takes short level walks, then a motor ride of one hour from room back to room, then longer walks and rides, then lastly, a little golf on a non-hilly course.

By such measures many a man who has shown definite physical and electrocardiographic evidence of myocardial disease may be restored to health and usefulness. But if he has offended nature he must be told as a final injunction, "Go and sin no more."

MYOCARDIAL DISEASE AND ITS GASTRIC MASQUERADES [1]

One of my earliest recollections in the practice of medicine is as follows:

A medical friend of mine on withdrawing from practice to enter laboratory work asked me to look after his family, including an elderly gentleman, his grandfather. The latter was a retired builder who appeared to be in good health except for one complaint: on carrying home the market basket, a daily custom, he would experience a sense of oppression in the lower sternal region and in the epigastrium. He would rest for a moment to bring up a little gas and then, completely relieved, would walk home the remainder of the way in comfort. He had no pain, no feeling of anxiety, only, as he expressed it, "indigestion and gas."

I was just out of the hospital and had the vast experience of three months' medical training to my credit. On examining the old gentleman I found beaded radial arteries and prescribed glyceryl trinitrate on general principles. As the patient did not improve, I took him to a noted consultant, who diagnosed the case as one of indigestion and ordered phenyl salicylate and sodium phosphate. A few weeks later, when apparently convalescing from a mild attack of grip, the patient suddenly died in bed.

It was, I think, my first death in private practice. Neither I nor any one in the family had been prepared for it. The shock was great and the lesson for me lasting.

Since that memorable day I have seen a goodly number of cases in which symptoms of indigestion masked organic heart disease and have observed with interest how many prominent persons die, according to the newspapers, of acute indigestion.

The gastro-intestinal tract is so intimately connected with the heart through the vagus nerve that reciprocal disturbances are not surprising. It is perhaps easy to understand why gaseous distention of the stomach should cause palpitation and precordial distress. Conversely, the heart may produce symptoms in the region of the

[1] Read before the Section on Gastro-Enterology and Proctology at the Seventy-ninth Annual Session of the American Medical Association, Minneapolis, June 14, 1928.

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stomach or the upper part of the abdomen. Of these symptoms, those resulting from passive congestion of the stomach in states of decompensation are comparatively easy of explanation. Others are very obscure. I shall illustrate some of these more obscure types which are clinically important in proportion to their obscurity.

Case I.—Dr. C. began to have epigastric fulness and pressure, with loss of appetite and great fatigability. He lost flesh, looked bad, was despondent, and believed himself the victim of malignant disease. An X-ray examination seemed to bear out the suspicion of a cancer of the stomach. When I inspected the roentgenograms I was unable to agree with that opinion. Examination of the patient showed slight enlargement of the heart with feeble flapping sounds, low blood pressure, and absence of any mass in the abdomen. On further questioning he stated that he was a little short of breath on exertion and that he did not have any vomiting or pain.

Weighing the facts carefully, pro and con, I came to the conclusion that his symptoms were due to myocardial weakness. I advised rest, digitalis, and a reasonable diet. For some time after leaving the patient I was uneasy, thinking that perhaps after all he might have malignant disease. But when he came to see me a few months later he was practically a well man.

In this patient the myocardial weakness expressed itself under the guise of loss of appetite, gaseous distention and pressure, marked fatigability, and shortness of breath which was not at first mentioned.

Case II.—Dr. P. complained of fulness and oppression after meals and of a sense of weight in the upper part of the abdomen. On close questioning he admitted that he had some shortness of breath, but he laid emphasis only on the indigestion. A gastro-enterologist had been consulted and, taking the patient's view, had instituted lavage and dietetic and other treatment directed to the stomach. When I saw the patient I was struck by his evident debility and by his sallow color and was not surprised to find the signs of myocardial disease, marked cardiac enlargement and a gallop rhythm; there was no murmur. The liver was distinctly enlarged. The diagnosis of myocardial disease with passive congestion of the liver was confirmed by the subsequent course. It is interesting that the patient, a very capable internist, and the gastro-enterologic specialist were both entirely misled by the prominence of the digestive symptoms. I think that if there had been a murmur present the true diagnosis would have been reached much earlier.

If angina pectoris and coronary obstruction are included under the general head of myocardial disease, the number of cases of a gastro-intestinal or abdominal type is greatly increased. Such inclusion is entirely proper, for it is clinically often impossible to separate chronic myocardial disease from disease of the blood vessels of the heart; in fact, many cases of the former are directly traceable to blood starvation, the result of sclerosis of the coronary arteries.

Coronary disease may cause gastric symptoms of a pronounced

character, the most extreme mimicry being produced by acute coronary obstruction. This may simulate perforation of a peptic ulcer, biliary colic, acute pancreatitis, or intestinal obstruction.

The following case is illustrative in this connection:

CASE III.—M. A., a man, aged 44, Russian, married, a manufacturer, for several years had had a good deal of pain in the epigastrium for which he had consulted a number of physicians, receiving various diagnoses, such as duodenal ulcer and gallstones. One day I was asked to see him. I found him in an attack characterized by excruciating pain in the epigastrium and profound shock ending in eventual unconsciousness. The symptoms and physical signs were those of coronary occlusion. The patient died during the attack. On going over my records I found that the man had come to me on one occasion several years before complaining of sciatica. On examination I found the dorsalis pedis pulse absent and after close study was able to make a diagnosis of intermittent claudication. We may justly assume that the intermittent attacks of abdominal pain which had led to a diagnosis of gallstones or ulcer had been due to a temporary or permanent occlusion of small branches of the coronary artery; the possibility of a true abdominal angina, an intermittent claudication of branches of the celiac axis, has also to be kept in mind.

Complete occlusion of the coronary arteries may produce gastric or other abdominal symptoms but a non-obliterative endarteritis is also capable of producing these symptoms. In this type of case the outstanding features are fatigue on slight exertion, some shortness of breath, and a sense of oppression in the precordial area or in the epigastrium, and frequently distention with gas. It is the last that often dominates the picture and gives the impression of a primary gastric disease.

CASE IV.—P. B., a man, aged 59, married, complains of spells of indigestion during which he fills up with gas and has pain in the epigastrium and right hypochondrium. At first sight the symptoms suggest some gastric or gallbladder disease, but there are two additional facts of importance which modify that diagnosis. First, the spells of gaseous distention are accompanied by an extreme apprehension, a profound fear of death, and, secondly, the patient has had typical attacks of angina pectoris with retrosternal pain radiating into the left arm. The fear of death is not nearly as marked in the anginal attacks as in those of so-called indigestion.

The patient is markedly prostrated, with low blood pressure, muffled heart sounds and a slightly enlarged, somewhat tender liver.

There is every reason for thinking that he is suffering from coronary disease and that the "indigestion" is symptomatic of that condition. I do not believe that he has gallbladder trouble.

CASE V.—Mrs. P. F., aged 65, complains of indigestion, fulness after eating, gaseous distention, and midthoracic pain which she attributes to the gas, although it often assumes an anginal character. She has dieted for a number of years and takes yeast, soda mint and compound spirit of ether to bring up the gas. What are the facts? Her blood pressure varies from 180 to 220 systolic; the arteries are definitely sclerotic. She has little

endurance and is easily exhausted by trivial efforts. Lately, a systolic murmur has appeared over the body of the enlarged heart. Undoubtedly, the real lesion is myocardial, probably coronary, disease, but for the patient the true nature is masked by the bloating and the attendant eructation.

CASE VI.—M. J. K., a widower, aged 64, complains of indigestion and gas, which is most distressing when the stomach is empty but is relieved by taking food. The systolic blood pressure is 200 and the heart is enlarged to the left. An electrocardiographic tracing shows evidence of defective muscular contractility. The diagnosis is myocardial degeneration with gastric symptoms.

CASE VII.—Mrs. G., aged 61, lost a son in the war, and began to have nervous dyspepsia with suggestion of mild gallbladder disease. Examination showed marked enlargement of the heart, extrasystolic arrhythmia, systolic blood pressure 212, and diastolic blood pressure 110.

In the foregoing cases the outstanding symptoms of the hypertensive myocardial disease were in so large a measure digestive that the serious underlying condition had been pushed into the background.

CASE VIII.—Dr. K., aged 59, had had attacks of indigestion and pain in the gallbladder region. Recently, he had an operation for the removal of the gallbladder, which contained twelve stones. Improvement was temporary. There was gradual onset of cardiac decompensation, which is now quite marked.

In this case, I believe the myocardial disease, perhaps attributable to focal infection arising in the gallbladder, had existed for a long time but had been overshadowed by the abdominal disease. Had it been recognized and its true relation fully understood, operation might have been done earlier and the final breakup postponed.

Persistent vomiting may be the chief symptom of cardiac decompensation and may readily be interpreted as due to primary gastric disease. I have seen it lead to a diagnosis of cancer of the stomach. In several instances I was able to trace the vomiting to digitalis that had been given either on general principles or because the cardiac disease had been diagnosed. However, when the vomiting began and proved resistant, the diagnosis had been changed to that of disease of the stomach. One patient was actually being prepared for operation for supposed gastric carcinoma when examination revealed mitral stenosis with decompensation affecting especially the left lobe of the liver.

I might add that pericarditis in some instances causes reference of pain to the epigastrium and to the right upper quadrant. Sometimes the pericarditis is part of a coronary occlusion syndrome and the abdominal signs are due to the underlying thrombosis rather than to the pericarditis; but a rheumatic pericarditis without coronary involvement may act in the same manner.

I could cite many more illustrative cases, but those I have given are probably sufficient to sustain my thesis that disease of the heart may appear in the guise of a gastric or other abdominal disturbance and that the disguise may be so complete that the real disease behind the mask is not suspected.

Of course, it is always possible that the two diseases may coexist.

And now a few words about the methods of avoiding diagnostic errors, which in the nature of things might prove very serious:

1. One should take nothing for granted, neither the patient's opinion nor the diagnosis of previous physicians, no matter how eminent.

2. One should make, as naturally follows from the preceding caution, a thorough objective examination.

3. In that examination one should make use of the somewhat neglected methods of inspection, palpation and percussion, in order to determine the position of the apex beat and the shape and size of the heart.

4. The electrocardiograph is useful, but it takes second place when compared with the universally applicable methods of physical diagnosis. The same thing applies to the X-ray.

5. I have not spoken of auscultation because it is the one method of physical diagnosis that even the most enthusiastic laboratory trained clinician respects. But it must be remembered that serious myocardial as well as coronary disease may exist in hearts that on auscultation do not reveal a murmur or even any arrhythmia.

With respect to the diagnosis of coronary disease simulating a disturbance of the upper part of the abdomen, I shall refrain from going into details. Suffice it to say that the essential thing is to bear in mind the mimicry to which I have referred and to examine the heart and to search the history for attacks of angina or of mild spells of thoracic oppression. A pericarditic patch helps the diagnosis greatly; fever and leukocytosis are likewise of help and also, as already mentioned, absence of the dorsalis pedis pulse, since that at times offers collateral evidence of arterial disease.

I would once more emphasize the importance of bearing in mind that apparent disease in the upper abdomen may in reality have its seat or origin in the heart.

EASILY OVERLOOKED MANIFESTATIONS OF CIRCULATORY FAILURE WITH REMARKS UPON DIAGNOSIS AND TREATMENT [1]

A good many years ago a friend and I were walking over Walnut street bridge, Philadelphia, discussing the physical diagnosis of diseases of heart. In our youthful ignorance we agreed, like the three tailors in Tooley street, that it was a closed chapter, that all was known that ever could be known, and we had best devote our untapped energies in physical diagnosis to some other branch of medicine if we wanted to make discoveries.[2] Little did we think that in a small provincial town in England a man at that very moment was blazing a new path in cardiac diagnosis, and that his work was to revolutionize a subject we believed to be perfect and unchangeable.

Sir James Mackenzie and those who have trodden in his footsteps have created a new science, and with it a new language, that would sound strange to the ears of Corvisart, Stokes, Bamberger, Skoda, Grainger Stewart, and Rosenbach.

If I venture tonight to touch upon the subject of heart disease, I am standing with one foot in the old world of physical diagnosis and with the other in the new world of laboratory diagnosis. The new, be it remembered, has not displaced the old, the one supplements the other.

I want to speak of some manifestations of circulatory failure, the picture of which is very obscure, often misleading the unwary and sometimes the expert. Even Mackenzie—*il maestro di color che sanno*—I am sure has sometimes gone astray.

The term "failing heart power" gives the impression that the heart alone is concerned in the pathogenesis of the symptoms. That is our traditional mode of expression, but it is inadequate and incomplete. Hence, before going further I want to make it clear

[1] Read before the Inter-State Post Graduate Assembly of America, Milwaukee, Wisconsin, October 27-31, 1924.

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[2] In this connection it is interesting to note that Andral in 1829 wrote the following: "Since the publication of the immortal researches of Corvisart, and of numerous other works subsequent to his, which have still further enlarged the dominion of science, the history of diseases of the heart and its membranes is to be regarded as almost complete."

that when I speak of failing heart power I have in mind the entire circulatory apparatus, which though anatomically divisible into heart, arteries, veins and capillaries—is physiologically one great organ. Heart failure, therefore, nearly always means circulatory failure. The need to emphasize this conception comes from the fact that we have not hitherto given enough attention to the other components of the circulatory system, the heart having completely filled our horizon. Studies on venous pressure, capillary circulation, gaseous exchange in the lungs, and osmosis, are throwing a flood of light on the subject of failing circulation.

As a rule the earliest sign of failing heart power is shortness of breath on exertion. When that symptom obtrudes itself few men fail to recognize its meaning. Nevertheless, mistakes are common. If the dyspnea is pronounced and is associated with coughing and wheezing, the diagnosis of asthma is often made. If a murmur is detected, the term "cardiac asthma" is generally used; in the absence of a murmur the diagnosis is apt to be plain asthma.

Many men, especially those who have not served in a large municipal hospital, hold to the view *sans* murmur no heart disease. This is a very pernicious doctrine, for it means overlooking many instances of failing heart at a time when the condition is remediable.

I hear some one say if no murmur is present, how can you tell the heart is diseased? By ordinary physical examination, which usually reveals the following departures from normal:

1. Apex beat is a little to left of normal position.
2. Percussion reveals enlargement of area of cardiac dullness.
3. Auscultation is at times the least informing, although to the trained ear something in the sounds, a muffling of the first sound, perhaps a prolongation of it, is suggestive.

The electrocardiograph proves helpful in localizing myocardial lesions, but in daily practice is rarely available.

What about arhythmia? Arhythmia may be absent and yet the heart may be gravely diseased; the reverse is also true. Extrasystoles and auricular fibrillation while often found in failing hearts, are entirely compatible with normal function, and of themselves and by themselves are not of much prognostic value.

A gallop rhythm may be significant if it is of the cantering type, that is, if produced by a duplication of the first sound like the Greek anapest meter.

One other sign is often present in cases of early cardiac disease—a few moist rales at the bases of the lungs on deep breathing. They may be heard only on one side, usually the one on which the

patient is lying. Naturally when the stage of edema of the legs is reached, the diagnosis is no longer in doubt.

Gastric symptoms sometimes usher in failing circulation. Even if not the first manifestation, they may come to dominate the scene.

The following case is an illustration of what I have in mind. A married woman twenty-seven years of age consulted me on account of persistent vomiting. She stated that she had been well until April, 1922, when her vomiting began suddenly. She stayed in bed for a week and the vomiting ceased, but she continued to be a little short of breath, although able to lie flat, and had occasional attacks of palpitation. Since that time her chief trouble had been recurrent, painless vomiting. Her previous history is meager in points of significance. She has never had rheumatism; only a slight tonsillitis, no chorea. She was married eight years ago and has two healthy children, one seven years and one eighteen months old, with a miscarriage between them.

The attacks of vomiting, with the emphasis she laid upon them to the exclusion of other symptoms, made us at first suspect some primary gastric disease. Examination, however, showed a double mitral murmur, a large heart and a large liver without any edema anywhere. In this patient, the cardiac failure was rather advanced and yet vomiting was the chief symptom. It was evidently connected with congestion of the gastric mucosa and liver.

Another striking feature in this case was the marked enlargement of the liver without visible edema. One usually expects some degree of dropsy when the liver is greatly enlarged as a result of cardiac decompensation. It is, however, possible, as this case illustrates, to have the decompensation fall principally upon the liver. That organ can hold an enormous amount of blood. I am in the habit of comparing it to a lock in a canal—for a time it can hold back large quantities of stagnant blood, eventually, however, there is a spilling over with the appearance of edema and ascites.

The important point in this matter is that such enlargement of the liver without familiar signs of decompensation is liable to lead to diagnostic error. In several instances I have seen the diagnosis of malignant tumor made.

Particularly difficult are the cases of mitral stenosis with enlargement of the left lobe of the liver producing a prominent tender epigastric tumor. Since the murmur of mitral stenosis is often inaudible, the cause of the enlargement of the liver will not be suspected, and the tumor will be interpreted as a malignant growth.

On one occasion a surgeon asked me to see a patient prior to operation for gastric cancer. There was vomiting, failing appetite,

loss of flesh and the presence of a large tumor-like mass in the epigastrium. I found that the case was one of mitral stenosis with a left lobe enlargement of the liver.

Cough is a common feature of beginning as well as of advanced decompensation. In rare instances it is so severe as to be an overshadowing symptom, as in the following case: Mrs. T., a widow, sixty-eight years of age, had for some time been troubled by a harassing, unproductive cough and insomnia. My first impression when I saw her was that she was suffering from chronic bronchitis with some degree of emphysema.

To my surprise I found on examination that the apex beat was in the anterior axillary line. There was no murmur, no arhythmia, no effusion, no edema. Treatment on the basis that the cough was an expression of cardiac weakness proved helpful, but not for long. The damage to the myocardium was beyond repair.

Here the old fashioned methods of inspection, palpation and percussion gave the required information. The Hippocratic practice of using the eyes and hands and that of the immortal Auenbrugger of using the fingers were quite adequate for the needs of the situation.

That myocardial weakness may simulate malignant disease of the gastrointestinal canal may at first sight seem unlikely, but the following case as well as some others I might cite prove it:

I was once called to Johnstown, Pennsylvania, to see a man, fifty-four years of age, who was suspected of having malignant disease either of the stomach or bowel. The chief symptoms were great weakness, an epigastric pressure feeling with eructation of gas on exertion, poor appetite, loss of flesh and increasing despondency. When I heard the story and saw the patient, I was quite prepared to accept the diagnosis. An X-ray study of the gastrointestinal tract had been made but the pictures gave little information. On examination I found that the heart was somewhat enlarged, the sounds extremely feeble and the blood-pressure low. There was neither arhythmia nor murmur. With some trepidation I made a diagnosis of myocarditis—using that term in the clinical sense—and attributed everything to circulatory weakness. Under digitalis and other appropriate treatment the patient recovered in a short time and afterwards visited me in Philadelphia. The heart is still slightly enlarged but fully competent. I must confess that when I took the train home from Johnstown, I asked myself the disquieting question, "Is it heart disease or is it latent cancer?"

Much more common than the resemblance to malignant disease is that to the severer forms of nervous or functional dyspepsia. Sometimes the gastric manifestations in early circulatory failure, as in the

first case I mentioned, are so prominent that they focus the attention upon an innocent organ, the stomach, rather than upon the heart.

The following case is illustrative of this fact: L. P., physician, fifty-four years of age, had "suffered from gas"—bloating and belching—and from signs of epigastric pressure for several years. A noted gastro-enterologist whom he had consulted lavaged and dieted him but to no avail. When I saw him I found in addition to gastric symptoms, which were the only ones he stressed, a little shortness of breath and a sense of great exhaustion. Physical examination showed some enlargement of the liver, decided cardiac dilatation, with a distinct *bruit de galop*. The case was clearly one of progressive myocarditis with predominantly gastric symptoms, an interpretation confirmed by the denouement.

Ascites as a solitary transudate or exudate is attributed to cirrhosis of the liver, to tuberculous peritonitis, or to malignant disease. Nevertheless such a silent ascites may be due to cardiac failure and is an exception to the rule that ascites, dropsy and pulmonary congestion and perhaps hydrothorax are usually found in association in cases of heart failure. Adherent pericardium is the chief cause of ascites as a monosymptomatic expression of heart failure. Occasionally the cause is a chronic myocarditis. The diagnosis can be made by careful attention to the physical signs, in particular to the presence of marked increase in the area of cardiac dullness.

Hydrothorax, especially one sided, may be the only objective manifestation of a failing heart. As a rule the effusion is on the right side, but it may be on the left. If the case is one without a murmur, the cause of the hydrothorax may be misinterpreted. An overlooked hydrothorax is often the obstacle to successful digitalis therapy—when the effusion is removed, the drug takes hold.

Pulmonary Edema. I have in mind the sudden so-called apoplectiform edema of the lungs, which sometimes occurs in cases of mitral stenosis. It is terrifying both to the patient and to onlookers. It may come on without the slightest warning, and has appeared occasionally during or after labor. In addition to sudden onset, a tendency to recur is one of its striking features. If properly treated, it is rarely fatal, but the physician must be familiar with its significance and management.

Pulmonary hemorrhage, as a symptom of cardiac disease, is quite well known. It is most frequent in mitral stenosis, the murmur of which, as I have already stated, is at times inaudible. That explains a fact well known to sanatorium physicians, that cases of hemoptysis due to mitral stenosis are very often diagnosed as pulmonary

tuberculosis. One should always, in sudden pulmonary hemorrhage, think of this fact, especially if the patient is a young person.

A few years ago I pointed out the occurrence of *psychoses* during the course of heart disease. It is very easy in such a case to conclude that the patient has some form of independent insanity, when in reality the mental manifestations are dependent upon the heart lesion, more rarely upon digitalis.

One other subject because of its practical importance should be mentioned. As you know, in cases of failing heart with dropsy, the urine often contains albumin and tube casts. To many minds these urinary findings are proof of nephritis, of some form of Bright's disease. Such an opinion would receive corroboration if the physical examination showed a regular, murmurless heart. When not called nephritis, such cases are spoken of as cardiorenal or as chronic parenchymatous nephritis with hypertrophy and dilatation of the heart. The following story illustrates the point I wish to make:

One day I came into my wards at the Philadelphia General Hospital and asked the intern what he had for my class. He replied, "I have a good case of Bright's disease."

The patient had just had a hot pack and seemed greatly exhausted. On examination I found that he had general anasarca, and a perfectly regular heart without murmur. The urine contained a large amount of albumin. To all appearance the diagnosis was justified. Examination, however, showed that the case was one of great dilatation of the heart with secondary passive congestion of the kidneys. The hot packs were stopped, digitalis was administered and complete rest enjoined. In a short time the patient left the hospital with good compensation and normal urine.

The differentiation between cases of nephritis with secondary cardiac failure, which are the true cardiorenal cases, though better called renocardiac, and cases of primary heart disease with passive congestion of the kidneys, falsely called cardiorenal, is not easy. The phenolsulphonphthalein test is often fallacious, giving reduction in both types. The blood chemistry is likewise of little help. In time the therapeutic test may determine the correct diagnosis, for the primary cardiac cases often recover from the attack, while the true renal cases generally go on to a fatal termination. For rapid bedside distinction the character of the urine is of great value. In cases of congestion of the kidneys secondary to heart failure, the urine is dark, strongly acid and throws down a heavy pinkish sediment of urates. This does not occur in true nephritis. A feature in the history is also important, namely that heart cases

often have a record of repeated admissions to hospitals, each for a cardiac break. This is not the history of nephritis.

Treatment—I now come to the subject of treatment. It is not necessary to dwell on the well known principles of rest and diet and digitalis.[3] I want to emphasize the importance of not overlooking a large effusion, which acts as a hindrance to the heart and prevents it from reacting properly to treatment. A single tapping may suffice to change the case completely, or it may be necessary to tap two or three times. Recently a patient, W. M., fifty-seven years of age, came to see me on account of great prostration and shortness of breath. He had been under treatment for heart trouble, but had been steadily getting worse. I found aortic insufficiency with all the characteristic signs, but that was not sufficient in itself to explain the man's disability and dyspnea. The discovery of a large effusion seemed to be an adequate explanation. I had him tapped and a quart of fluid was removed, with the result that he has been a changed man, and is eager to resume his occupation as a teacher of manual training.

Sometimes despite every effort the dropsy persists. The integument is full of water, the face puffy and cyanosed, the serous cavities filled, the genitalia swollen, the lower limbs enormously enlarged. The patient has to sit up night and day, gets very little sleep, and is in an altogether pitiable condition. I have seen patients in this state recover completely from the dropsy and the serous effusions and live for several years as a result of a simple procedure, very ancient though forgotten, namely, scarification of the legs. The following case is an illustration:

Mrs. C. H., forty-two years of age, married, was seen on September 21, 1921, with Dr. I. V. Levi. The patient had been dropsical since July. The urine was very scanty—eleven ounces in twenty-four hours—and contained albumin and casts. She had been digitalized several times, and had come to have an absolute intolerance for the drug. Whether given orally or hypodermically it always produced immediate nausea.

I found her sitting up in bed; her face puffy, the cheeks purple, the lips of a maroon color. She was dropsical from head to foot; her legs were enormous; there was fluid in the abdomen and probably in the chest. The heart was enlarged to the left and irregular, and at the apex a blowing systolic murmur could be heard.

The heart rate on auscultation was 156, the pulse at the wrist 86, a deficit of 70 beats.

As there was no preparation of digitalis that had not been tried

[3] When digitalis fails, apocynum canabinum may be used.

in the patient, either by mouth or hypodermically, there was no profit in persisting in its use.

At my suggestion the patient's legs were scarified with numerous incisions on the outer and inner surface below the knee. The result was wonderful. The anasarca entirely disappeared from the skin, and the patient was able to go home. I saw her again, and found her limbs of normal size; there was no edema but a well marked ascites was still present. This was removed by tapping.

Early this past summer I was walking through the lobby of an Atlantic City hotel when a man accosted me, and asked me to come over to meet his wife. I was somewhat nonplussed as he was a stranger to me, nor could I recall having seen the lady introduced as his wife, but when she told me her name, I remembered her at once. It was Mrs. H., the dropsical woman whom I had scarified two years before. She seemed perfectly well and was enjoying life at the seashore.

It may not be without interest to those who take pleasure in medical history to quote something upon scarification which I found in a book called "The History of Physick; from the time of Galen to the beginning of the sixteenth century," by J. Freind, M.D. "In a work by Sylvius de le Boë this author (de le Boë) relates from Asclepiades the manner of curing an Anasarca very exactly. This is by making incisions on the inside of the leg, about four fingers breadth above the ankle, as deep as generally those in bleeding are made. At first a little blood issues out; after, there is a continual discharge of water, without any inflammation, so that the aperture cannot be closed, till the humor is spent, and the swelling gone down: and this drain cures the distemper without any internal medicine. Leonides the Alexandrian, an author who lived after but near Galen's time, and whose remains we find chiefly in Aetius, says further, that if the incisions in the legs do not make a discharge quick enough, some ought to be made in other parts of the body; in the thighs, in the arms, or in the scrotum, if swelled, by which means a great quantity of watery matter may be evacuated. Archigenes adds, that by these scarifications, not only the swelling of the thighs and legs, but that of the belly has been found to subside. And, no doubt, where an Ascites is attended with an Anasarca this method may succeed in some degree; though in a simple ascites it must be ineffectual. The operation itself is mentioned by Hippocrates; and has been practiced from his time, down to our own days, with great success."

I once measured the amount of fluid by having a double-bottomed tray made on which the patient rested her feet. We collected 35 oz.

of serum a day. That is by no means as much as is drained off in some cases, but it cannot be measured because it soaks into the dressings.

Southey's tubes may be used, but they have no great advantage over scarification. Infection is rare in either case, the serum being in a measure bactericidal.

I usually make about six cuts an inch to an inch and a quarter long on the outer and inner aspects of the leg below the knee. The incisions are carried through the integument into the subcutaneous cellular tissue. A little blood may flow at first, but it soon gives place to a continuous stream of watery serum.

When a patient recovers from typhoid fever or pneumonia, the credit seldom belongs to the doctor directly. The vis medicatrix naturae left to herself is capable of battling successfully with many acute and chronic infections. In cases of advanced circulatory failure with serous effusions, general dropsy, inactive kidneys, and the whole train of well-known symptoms, nature left to herself lets the patient die.

But when we succeed, either by drugs or by scarification, in restoring the patient to fair health, then we have achieved a real triumph. Then we have fulfilled one of the greatest missions of the physician—we have done what nature unaided could not do.

DIAGNOSIS AND TREATMENT OF ACUTE AND CHRONIC MYOCARDIAL WEAKNESS [1]

The subject I have chosen deals with phases of medicine that confront every practitioner every day, for the crises of disease are practically all dominated by the strength or weakness of the circulation. By the response of the heart and its branches, the blood-vessels, the sick stand or fall. Simple as this statement is, the problems involved are far from simple.

When we say a pneumonia patient died because his heart gave out it seems trite, but when we come to analyze what has actually happened we find ourselves at once in a maze difficult to thread. If tonight I attempt to imitate Ariadne, I do so with proper distrust of my powers. After I have discussed the acute phases of circulatory failure I shall take up the chronic ones which have a character somewhat different.

I have spoken of pneumonia—let me use that disease as a text. I might with equal propriety choose typhoid fever, influenza, or septicemia.

A patient with acute lobar pneumonia presents the signs and symptoms of a severe toxemia—his temperature is high, the pulse rapid, the heart sounds, especially the second pulmonic, feeble; the blood-pressure has fallen from 120 to 100 systolic, and the diastolic pressure is low.

The hitherto healthy lung shows a number of moist rales, the skin is a little leaky, the abdomen distended with gas, and the diaphragm pushed up. The sleepless patient is beginning to be delirious. Everything points to a grave situation; we realize that the patient may succumb before a favorable crisis has had a chance to occur. Death, if it ensues, is attributed to failure of the circulation.

What has happened? The poison of the disease, the pneumotoxin, and, as I believe, the metabolic poisons derived from the cellular exudate in the diseased lung, have caused a degenerative change in the heart muscle and in the muscle tissue of the blood-

[1] Address delivered before the William Pierson Medical Library Association, Morristown, N. J., March 9, 1926.
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vessels, probably also in the vasomotor mechanism, central and peripheral; likewise in the capillary circulation in all organs and tissues. Other factors, obscure and subtle, may contribute to the process—changes in the endocrine glands to which in acute diseases little attention has so far been given.[2]

The result of the conjoint action of these various factors is a weakening of the heart's action, a fall in blood-pressure, and generalized pulmonary edema. What we call heart failure in acute disease (and after operation) is, therefore, a widespread complex process about which we have very much to learn.

Whether the condition proves fatal or not depends to some extent upon what we do—before and during the danger period—to a larger extent upon the forces of resistance, innate and newborn, in the patient.

Treatment—I shall divide this phase of the subject into two parts: (a) anticipatory or prophylactic, (b) curative.

(a) *Anticipatory*—Knowing what may happen, we must do everything in our power to spare the patient both physical and psychic disturbance, make the environment quiet, keep away visitors, move the patient as little as possible, making examinations only when essential, and then quickly; secure abundant sleep by means of opiates, and give a proper diet—milk or buttermilk, cereals, broths, junket, water-ice, orange-juice, egg albumen, water in abundance or at least sufficient to secure an output of from 1500 to 1800 c.c. of urine. The bowels are kept open with a gentle laxative—milk of magnesia, phenolphthalein, or cascara, or by means of an enema on alternate days. If the pulse is over 100 small doses of digitalis may be given, 5 to 10 drops every six hours.

I shall not enter into the controversy as to whether digitalis is or is not of value in acute fevers. It may be said, however, that one rarely finds the pulse reduced under its use. Since Plummer has shown the harmfulness of the drug as a routine measure in exophthalmic goiter prior to operation, men generally have been thinking about the value of digitalis in other conditions. Formerly I employed it routinely in all cases of pneumonia regardless of the pulse rate. However, I have come to the conviction that when the pulse is slow—in the neighborhood of 90—digitalis is not indicated; but when the pulse is 100 or higher then its use may be warranted.

(b) *Curative*—The conditions that chiefly confront us during the critical period of the disease are: (1) vasomotor paralysis,

[2] The work of Müller and Petersen (Klin. Woch., January 8, 1926), on what they term "splanchnoperipheric equilibrium," promises to throw some light on this field.

(2) weakness of the heart's action, (3) pulmonary edema, possibly consequential upon the other two.

The first, that is, vasomotor paralysis, is best controlled by the use of pituitrin hypodermically—from ½ to 1 ampule of surgical pituitrin every six hours. For the second, one or more of the well-known cardiac stimulants may be used: caffein-sodium benzoate, camphor in oil, digitalis, whiskey. And for the third, atropin sulphate in large doses. If the patient is very cyanotic venesection may prove of value.

It is probable that glucose acts as a muscle food, and hence it is advisable to administer it freely in cases of acute myocardial weakness. It may be given in the form of a 5 or 10 per cent. solution by bowel or intravenously.

Should the patient be very restless or sleepless, a small dose of morphin is the best remedy. It acts under such conditions not only as a sedative, but as a veritable cardiac stimulant.

Chronic Failure of Circulation

Leaving out of consideration such episodal phenomena as angina pectoris, coronary thrombosis, and rupture of the heart, chronic cardiac disease, when it begins to manifest itself, gives rise to a great variety of symptoms among which the respiratory and gastro-intestinal are the most conspicuous.

When we try to analyze the clinical picture we find it difficult to determine to what partitional extent the heart muscle, the valvular defect, and the vessels contribute to the totality of the picture. Certain it is that a valvular defect can exist for many years without signs or symptoms of cardiac impairment. Eventually, through increasing inadequacy of the intracardiac circulation, the hypertrophied muscle begins to weaken and then conditions are ripe for the development of symptoms.

Some have carried the thought of the part played by the heart muscle too far and have made light of murmurs, especially of that of mitral insufficiency; and yet the valvular lesion if old must be looked upon as the starting-point of subsequent, even if long-delayed, myocardial inadequacy. It is, however, true—as the experience of men in large hospitals proves—that the self-same decompensatory process can occur in hearts without valvular defect. Here the cause must be a muscle degeneration or fibrosis. This particular type—we might call it the non-valvular type of myocardial disease—is related to hypertension or to disease of the intrinsic vessels through which the nutrition or proper metabolism of the heart muscle suffers.

A cursory autopsy often fails to show an adequate reason for the failure of the heart so evident during life, there being no marked signs of fibrosis, no adherent pericardium, no coronary disease, and no striking degeneration. While the microscope may sometimes reveal changes in the muscle-fibers or in the conducting mechanism of the heart, the changes are often too slight to explain the symptoms of heart failure so evident before death.

The reverse is also true, and one may find in persons dying of accidental causes advanced myocardial or coronary disease, or both —although there were no symptoms of cardiac weakness during life.

There is but one conclusion to be drawn from these facts, namely, that cardiac adequacy and cardiac inadequacy are in the last analysis matters of function, and that anatomic structure, as far as our present methods of study go, is not a reliable index of functional capacity. Much additional light is needed on this subject. It may come from biochemistry and from a better knowledge concerning capillary circulation and the permeability of the endothelial cells.

It is a common practice in certain Philadelphia hospitals to use the term "chronic myocarditis" in non-valvular cases of heart failure. When I use the term "non-valvular," I do not necessarily mean "murmurless"—a mitral systolic murmur or an aortic systolic murmur is often present. By "non-valvular" I mean non-endocarditic—the disease of the heart wall, whatever it be, depending on something else than a valvular defect. The mitral systolic murmur just mentioned is often a functional or dynamic murmur due to cardiac dilatation, and the murmur heard at the aortic area in this same type of case is due to sclerosis of the aortic arch rather than to disease of the aortic valve.

Whether it is right and proper to use the term "chronic myocarditis" in such cases is still a controversial question. As I have indicated above, in some cases no evidence of inflammation is found. A somewhat similar situation exists with regard to the kidneys and has led to the use of the terms "nephrosis" and "nephritis" to indicate non-inflammatory and inflammatory renal disease. Accepting that as a guide, I have coined the word "myocardosis" to cover those cases of chronic myocardial failure in which the signs of inflammation are lacking.

The pathogenesis of chronic myocardial failure is by no means well understood. Syphilis may play a part, but it is not nearly so important as some writers would make us believe. Nevertheless, the interesting studies of Warthin call attention to the fact that lues may exist when it is not suspected.

Heredity—the inheritance of less resistant tissues—is a very important factor often revealed if a careful family history is taken. Mental and physical strain, focal infections in various distant parts, particularly in the gall-bladder, disease of the thyroid gland (toxic goiter), are additional etiologic factors. Acute diseases, such as influenza, repeated attacks of pneumonia, may by producing degenerative processes lay the groundwork of chronic myocardial failure appearing years afterward. I have a particular thought in mind in referring to acute diseases as a possible factor in the development of chronic myocardial weakness, namely, that we must give more attention to our patients during convalescence from acute diseases. It is my firm belief that if we would watch the circulation more carefully in patients recovering from acute infections, even as trivial a one as tonsillitis, and also from operations, we should not infrequently find reasons for stepping in to act as guardians of the future. We should find a marked rise in the pulse rate on slight effort, a persistently low blood-pressure, a little shortness of breath, a sense of fatigue on exertion—all indicating a slightly damaged circulation. If neglected nothing may happen for years, then under a strain or in some acute disease of little moment or after an operation the patient begins to show the familiar signs and symptoms of failing circulation. Perhaps then the real cause, dating back many years, is all but forgotten.

To one who sees in prevention the doctor's greatest usefulness, these things are of signal importance and justify constant emphasis. Please remember the slogan, "Watch the convalescent."

And now we come to the consideration of the diagnosis of myocardial failure, using the phrase in its widest sense.

When there is dropsy the diagnosis is easy, but the diagnosis ought to be made, for the good of the patient, before dropsy occurs. If there is a valvular murmur, even a cursory examination will fix attention upon the heart, but in the absence of a murmur, if there is no dropsy, many will not realize that the heart is the chief factor in the beginning drama.

What are the more obscure manifestations of circulatory failure in the presence of which diagnostic errors are possible? These are many. I shall mention only the most important:

Symptoms—*Cough*—Spasmodic or continuous cough, severe or mild in nature, may be the chief if not the only symptom of a weakening heart. It is instructive to see how useless the ordinary cough medicines are in such cases. Opiates help, but they do not cure. Only rest and digitalis will do that. I shall defer a discussion of the means of diagnosis until I have spoken of some other symptoms.

Gastro-intestinal Symptoms—These are pain, gaseous distention, flatulence, loss of appetite, at times pronounced nausea and even vomiting, but often merely a sense of pressure in the lower chest or epigastrium. The feeling of gaseous distention or of pressure may come only on effort, and as it is quickly relieved by the eructation of gas, the patient is quite convinced that the fault lies in his stomach. The doctor who fails to penetrate beneath the surface of things often will share that conviction. Patients have died suddenly who have never had anything more to complain of than a sense of oppression in the lower chest and epigastrium. In the newspapers such cases are often attributed to "acute indigestion"—a journalistic diagnosis based on error.

Shortness of Breath—This is usually an early manifestation, but is not of necessity present. The others I have mentioned may overshadow it. The diagnosis of the real cause is less difficult, for dyspnea is associated in every physician's mind either with some disease of the lungs or with disease of the heart. While the doctor may correctly attribute the shortness of breath to the heart, it frequently happens that he overlooks the most important factor in the dyspnea, viz., a hydrothorax. The frequency with which I find an unsuspected pleural effusion I rate as one of the most remarkable experiences in my work as a clinician. No skill is required to discover this apart from a thorough routine examination and the ever-present thought that persistent shortness of breath is likely to be dependent on some additional factor.

Ascites as a monosymptomatic occurrence, i. e., one unaccompanied by such symptoms as general anasarca, fever, pain, etc., is a difficult nut for the diagnostician to crack. It may be due to tuberculous peritonitis, to abdominal or pelvic carcinoma, to cirrhosis of the liver, and these will be the first thoughts entertained. Few men, unless they have had experience with this condition, will think of the heart as the cause of such a silent ascites as I am in the habit of terming it. Nevertheless, that is an ever-present possibility. As regards the cardiac lesion underlying the ascites, it may be an adherent pericardium (Concato's or Pick's disease) or it may be nothing more than a dilatation of the heart and myocardial relaxation. A satisfactory explanation is wholly wanting why the latter condition in rare circumstances produces an ascites instead of a general dropsy.

Enlargement of the Liver—This in cardiac decompensation commonly affects the right lobe or both lobes, so that the organ projects for a greater or lesser distance below the right costal arch and

enters the epigastric triangle. There are, then, no great diagnostic difficulties. Sometimes, however, the left lobe bears the chief brunt of the process of passive congestion, forming a conspicuous swelling in the epigastrium. This peculiar enlargement, more frequent perhaps in mitral stenosis than in other cardiac lesions, is easily interpreted as a new growth of the stomach or liver. If vomiting and anorexia are present, this belief will naturally be strengthened. A careful analysis of the history and a painstaking physical examination are the only ways in which errors can be avoided.

Acute Recurrent Pulmonary Edema—This catastrophic symptom is perhaps most common in cases of hypertension, especially in those of nephritic origin, but it is also seen in myocardial disease with or without valvular lesions and with or without increase in blood-pressure. The pathogenesis of this condition which I have discussed elsewhere is obscure.[3] When hypertension exists we feel that there is an adequate explanation, although we really do not quite understand what happens, but in the absence of hypertension and in the absence of a valvular lesion the fact that the sudden pulmonary edema is really of cardiac origin may not be suspected.

Psychoses—The last symptom I should like to mention in my survey of the phenomena caused by circulatory weakness or failure is mental disturbance. It may happen during the course of decompensation that a patient develops a mania-like psychosis or a delusion or a fear of poisoning. The phases are manifold and perplexing, and often suggest a primary insanity. However, they are really secondary, and are due to disturbance of the cerebral circulation or, in rare instances, to a toxic effect of digitalis.

Diagnosis—I now come to a consideration of those signs by which myocardial weakness may be discovered, especially in what might be called "larval cases." One of the best means, in my opinion, is to determine the cardiac outline. This can be accomplished by locating the heart beat through inspection and palpation and by outlining the boundaries of the heart by light percussion.[4]

These methods are more important in many cases than auscultation, not that auscultation is a negligible procedure—far from it—but it may mislead, while inspection, palpation, and percussion rarely do so. I have said that auscultation may mislead; this statement requires some explanation. Myocardial failure may exist with perfect rhythm and with what are to all intents and purposes

[3] Acute Pulmonary Edema with Special Reference to a Recurrent Form, Amer. Jour. Med. Sci., January, 1907.

[4] Some of my friends advocate heavy percussion, but personally I prefer light percussion, which I find gives good results providing the pleximeter finger is pressed firmly upon the chest.

normal heart sounds. Nevertheless, in such cases the other methods of physical diagnosis will show changes.

As I said earlier in this paper, a systolic murmur at the mitral area or at the aortic area may be revealed on auscultation. These are more or less accidental and are not due to endocardial changes. Auscultation may also show arhythmias; these, however, are often of little diagnostic value as regards the nature of the case, and certainly not as regards its gravity. For example, one may find auricular fibrillation in a heart with entire functional capacity. Much might be said, however, upon the subject of arhythmia in connection with myocardial disease, but this would carry me too far afield. A gallop rhythm of a certain type should, however, be mentioned on account of its diagnostic and prognostic importance. It is the one in which the first sound is reduplicated, the so-called anapest type or *bruit de galop*. In the absence of a febrile process it indicates serious cardiac damage. I have found it most frequently in a type of myocardial failure that I would call "progressive myocarditis," using myocarditis in its widest sense. This type is often but not always associated with true nephritis.

The electrocardiograph gives a good deal of information not only regarding the arythmias but also regarding the state of the myocardium, so that when available it should be brought into the case, but it is not essential, and every practitioner can learn to diagnose the important arhythmias or important myocardial changes without it.

Treatment—The treatment of chronic failure of the circulation is a simple matter as a rule, if the true conditions are recognized—rest in bed, mental rest, light meals, open bowels, and digitalis sum up all of the treatment in the ordinary case. One should bear in mind the frequency of undiscovered pleural effusion. When found, the effusion is removed by tapping. If there is reason to think it has been of long standing, the tapping should be done very slowly so as to guard against the danger of acute pulmonary edema which I have called "edema by recoil." If there is much dropsy, salt restriction is indicated. In the more advanced cases, when there is general dropsy with cyanosis and shortness of breath, digitalis is the mainstay of treatment. The mode of administration, the preparation used, and the individual dose are not so vitally important. Most of the preparations on the market seem to have merit.

When the liver is enlarged, and if there is no evidence of primary kidney disease, then I find the following capsule, a modification of the Niemeyer pill, very useful:

Powdered digitalis	0.06 (gr. 1)
Calomel	0.06 (gr. 1)
Powdered squill	0.06 (gr. 1)
Caffein	0.06 (gr. 1)

It is necessary when giving this to watch for salivation. Diuretics are of value; among the best are theocin and theobromin.

If digitalis fails or is not well borne, good results are sometimes obtained by giving the fluid extract of apocynum cannabinum in doses of from 5 to 8 minims three or four times a day.

For restlessness and insomnia nothing equals a small dose of morphin which, just as in acute cases, acts here too as a cardiac stimulant by its sedative and sleep-producing effects. In cases with chronic cyanosis and distention of the veins, venesection is helpful, particularly when there is marked orthopnea. In cases with cyanosis so profound as to raise a suspicion of mediastinal tumor or coal-tar poisoning, free bleeding from the arm is unequaled as a remedial agent. If the dropsy is unyielding to drugs, scarification of the legs or the use of Southey's tubes not only removes the dropsy, but often restores compensation.

The Nauheim treatment, either on its native heath in western Germany or at home, or in some well-known sanitariums in this country, is useful, especially in cases not associated with hypertension and advanced arterial hardening.

ACUTE PSYCHOSES ARISING DURING THE COURSE OF HEART DISEASE [1]

Acute mental disturbances sometimes appear during the course of heart disease with such startling suddenness as to disconcert the attending physician and to prove a severe shock to the patient's family. The majority of text-books are silent on this subject, yet the condition is one upon which both from the point of view of etiology and of prognosis much light is needed. Dr. Head, in 1901, in a masterly article,[2] called attention to the mental changes accompanying visceral disease, including heart affections; he concerned himself, however, chiefly with hallucinations of sight, sound and smell, and states of mild depression or exaltation, which he analyzed with very keen insight. In keeping with the opinion of the day in which he wrote, he speaks of aortic valve disease, mitral regurgitation and mitral stenosis, but does not mention that great group of cardiac affections in which valvular lesions play a subordinate or negligible part.

It is of course well known that cardiac patients often are depressed and irritable, particularly after decompensation has been established, and sleep, digestion and respiration are in consequence disturbed. The particular state of mind is closely related to the patient's temperamental make-up and to his philosophy of life. I once had under my care a woman, aged about forty years, with the most hopeless cardiac break, with dropsy, serous effusions, large liver, cyanosis, insomnia and orthopnea, who until her death maintained a perfect sweetness of disposition and a hopefulness of spirit that was greater than any spes phthisica that I have ever witnessed. On the other hand, I have seen patients who when decompensation was far advanced, by their fretfulness and their unreasonable demands, made life miserable for family, doctor and nurse. But while such a mental condition is abnormal it cannot be called a true psychosis. Nor shall I consider among the cardiac psychoses the delirium of acute and subacute septic endocarditis, since that is dependent more upon the infectious toxemia than upon the heart disease as such.

[1] Read before the Association of American Physicians, Atlantic City, N. J., May 4, 1920. Extracted from the American Journal of the Medical Sciences, February, 1921, No. 2, Vol. CLXI, p. 157.

[2] Brain, 1901, 24, 345.

The manifestations of true psychoses are quite varied. Among the more important types are the following:

1. **Hallucinations** of sight and sound, more rarely of smell. These were found by Head [3] to be most frequent in aortic disease. The auditory hallucinations consist chiefly of rhythmic sounds like the tolling of bells or of knocking; the visual usually take the form of the face of a man or woman with dimly outlined body standing at the foot of the bed or stalking slowly across the room. The patients as a rule recognize the hallucinatory character of the sound or vision and are disinclined to speak of it until the physician has gained their confidence. Hirschfelder [4] states that a number of patients admitted having hallucinations after he had assured them that visual hallucinations were not uncommon in their disease and were merely to be regarded as troublesome but not as significant features. All who gave positive answers accurately described the visual hallucination as detailed above.

The hallucinations are to be looked upon as misinterpreted sensations caused either by anemia or by venous stasis of definite brain centers—those connected with sight or hearing—or by circulatory or trophic disturbances in the corresponding peripheral end-organs. They are usually of a transitory character and do not affect the prognosis in any definite manner.

2. The most common cardiac psychosis is a state of *confusion*, in some cases present only as the patient awakens from sleep or is about to go to sleep; in others it is a more or less constant symptom. The patient confuses his surroundings, is disorientated as to time but may become rational when his attention is sufficiently aroused. This mild type of psychosis is common in myocardial cases with auricular fibrillation with or without decompensation. The less the natural sleep the greater the confusion.

3. In some cases, especially in elderly persons suffering with fibroid myocarditis, the mental state is one of *excitation with decided disorientation*. Such a type is illustrated by the following case:

Mrs. F. H. W., aged seventy years, with cardiac hypertrophy and hypertension, dyspnea on exertion and a little edema of the lower limbs, suddenly began to exhibit a state of mental confusion and excitation which was most marked when she awakened from sleep. She would stare excitedly about the room, talk incoherently and try to get out of bed. When engaged in conversation, she answered most questions pertaining to herself quite well, but to

[3] Loc. cit.
[4] Diseases of the Heart and Aorta, Philadelphia, 1918, p. 229.

those dealing with the day's events or with familiar contemporary history, she gave confused and inappropriate answers. There was no evidence of motor weakness or paralysis; indeed, she seemed surprisingly strong. The urine contained a faint trace of albumin, no casts, no blood, but a very large quantity of urates; its specific gravity ranged from 1012 to 1022.

The prognosis in such cases is not good, death usually following within a few weeks after the onset of the psychosis. The patient may, however, clear up if the myocardial degeneration has not gone too far and if no complications ensue. In the case just mentioned a pneumonia supervened.

In some cases the state of excitement alternates with one of complete apathy and silence—the patient may sit up promptly when the doctor approaches and may stare directly at him, but answers no questions and does not betray by any sign that he understands what is said to him. Such taciturn myocardial patients have to be watched as they may suddenly become agitated, get out of bed, and make powerful muscular efforts that may end in collapse.

4. Perhaps the most interesting, certainly the most startling disturbance arising in diseases of the heart is *acute mania* which may appear with the suddenness of an apoplexy and for a time defy all efforts at control. I have seen it appear under two conditions: in acute pericarditis and in advanced decompensation of myocardial origin. Its occurrence in pericarditis was pointed out long ago by Da Costa. The late F. A. Packard was the first to bring it to my attention when I was his intern in the Philadelphia General Hospital. We had in our ward a woman, Louisa Wilbur, who had an acute fibrinous pericarditis, the cause of which I do not remember. One day without warning she suddenly became wild and maniacal and had to be restrained. She remained in her state of mania until death. This experience impressed upon me the importance of examining for pericarditis all cases of sudden wild delirium or mania.

Mania in the course of myocardial disease is illustrated by the following case: W. M. R., a physician, aged about fifty years, was brought to my office in June, 1914, in a state of extreme shortness of breath and collapse, which had come on while he was cranking a refractory motor car. Examination showed total arhythmia, an enlarged heart, enlarged liver but no edema of the extremities. Under rest and digitalis the patient improved; the auricular fibrillation, however, was very slow in subsiding. Although he never regained his full strength, he was able to do a little practice until the spring of 1915; then, despite treatment, he began to lose

compensation rapidly. At the beginning of June he suddenly started one day to "act like a crazy man," as his wife expressed it. For six consecutive hours he raced around his library table, throwing his hands wildly about and exclaiming: "I am a thief; no I am not. You are a thief; no you are not. I am a liar; no I am not. You are a liar; no you are not." These phrases he repeated over and over without stopping as fast as he could talk for six solid hours. It was only after Dr. H. MacVeigh Brown, with whom I was seeing him, had given three large hypodermic injections of morphin that the man quieted down. For nearly a week, however, he remained in a state of great physical agitation. He talked incessantly, mostly in a facetious vein, but without much coherence. Throughout that time he slept neither night nor day. It was a marvel to all of us how his heart stood the strain. Toward the end of this period another strange thing happened—the urine, which had been very scanty, became greatly augmented, the dropsy disappeared, and the man was able to lie down flat, which he had not done for a long time. He never regained his mind completely and died in stupor six days after the termination of the maniacal episode.

5. **Delusional States.** When delusions occur they usually take a persecutory form and render the patient most unhappy. While mania and mental confusion are not confined to any particular type of heart disease, I have seen delusions of persecution so far only in connection with lesions of the aortic valve. One of the cases was that of a young baker in my wards at the Philadelphia General Hospital, who had aortic stenosis of rheumatic origin. He thought he was being poisoned with gas by enemies in his shop. Under rest the delusion disappeared in a short time.

6. During attacks of Cheyne-Stokes breathing—a common symptom in cardiac diseases—there is at times in the dyspneic period a state of mental excitement or delirium which subsides during the apneic period. The seizures of Adams-Stokes disease, which so closely resemble petit-mal, should also be mentioned here.

In considering *the causes of the cardiogenic psychoses* a number of possibilities suggest themselves:

1. The connection may be an accidental one. In an individual of psychopathic make-up the taint may at any time break forth quite independently of the existence of heart disease, although the latter would favor it by impairing the circulation. In asylums for the insane, cases in which the psychopathy is associated with disease of the heart are numerous. These chronic psychiatric cases do not, however, belong here, as this paper concerns itself only with acute manifestations.

2. A probable factor, in some cases at least, is disease of the kidneys, a frequent concomitant of disorders of the circulation. Uremia by itself is quite capable of producing psychoses, either of the maniacal or of the melancholic type. However, I do not believe that the passive congestion of the kidneys in decompensation of the heart, although often considered a true nephritis, is capable of producing a uremic state. As an accessory factor, it cannot be ignored.

3. I have sometimes thought that acidosis may play a part in the production of mental symptoms in cardiac disease. One often finds when the circulation is failing that the urine becomes intensely acid and throws down a heavy pinkish sediment of urates. This is such a constant phenomenon that I look upon it as possessing diagnostic value. It occurs in secondary renal congestion, not in primary nephritis. A study of the subject of acidosis in diseases of the circulation—the blood carbon dioxide, the hydrogen ion concentration, the ketones and other acid bodies—may, in the future, yield valuable information.

4. That drugs and poisons may be a factor is a natural assumption. An amount of alcohol that in otherwise healthy persons might not do any recognizable harm, may in a patient with disordered circulation lead to a psychosis. Some older writers have held digitalis responsible for maniacal and other acute psychopathic outbreaks. Duroziez[5] reported a number of cases of delirium and coma, which he attributed to digitalis medication. H. O. Hall[6] also called attention to delirium and hallucinations during the course of the administration of digitalis. In one case cited by him, it would certainly seem as if digitalis had been responsible for a condition of mental depression bordering on melancholia. Babcock (quoted by Hall) noted in two patients a peculiar mental and emotional state that disappeared after the use of digitalis was discontinued. In the one case, that of a woman, with mitral stenosis, the mental disturbance took the form of a sullen moroseness with taciturnity; while the other patient, a man with aortic insufficiency, manifested a mild delirium of a harmless kind.

At the present moment I have under observation a woman with auricular fibrillation, who, after about the third or fourth day, became confused and talkative. She did not seem to know where she was, although on the occasion of my visits she would answer questions rationally. She herself said, both to the nurse and to me, that she thought the dark medicine did not agree with her. The

[5] Gaz. hebdom., 1874, XI, 780.
[6] Am. Med., 1901, I, 598; Ibid., 1905, IX, p. 489.

dark medicine was tincture of digitalis, with a very small amount of tincture of belladonna. I thought that she might have a prejudice, so I substituted digipuratum for the tincture of digitalis. But she also objects to that, and I am strongly inclined to stop the administration of digitalis altogether.[7]

While digitalis may in rare instances exert a direct action upon the brain, it is possible that in some cases when overdoses are given, it may, by disturbing the cardiac rhythm through its action on the conducting mechanism, still further impair an already inadequate circulation. On the whole, however, considering the universal use of the drug and the carelessness in dosage, one would expect that if digitalis could cause psychoses they would be much more frequent.

5. Several years ago I had the following experience: Mr. H. B. B., a man in the late fifties, was suffering with cardiovascular disease, with extreme dropsy. I tried digitalis and all other well-known diuretics without result. About that time agurin appeared on the market. I prescribed it and was amazed to find the urine output increased to an enormous degree, with a coincident rapid disappearance of serous effusions and of every trace of dropsy. During the time that the patient was putting out huge quantities of urine (in one day more than 200 ounces), he developed a delirious, incoherent state, which lasted several days and proved most distressing to his devoted family. I attributed it to a swamping of the system with the toxic material that had been held in solution in the dropsical fluid, and which, in order to reach the kidneys, had to return to the general circulation.

6. In cases in which the foregoing factors are lacking, in which the cardiac patient without neuropathic taint, nephritis, acidosis or exogenous intoxication, develops an acute psychosis, we may assume that it is due to some direct disturbance of the cerebral circulation, affecting the higher centers. At times there is probably syphilitic disease of the vessels, but that is not a prerequisite. Dana's hypothesis[8] concerning the part played by the neuronic synapes may help us to understand why, in disturbances of the circulation, alterations may occur in the psyche. Nevertheless, it is still a far cry from hypofunction of the synapses to an understanding of mental exaltation or depression, of hallucinations or of confusional states.

Not much need be said about treatment, which will vary with the type of disturbance found. Maniacal patients often do not

[7] This was done but the psychosis continued, so that it is not likely that digitalis had anything to do with it.

[8] Jour. Am. Med. Assn., April 24, 1920.

respond to morphine or any of its cogeners. I have obtained better results with chloral, which I believe to be not so depressive to the heart as it is usually considered.

As regards diagnosis, it is always necessary to bear in mind that acute mania or melancholia may be symptomatic of visceral disease, in particular, of disease of the heart, and that patients so affected are not of necessity subjects for the asylum. The prognosis is governed by the state of the circulation—if the patient's heart holds out his psychosis will disappear.

TREATMENT AND GUIDANCE OF PATIENTS WITH DAMAGED HEARTS [1]

The first patient I am going to show is a man thirty-five years of age who had rheumatic fever in the twenties. He has had several attacks since but probably sustained damage to his heart in the first one. Proving however that nature takes care of us, he was able to do the hardest kind of labor. The work that he did of late years, which none of you I think has ever tried, was delivering beer barrels and boxes of beer, the barrels weighing two hundred pounds each. He would deliver sometimes twenty or twenty-five a day, carrying them up one, two and even three flights, all the time having a mitral insufficiency.

The reason he was able to do that was that the heart compensated for the valvular leak by becoming enlarged, and that enlargement has increased progressively until now the heart is truly enormous. In the X-ray film it almost fills the entire chest. He has had many cardiac breaks in recent years. When we ordinarily speak of "a break" we have unexpected good fortune in mind, but in this man's case a break is something altogether undesirable. He has spent about four years in hospitals since his trouble began, and now he has dropsy, a large liver, rales in his chest, and as I have said, a heart enormously enlarged, so large that when I saw him yesterday I thought he might have a pericardial effusion, but against that is the fact that the heart-beat is very plain and the heart sounds very clear. I admit that does not always rule out an effusion, but it is unusual. The other possibilities are a marked dilatation and pericardial adhesions.

I have just had a talk outside with the next speaker, Dr. Beck. He tells me he has found in animal experiments that pericardial adhesions by themselves do not cause hypertrophy. This is very interesting and it may well be that if the patient has adhesions they are not the cause of the large heart, but the mitral lesion and the myocardial disease are the responsible factors. You will note that the man is deeply cyanosed. He has some peculiar lesions on

[1] Reprinted from Proceedings of the Inter-State Postgraduate Medical Assembly of North America, 1936.

his body that do not heal because his nutrition, especially that of his skin, is bad. He is, however, getting better.

What can we do for him? The quickest relief we can give him is by taking some blood from the elbow, not with a syringe, but by making a cut with a knife and letting the blood spurt up in the air. It is the old-fashioned way. Four or five hundred cc. will probably do away with the cyanosis and will relieve the heart of much embarrassment.

Secondly, we give digitalis. Most of these patients have had the drug before they come to hospitals—and the heart cannot stand any more or the stomach cannot stand any more, because digitalis produces nausea. So we use substitutes. If the kidneys are sound we get good results from mercurial preparations, mercupurin or salyrgan, combined perhaps with ammonium chloride. I have seen marvelous diuresis from such treatment, the dropsy just melting away. It may come back, but for the time being the patient is very much better.

There is another way of treating these cases of dropsy if they do not yield to medicines, and that is by scarifying the legs. I have done that many a time and I have seen patients who were absolutely bedfast leave the hospital and be well for years. I make six or eight or ten cuts in each leg with a sharp scalpel through the skin to the subcutaneous tissue until serum or a little blood appears. In the period of a few days one can draw off a great deal of fluid. The method is not new—it goes back to Hippocrates.

The next patient, a woman, presents a rather pathetic case. When her periods set in at the age of eleven and a half years she had an attack of St. Vitus' dance, chorea. I believe that her heart trouble dates back to that, although she does not know anything about it. She had attacks of rheumatic fever afterwards.

No doubt her parents did not employ a doctor, or not a competent one, for she was made to work on the farm and to do a man's job, pitching hay and everything that had to be done. This she told me herself this morning. She did a man's work when she was a young girl with a damaged heart.

She married and had two children without any trouble, and two miscarriages. Of late years she has had several cardiac breaks. She has been short of breath and very blue, and dropsy has been present. She comes to the Ancker Hospital for relief. On examination I find enlargement of the liver, edema, rales in the chest, and an enlarged heart, with double mitral disease, mitral stenosis and insufficiency—a typical picture.

The interesting point is that she bore two children despite so

serious a lesion. We used to think that mitral stenosis contra-indicated pregnancy, but experience has taught us that if the heart is competent—and it may be so for years—the patient can go through one or two pregnancies without any harm. But if the patient shows signs of cardiac weakness during the pregnancy, the next pregnancy is apt to be fatal. Therefore, it is most important to watch the cardiac patient throughout the pregnancy.

This poor woman is to be treated very much like the other patient, but as her disease is not so far advanced, she will I think yield more promptly to treatment.

The next patient, a man 36 years old, is an ambulatory case, an employee of the Ancker Hospital, who has kindly consented to come here so that I may demonstrate him to you. His case is interesting. He had growing pains as a child. What a terrible thing growing pains may be in a child! They are nearly always rheumatic in origin. The pain may be only in one knee or in one hip and yet lead to permanent valvular disease. Parents must be educated to look upon growing pains as they would look upon a hemorrhage from the lungs; in fact it is more serious. Like the woman who has just gone out, this patient has also had St. Vitus' dance.

Despite a valvular defect, he did rather hard work for a time. When the lesion was discovered he was assigned to an easier job. This is one of the ways in which we can handle our cardiac patients —by giving them sedentary or other light work; then they can live comfortably for years.

This patient has another lesion, namely, aortic insufficiency. There is a general belief that rheumatic fever attacks the mitral valve much more often than the aortic. I do not believe that. I think the aortic valve is affected almost as often as the mitral. Very frequently both are affected. It makes little difference which is involved primarily, if the patient has recurring attacks the other valve, also on the left side, becomes diseased.

Patients with aortic disease can do the severest kind of work. I am connected with our City Hospital where we get longshoremen and other hard workers who despite aortic insufficiency have had no trouble for years.

This patient has a typical to and fro aortic insufficiency mumur—a double murmur at the base. There is nearly always such a double murmur, systolic and diastolic, in aortic insufficiency, but the systolic murmur does not mean much; it does not as a rule signify stenosis; the diastolic murmur is, however, always significant.

This man also has a soft murmur at the mitral area; it is slightly presystolic. The question arises whether there is a true mitral

stenosis or whether there is what is called a Flint murmur. I shall not go into the differential diagnosis, but merely mention this point. He has an exquisite Corrigan pulse. The way to feel the coronary pulse is not to put the finger on the artery, but to grasp the forearm with both hands flat and in front of the arm.

The next case in very interesting. The first three have been valvular cases, i. e., the disease started in the valves of the heart. The patient I now show you is not primarily a valvular case—she has myocardial disease, with marked enlargement of the heart and high blood pressure—not at present, but it has been up to over 200—and congestive heart failure. She has a soft systolic murmur at the apex, but as she has no rheumatic history whatsoever I look upon the murmur as one of dilatation of the mitral orifice and not as one due to endocarditis.

We used to speak of such cases in which there was high blood pressure and enlargement of the heart as myocarditis, but at necropsy we do not find any inflammation in the heart itself, so that the word myocarditis is not applicable. Myocardosis is a better term.

This patient has then a very soft, inconsequential mitral systolic murmur, edema of the legs and rales in the chest—the picture is typical of congestive failure, not on a valvular but on a myocardial basis.

The interesting point is that this type of heart disease is more common than the valvular type, but it is apt to be overlooked because there is often no murmur. The only way in which one can guard against error is to look for enlargement of the heart. There are three means of doing that—two you carry with you. One is the eye, looking for the apex beat; the other is the fingers, percussing the outline of the heart. The third is the fluoroscope.

This case to my mind is the most important that I am showing you today, because it is the most common type of heart disease in adults. As I have said elsewhere, we may call it the failing heart of middle life.

Many patients of this type have as the basis of their trouble a coronary sclerosis which may not show itself except in heart failure; but it may also show itself as angina pectoris or as coronary occlusion.

The last patient, a man 67 years of age, is in poor condition but he consented to come here at the suggestion of the physicians of the Ancker Hospital. He is very dropsical; his eye-lids are strikingly edematous; in fact he is swollen all over. His liver is enlarged, his lungs congested. While this patient has aortic regurgitation, that alone does not account satisfactorily for the tremendous edema so

that I looked for something else and I found the explanation in a tricuspid insufficiency. He has a systolic murmur at the pit of the stomach and a pulsating liver.

What is the cause of the aortic insufficiency in this patient? It is not rheumatic, it is syphilitic. He has a positive Wassermann test in his blood and spinal fluid, and a paretic gold curve in the latter. His pupils appear to be of the Argyll Robertson type. Thus the patient presents two varieties of lues, the vascular and the nervous. This brings up an interesting question. There has been a theory, largely maintained by French writers, that there are two kinds of spirochetes, one angiotropic, seeking the blood vessels, the other neurotropic, seeking the nervous system and causing paretic dementia and locomotor ataxia. I have doubted this on clinical grounds and believe that a case like the one I am showing you proves that there is but one type of spirocheta pallida. Would you treat this man for lues? No. The indication here is to treat him for his cardiac failure and to ignore the luetic disease until we have made an impression on the congestive failure.

In the time remaining I want to speak a little more fully on the text assigned to me, namely, "The Guidance of Patients with Damaged Hearts." Guidance after all is more important than treatment. It involves preventive medicine, which is the medicine of the future.

In order to make the best use of my time I shall limit myself to:

1. Rheumatic heart disease.
2. Coronary disease, including angina pectoris.
3. Myocardial disease due to or associated with hypertension.

The child whose heart has become involved in a first attack of rheumatic fever—an involvement that may be so slight as to be easily overlooked, has to be protected in order to reduce the damage to a minimum. We know furthermore that the valvular lesion is not the only injury done by the rheumatic poison—the heart muscle almost never escapes.

The best thing we can do for the child is to keep it at rest, six weeks at least or longer, so long indeed until the heart rate is normal and does not remain rapid for any length of time after exertion, and until all elevation of temperature has disappeared. Even a rise to 99 or 99.5 is sufficient reason for enforcing inactivity. There are cases in young boys and girls in which the murmur disappears on rest but in which these subfebrile temperatures and irritability of the pulse persist. Such children must be inactive for a long period. I once kept a boy of ten at rest, not always in bed, for 14 months. He recovered completely and is now active in all sports suitable to his age.

Prolonged confinement to bed or prolonged inactivity is a great trial not only for the patient but also for the mother and for the doctor. The doctor must be firm. A helpful poster has been issued by the Metropolitan Life Insurance Company.

What can we do to ward off a second attack, which is pretty certain to damage either the same valve or another, as well as the myocardium? If the tonsils are diseased they should be removed, although I am not sure that we thereby prevent recurrence of rheumatic fever. Proper clothing and footwear, sensible meals and vitamin A or cod liver oil, and avoidance of fatigue, are important. The anemia usually present must be combatted with iron. What about exercise? A child with rheumatic valvular disease whether mitral or aortic, without marked hypertrophy, who feels well can take exercise, except the more strenuous forms, such as rowing, track running, etc. If the parents have the means it is wise to take the child South for the winter, perhaps enrolling him in one of the Southern schools.

I have said nothing of the treatment of the damaged valve during the acute attack. Aside from rest there is practically nothing in our armamentarium, certainly no specific. I am not convinced that the streptococcus is the cause of rheumatic fever, at any rate it is not the sole cause; therefore, I have but little faith in streptococcus antigens, powerful as they are.

In the later stages of rheumatic heart disease, after the lapse of years, particularly if the mitral valve is involved, auricular fibrillation frequently ensues. It is best combatted by rest and digitalis.

Congestive heart failure, usually the terminal stage of rheumatic heart disease, I shall discuss later.

I now come to coronary heart disease, a new term introduced into medicine since my student days. William Heberden in 1768 described angina pectoris and ever since the disease has been an etiologic puzzle. Not all men are agreed that it has something to do with the coronary arteries, but I think the majority of men hold that opinion.

Given a patient whose symptoms justify the diagnosis of angina pectoris, how shall we treat and guide him? If we chance to see him in an attack we administer amyl nitrite by inhalation or nitroglycerin by mouth, under the tongue. If these fail a good dose of morphine sulphate with atropin should be given. As a rule the patient has to treat himself, before the doctor comes. He should, therefore, have in his possession nitroglycerin tablets, grain 1/100, or amyl nitrite pearls to crush and to inhale at the first sign of an attack.

Most patients after an attack are none the worse, nevertheless it is wise to enforce a day or two of rest and quiet. If the attacks are frequently repeated, then a more prolonged rest is advisable. Further treatment and guidance I shall discuss in connection with coronary occlusion.

Angina pectoris is not the sole manifestation of disorder of the coronary vessels. Thanks to James B. Herrick and numerous others, we have given a prominent place in our nosology to coronary occlusion. We hear and see a great deal of it. Even the laity are beginning to discuss coronary thrombosis. The condition is especially common among doctors; it might in fact be called the doctor's disease. Is it increasing? I do not know. We are certainly diagnosing it more often, perhaps only because we are coronary-minded.

In the majority of instances coronary thrombosis or coronary occlusion is a very characteristic disease, unmistakable, but there are times when the picture is confused so that various other possibilities suggest themselves—gall stone colic, perforation of a peptic ulcer, acute pancreatitis, gastric crises, mesenteric thrombosis, rupture of a dissecting aneurysm. I mention these merely to emphasize the importance of accurate diagnosis before undertaking treatment.

The principal indication in acute coronary thrombosis is to relieve pain. (It should be remembered, however, that sometimes coronary occlusion is painless.) Morphine in large doses up to safety is usually required but it may fail. I once saw a patient in whom it failed; chloroform was given, but as soon as he came out of the anesthetic, the pain returned. It disappeared promptly and miraculously on the application of leeches to the precordium. Oxygen inhalations have been recommended, but I have not seen much benefit from their use.

Absolute quiet, which also means that the patient should not be turned for the purpose of examining him, is of prime importance. On account of large doses of morphine one must watch for retention of urine.

The diet for the first few days should be very meager—water, orange juice, water ice, weak tea, applesauce.

If the heart is weak and the blood pressure very low, caffein sodium benzoate should be given hypodermically.

I have always refrained from using digitalis in the acute attack but afterwards if auricular fibrillation and signs of congestive failure appear, digitalis should be administered.

If the bowels need urging, a suppository or a little milk of magnesia or mineral oil, answers the purpose.

The thing of paramount importance in the guidance of patients who have had an attack of coronary occlusion is prolonged mental and physical rest. Six weeks should be the minimum stay in bed. It must be longer if the pulse is irritable, if the heart sounds are weak, if there is a gallop rhythm, and if the blood pressure remains much below the patient's normal.

In guiding these patients later it is well to lay down definite rules—these rules also apply to angina pectoris. They should be put in writing.

1. Small meals of simple foods, avoiding especially pastries and fancy dishes, fresh bread, things that create gas.
2. Fluids should not be taken in excess.
3. Straining to move the bowels should be avoided.
4. The patient should rest after meals, a half hour after breakfast and an hour after the noon meal. In the case of a business man or executive, it is advisable to have a couch in the private office. The use of tobacco should be discontinued.
5. Avoidance of undue exertion, running, stair-climbing, heavy lifting. (I tell my patients the only thing they should lift is a mortgage.)
6. No walking against a strong wind. Avoidance of chilling.
7. Temperance in all things, especially in coitus.
8. A better philosophy of life—living at a lower level.

Myocardial Disease. This is one of the most common manifestations of heart trouble. I have elsewhere called it the "failing heart of middle life." As it is often unaccompanied by any murmur the diagnosis is not always easy. It is made, as I have said above, on finding enlargement of the heart by percussion, palpation and fluoroscopy, and by symptoms of beginning heart failure. The earliest of these symptoms are breathlessness on effort and gastric disturbances, bloating and belching.

The condition was formerly called myocarditis. It is not truly inflammatory and the word myocardosis is more applicable. High blood pressure is the rule but is not invariably present. An interesting symptom group is that due to vascular spasm in the brain or elsewhere.

The patients usually come under observation during early or late stages of congestive failure. Very often the first treatment needed is tapping of the chest for the removal of fluid. Personally I believe this should be done with a syringe and not with a suction apparatus since too rapid withdrawal may lead to pulmonary edema. An accumulation of fluid in either the right or the left chest is among the earliest signs of failing heart power and

is frequently overlooked because it is painless. One or two tappings generally suffice. Under proper treatment there will be no further accumulation except in far advanced cases.

The general treatment of congestive failure consists in rest in bed with proper pillows or a bed rest to lessen the dyspnea, reduction in the fluid intake to 1200 or 1500 c.c., free action of the bowels with epsom salts, and digitalis, either by the Eggleston or massive method, or by the slow method, according to the urgency of the case. If the dyspnea is very marked and there is much cyanosis, withdrawal of a pint of blood from the elbow often acts like magic.

Sleep is one of the most important desiderata and is best procured with a hypodermic injection of morphine.

If there is general dropsy and digitalis fails to remove the fluid, then we must resort to other diuretics—first the theobromine group, as for example, theocin, five grains three times a day for not more than four days, or the so-called Niemeyer capsule, consisting of powdered digitalis, calomel, powdered squill and caffein, one grain each. This must not be used too long as there is danger of salivation.

Failing with these we resort to the synthetic mercurial preparations, salyrgan or mercupurin, combined perhaps with ammonium chloride. Finally, if all these things disappoint, then scarification usually succeeds.

After he has recovered from the congestive failure, and many recover from the first attack and a goodly proportion even from a second or third, we would advise the patient to avoid strenuous physical labor and mental strain, to rest a little during the day and if possible to abstain from work entirely on Saturday and Sunday. He should use tobacco and alcohol in moderation. If he is obese he should cut down his food intake. A little thyroid extract may even be given.

Some have advised total thyroidectomy for intractable congestive heart failure. The same operation has been recommended for angina pectoris. While there have been a number of apparently brilliant successes, the operation is still on trial. The same thing applies to other surgical procedures for the treatment of angina pectoris, such as paravertebral injections of alcohol and operations on the sympathetic nerves and ganglia in the neck.

Finally, psychotherapy has a most importance place in the guidance and treatment of the patient afflicted with heart disease. A cheerful word of encouragement often does more than any drugs.

SPLENECTOMY IN THE TREATMENT OF SUBACUTE BACTERIAL ENDOCARDITIS *

In subacute bacterial endocarditis as in Hodgkin's disease we know we are beaten from the start. Remissions may occur, raising the elusive hope of recovery but the end is early death. There are a few exceptions to this in subacute bacterial endocarditis but they are so few as to be negligible. We feel somehow that the patient infected with the mildly pathogenic Streptococcus viridans ought not to die. If the streptococcus is only a secondary invader as several authors maintain, then it behooves us to find the primary factors that enable it to become so irresistible an enemy. The interesting point made by recent writers that subacute bacterial endocarditis is only another manifestation of rheumatic infection needs further investigation. Our own impression is to the contrary.

Every imaginable agent and procedure has been used and practically all have been failures. This tragic fact led one of us a few years ago to the following reflections. Is it possible that death is due chiefly to the manufacture of bacteria and toxins in secondary foci and if so, is the spleen not likely to be the most important branch factory? In the majority of cases the spleen is greatly enlarged and the seat of multiple infarctions. Furthermore, in what is perhaps an analogous situation, syphilitic splenomegaly, it has been found that treatment is sometimes unavailing until after splenectomy.

On the basis of these considerations one of us,[1] in 1918, proposed splenectomy as a therapeutic procedure in subacute bacterial endocarditis and reported a case which is briefly summarized here, as Case I.

Case Abstracts

CASE I.—The first case was that of a man, aged 57, father of a medical colleague. On account of a large spleen and anemia with leukopenia the diagnosis of splenic anemia had been made. However, the finding of petechiæ, the presence of a valvular murmur and the long-continued fever

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Written in collaboration with John A. Kolmer, M.D., and David Polowe, M.D.

justified the diagnosis of subacute bacterial endocarditis, although the spleen was larger than is usually seen in such cases. As nothing had helped the patient, he and the doctors concerned readily accepted the suggestion of splenectomy. The organ was found to be the seat of numerous infarctions. So striking was the improvement that it encouraged the hope of cure. However, four weeks later the patient developed an abscess of the larynx from which he died.

Case II.—The second case is that of a married woman, aged 25, who had two attacks of rheumatic fever, one at 11, one at 14. At the age of 20 she had auricular fibrillation lasting two weeks. Her marriage was followed by two pregnancies that had to be terminated artificially because of the condition of her heart. On June 20, 1935, she consulted one of us because of a tired feeling and painful subcutaneous nodes on fingers and toes. Physical examination showed marked cardiac enlargement, a mitral systolic murmur and two painful ecchymotic nodes. Her general appearance was, however, that of a woman in good health. Blood culture yielded a Grampositive nonhemolytic streptococcus. The patient complained bitterly for a few weeks of pain in the right hip joint and in the abdomen. The blood counts are given in Table 1. Throughout the patient's illness the urine aside from a trace of albumin was entirely normal.

In addition to general supportive measures several specific forms of treatment were instituted—blood transfusions and specific bacteriophage therapy—the phage was kindly prepared by Dr. J. W. P. Love. It proved unavailing and this was also true of snake venom therapy. A total of 10 cc. of a 1 to 3000 solution of moccasin snake venom was administered. There was a transient lessening of the severe hip-joint pain, but after a few injections the pain returned and was worse than ever. The slightest jarring of the bed would make the patient cry out with pain.

It was decided to remove the spleen which had been palpable since early in July, 1935. At the operation the organ was found large and infarcted. Two pea-sized accessory spleens were also removed. There was immediate relief of joint and abdominal pains, an improvement in the red cell count and hemoglobin percentage, no further loss of weight, the heart became quiet and as the patient often stated "it had ceased to tumble about so." The fever continued and seemed to exhilarate her. She saw her friends, played bridge in bed and did not seem to realize that she was critically ill. There was not let-up, however, in the showers of emboli in the fingers and toes. On December 16, the patient began to develop thickness of speech and nocturnal Cheyne-Stokes breathing, which were interpreted as of cerebral embolic origin. On January 1, 1936, she was seized with convulsions and died on the following day.

Examination of the Spleen. Gross Morbid Anatomy. The main spleen was at least twice normal size, of firm consistency, deep red in color and covered by a fine frost of fibrinous exudate. A strong, wide, vascular band of adhesion connected the visceral surface and anterior tip of the spleen to the cardiac portion of the greater curvature of the stomach. After 10 days in formalin, the spleen weighed 13 ounces (404.3 gm.). A cross-section exhibited large lymphoid aggregations over the entire cut surface, except where the infarct presented itself.

Histologic Examination (Dr. Paul Klemperer). Follicles: These are really large, with centers particularly conspicuous. There is a great number of reticulum cells. But there are also neutrophils within the center of the

follicles. Around the follicles, in the perifollicular zone, there is a great accumulation of leukocytes and eosinophils among other cells.

Red Pulp. The sinuses and sinus epithelium are not particularly conspicuous. The sinuses contain a large number of neutrophils, lymphocytes and histiocytes. In the pulp proper there is an accumulation of plasma cells around the blood vessels. Moderate fibroblastic proliferation is present. There is a good number of pale nucleated cells (histiocytic cells) which contain iron pigment. The iron pigment is not very abundant. Gram-stained sections: no bacteria found.

TABLE 1.—THE BLOOD PICTURE IN CASE II

Date.	R.B.C., millions.	Hb., %.	W.B.C.	Neutrophils, %.	Band forms, %.	Eosinophils.	Basophils.	Other lymph.
Pre-operative.*								
6/22/35	3.9	74	9,900	63	8	0	1	36
7/ 9/35	3.8	79	10,300	75	†	0	2	23
7/24/35	†	76	10,800	75	†	2	1	22
7/30/35	†	83	7,400	70	12	0	2	28
8/ 3/35	4.4	84	6,800	75	15	1	0	24
8/ 7/35	†	†	8,000	61	8	1	1	37
9/14/35	3.7	65	12,800	78	†	2	0	20
Postoperative.								
9/19/35	4.1	66	14,300	77	15	5	0	18
9/24/35	3.8	74	21,600	79	10	5	0	16
10/ 1/35	3.5	70	14,700	72	14	2	0	26
10/ 8/35	4.1	73	21,100	75	14	2	1	22
10/23/35	4.1	75	14,700	70	9	1	0	29
11/20/35	4.0	73	26,600	77	20	1	0	22
12/16/35	4.4‡	67	29,900	73	12	0	1	26

* The platelet count before splenectomy was average normal (no actual count was made, but that is the note that appears on the blood count sheet as of July 24, 1935). Following splenectomy platelet counts were made on September 19 and 24 and October 1 and 8; these were found, respectively, to be 356,700, 253,440, 310,000 and 258,000.

† Not done.

‡ The blood count should be evaluated in the light of the presence of edema—the patient had gained 5 pounds of fluid in two weeks, although there was only slight pitting on pressure of the dorsum of the foot; a slight clubbing of the fingers, from which the blood for counting was taken, was also present, but this was present from the beginning. (Clubbing of fingers first noted, September 29, 1935.)

CASE III.—I. A., a youth aged 22, was seen in consultation with Dr. Blumberg by two of us on separate occasions. The patient presented the typical picture of subacute bacterial endocarditis. His illness had begun on March 25, 1935, with malaise, muscular pains and late afternoon fever. The symptoms and the laboratory data were characteristic of the disease. Blood cultures—many were made—were positive for Streptococcus viridans.

Despite every form of treatment the disease progressed rapidly downward.¶ A cerebral embolus produced hemiplegia and stupor. His condition was such that it was felt the end was near. The parents consenting to the

¶ The following were the more specific measures employed in this case: Intravenous and intramuscular injections of Streptococcus cardioarthriditis serum (Small) and concentrated polyvalent antistreptococcus serum, intravenous injections of bacteriophage prepared by Dr. John Love and one of us, transfusions of blood for a total of 19; intravenous injections of sodium cacodylate, and so on.

operation, it was performed on September 15, 1935, by Dr. W. W. Babcock. The spleen was found enlarged and showed infarction.

Notwithstanding the patient's critical condition the operation was well borne and was followed by striking amelioration. Weight and appetite markedly improved; there was less pain and greater comfort, less sweating, slight reduction of the leukocytosis and greatly improved morale. Unfortunately this favorable course persisted for only 10 days, then the former picture returned. Death took place on December 22, a little over two months after the operation.

Examination of the Spleen (Dr. H. J. Lemon). **Gross Description.** The spleen measures 17 by 10.5 by 4.5 cm. It is reddish-brown. The capsule is smooth and the organ is fairly soft. Scattered over the surface are several slightly raised areas which are yellowish-brown, the largest about 1.5 cm. in diameter and 2 cm. in depth, which appear to be abscesses. There is also a small accessory spleen, 1.2 cm. in diameter.

Microscopic Description. Sections of the spleen show many Malpighian corpuscles much larger than are normally seen. The enlargement is predominantly of the so-called germinal centers. These are surrounded by a broad zone of lymphoid cells. There are patchy areas of congestion present. Here the sinuses are filled with red blood cells and lymphocytes. In other areas the sinuses are partly empty but appear enlargd. The splenic cords appear thickened and contain many lymphocytes and neutrophils. Large areas of necrosis are present in which there are numerous collections of neutrophils. Active fibrosis is beginning around the edges of the infarcted areas.

Diagnosis. Subacute splenitis with infarcts.

Case IV.—H. M., aged 39, had no history of rheumatic infection. His illness began in January, 1935, with lack of "pep," weakness and irritability. In February he had an attack of grippe from which he never fully recovered. On biliary drainage (Dr. H. S. Davidson), the culture yielded a nonhemolytic streptococcus. In May, the man felt somewhat better and continued at work but began to have late afternoon fever. Blood cultures were negative. Somewhat later a thorough study of the patient's case was made in Youngstown, Ohio—Hodgkin's disease and leukemia were suspected.

When seen in Atlantic City he had the typical symptoms of sepsis—chills, fever and drenching sweats. The heart sounds were exceedingly feeble, indeed scarcely audible, but there was no murmur and no arrhythmia. The liver was enlarged and slightly tender. The spleen was easily palpable.

TABLE 2.—SOME BLOOD COUNTS FROM CASE IV.

	8/10/35.	9/26/35.	11/4/35.	4/29/36.	5/11/36.
R.B.C.	4,600,000	3,790,000	4,550,000	4,500,000	4,401,000
W.B.C.	5,750	1,850	9,350	17,400	13,600
Hemoglobin	11 gm. (66%)	9 gm. (54%)	11.5 gm. (69%)	12.5 gm. (73.7%)	12 gm. (70.8%)
Eosinophils	0	4	2	1	1
Mononuclears	19	14	16	9	12
Neutrophils	67	44	70	73	78
Lymphocytes	13	38	10	16	8
Basophils	1	0	2	1	1
Color index	0.71	0.71	0.76	0.81	0.8

As the disease progressed the patient lost more and more weight, a total of about 60 pounds. His color became sallow, he grew weak and very irritable and had an extreme hyperesthesia of the skin of the entire body. The spleen was much enlarged and a little fluid could be detected in the abdomen.

No definite diagnosis was arrived at—mural subacute bacterial endocarditis seemed reasonable. As nearly every conceivable treatment had been tried without any result, splenectomy was suggested as a last resort. The patient readily acquiesced and the operation was performed by Dr. Babcock on October 1, 1935.

It was exceedingly well borne, and for about eight or nine days the patient appeared distinctly improved. However, on October 11 the temperature began to run in the same manner as it had prior to the operation, but on October 23 it suddenly dropped to subnormal. The patient had a convulsive seizure and was comatose, almost pulseless, and death was expected at any moment. Under stimulation he revived and from that time on his improvement was rapid and progressive. On November 4 he was discharged convalescent. He returned to work and when last seen was in very good condition.

Bacteriologic examination of the spleen revealed a pure culture of Streptococcus viridans.

It is difficult to explain the cause of the collapse of H. M. 23 days after the splenectomy, but following it there was no doubt of his rapid return to normal and a state of satisfactory health. During recent weeks he has had three periods of fever with pain in the left loin, sweats and leukocytosis. It is possible that he is developing a perinephric abscess, although the studies with that thought in mind have been negative. Whether the morbid process underlying these attacks is the same as that which afflicted him originally or whether what is going on now is something left over from the operation cannot at present be decided. Dr. Harold Davidson, the family doctor, is convinced that the patient was dying when we saw him together and that the splenectomy saved his life. He gained 60 pounds in weight and for five months has been to all intents and purposes a well man.

Examination of the Spleen (Dr. Frank Konzelmann). **Gross Description.** The specimen measures 18 by 12 by 6 cm. The surface is bluish-red and nodular. There is some wrinkling of the capsule. The pulp is moderately firm. The incised surface is a deep red; it is granular. The follicles are few and barely visible. The trabeculae are not marked. There are occasional translucent irregular whitish markings throughout the organ. There is no evidence of thrombosis of the splenic vein.

Microscopic Description. (Bouin fixation, hematoxylin and eosin.) The follicles are few in number; the number of lymphocytes composing them is also small, with a decidedly eccentric arrangement of cells that are somewhat larger than ordinary lymphocytes and cells that have a somewhat more reticular nucleus. The periphery of these small follicles is frequently the seat of hemorrhage. In the interfollicular areas the usual splenic sinuses are almost obliterated by what seems to be swelling of the reticulum. The number of free cells and of lymphocytes seems to be distinctly diminished, while the number of reticulum cells, notably cells that have oval or elongated nuclei, seems to be increased. Occasionally a large cell measuring 30 to 40 microne in diameter with an equally large nucleus is seen. The nucleus of this cell consists of a deep-staining membrane, huge nucleoli and

a very scant scattering of chromatin particles. Occasionally there are patches in which several giant cells occur, possessing two, three or four nuclei of the type just described. These cells make one think of the Reed-Sternberg cell of Hodgkin's disease. However, the absence of the other cellular elements of Hodgkin's disease makes such a diagnosis improbable. Occasionally mitotic figures are seen among the reticulum cells. The striking feature is the relatively small amount of blood in the organ. There are patches, especially around the follicles, as mentioned above, where vessels are engorged. An occasional engorged venule is seen, and very careful search reveals here and there pools of blood in very much distended sinuses. It seems as if these bloody collections are most numerous where nodules appear on the surface of the organ. It is also noteworthy that many of the arterioles are characterized by a hyalin degenerative process of the endothelial lining and sometimes of the tunica media. Examination with oil immersion reveals in some of the macrophages small granules that are suggestive of coccoid bodies. Nothing resembling Leishman-Donovan bodies can be discovered.

Diagnosis. Chronic splenitis showing hyperplasia of the fibrous and cellular reticulum.*

The literature on splenectomy in septic conditions, particularly in subacute bacterial endocarditis, is exceedingly meager. The senior author's case was apparently the first to be reported. Of two patients with subacute bacterial endocarditis operated in the Mayo Clinic, one lived three months, one, seven months after the operation. We found one article in the Russian literature by Sawadski [2] in which a successful splenectomy is reported. The case was not altogether typical of endocarditis but it was one of long-continued fever in a woman of 28 years with a rheumatic history. Sawadski believes that the spleen may act as a focus of infection and says, specifically, that the presence of bacteria in the blood stream is no contraindication to the operation of splenectomy.

Persistent search has revealed a few additional articles. Wieden [3] reports a series of cases of splenectomy from Prague. Among 81 instances of splenectomy, there were five cases of endocarditis in which the operation was done for infarcts of the spleen. The first case was that of a military officer of 21 years who had had a long-standing sepsis following a grenade injury. After removal of the spleen, which was enlarged and contained several infarcts, the patient recovered completely. While the clinical diagnosis was endocarditis, the possibility of chronic sepsis secondary to wound infection cannot be excluded. The second patient, a man of 40, with a history of rheumatic fever, cardiac enlargement and a systolic and

* Since writing the foregoing article the patient, H. M., was operated upon in the suspicion that he might have a perirenal abscess. No abscess was found. He died in his home in Atlantic City on June 10. No autopsy was obtained. Dr. Kolmer, one of the attending physicians, thinks that death was due to subacute bacterial endocarditis. Whatever the nature of the process may have been, the fact remains that when splenectomy was done the patient to all intents and purposes was near death. He lived nearly seven months and for most of that time was in good health and able to look after his business.

diastolic murmur, was evidently a case of subacute bacterial endocarditis. He died without any improvement in his condition two months after the operation. The third case, that of a young woman of 24, with the symptoms of subacute bacterial endocarditis, died three months after the operation. The fourth patient was a woman of 57 with symptoms of sepsis, a systolic murmur at the mitral area and enlargement of the spleen. On removal the spleen was found enlarged, with numerous infarcts and hemorrhages. The patient recovered, but seven months later there was a recurrence followed again by improvement. A year after the operation signs and symptoms of lymphatic leukemia appeared and the patient died in coma. The autopsy showed lymphatic leukemia and mitral and aortic endocarditis. The fifth patient was a man of 27 with a history of rheumatic fever. He had a murmur and a large spleen. The spleen on removal was found to be the seat of infarcts the size of walnuts. On culture nonhemolytic streptococcus and staphylococcus were obtained. Death occurred 20 days after operation from cerebral embolism.

Vogel,[4] in a lengthy article on extirpation of the spleen in diseases of the blood, says that he wants particularly to recommend splenectomy in the early stages of endocarditis lenta when the general state of the body is adequate and the heart lesion has not progressed too far. He does not think that the continued reinfection of the blood stream is derived from the vegetations on the valves which in the beginning are certainly very slight, but believes it not impossible that a chronic focus of infection such as might be in the spleen overflows into the blood. It is also possible that the bone marrow is a source of sepsis.

Nordmann[5] performed splenectomy in a case of endocarditis in the belief that the spleen might be responsible for the continuance of the infection, by being a reservoir for bacteria and toxic substances. His patient had mitral stenosis and insufficiency as the result of an acute attack of rheumatic fever. Two years later the symptoms of subacute bacterial endocarditis manifested themselves. After six months of septic fever uninfluenced by treatment, Nordmann extirpated the infarcted spleen. The patient made a complete recovery and "long ago left the clinic a well man."

Münzer[6] recommended splenectomy but reported no cases in which the operation had been performed.

We have found one case in the Spanish literature reported by Escudero and Merlo,[7] of Buenos Aires. The patient at the age of 24 had had an attack of polyarthritis; later a syphilitic chancre for which he was actively treated. When 28 years old the signs and

symptoms of subacute bacterial endocarditis appeared—there was mitral insufficiency, hypochromic anemia and severe pain in the left hypochondrium. Blood culture yielded Streptococcus viridans. Splenectomy was performed and was well borne. The hypochondriac pains promptly disappeared but the general symptoms were not changed. Four weeks after the operation the patient at his own request was permitted to go home and sometime later, the day is not given, he died of pulmonary embolism.

Heilborn [8] reports two cases of splenectomy in endocarditis ulcerosa. The first was that of a man of 31. Two years previously he had an acute attack of articular rheumatism which left him with mitral insufficiency and stenosis. The symptoms of subacute bacterial endocarditis appeared one and one-half years later. The spleen was enlarged and tender. Blood culture was negative. After splenectomy the patient made a very good recovery and returned to work. The valvular murmurs were however unchanged. Six months later the man died from cerebral embolism, having previously had an infarct in the kidney. The second case was that of a man of 27 who had had articular rheumatism, gonorrhea, cholera and lues, for which he was actively treated. From January, 1921, onward he had a continual evening fever. The spleen, which was much enlarged, was removed in March; three weeks later the patient suddenly became worse; signs of aneurysm appeared. A massive hemorrhage killed him on August 30. Heilborn concludes that cases of endocarditis ulcerosa, endocarditis lenta and chronic sepsis are favorably influenced by splenectomy if the clinical phenomena point to a pronounced participation of the spleen. It is important, however, to do the operation early. The removal of the spleen may prevent a continuing reinfection of the heart; perhaps it acts also by stimulating the reticuloendothelial system. In any event the experiences to date justify further resort to operation.

There are unquestionably theoretical objections to the removal of the spleen in infective states. The spleen plays an important role in resistance and immunity through its large content of cells of the reticuloendothelial system which are accepted as actively concerned in phagocytosis and in antibody production. Therefore, removal of the spleen would appear to be contraindicated from the point of view of removing an organ actively concerned in resistance and immunity. Furthermore, as Krumbhaar [9] has shown, the removal of the spleen in normal animals causes a mild anemia, which however is temporary. The antianemic function of the spleen, depending perhaps upon its power to conserve iron, is readily taken over by the bone marrow and other members of the

reticuloendothelial system. The absence of stainable bacteria in the spleen of one of our cases suggests the further thought that the organ may actually destroy bacteria.

On the other hand, just as the resistance of the lymph nodes may sometimes be overcome so that they become the sites of abscess or tuberculosis, so the spleen is very commonly found to be the seat of infection during natural and experimentally produced infections. This is probably because the histologic structure of its pulp favors filtration and localization of organisms and especially of those occurring in the blood and peritoneal cavity. Furthermore, its histologic structure facilitates bacterial embolism and infarction, especially in the course of subacute bacterial endocarditis. Under the circumstances removal of the spleen may be beneficial in the way of removing a mass of secondary infection and thereby enabling the individual better to combat the primary infection.

Summary

1. Splenectomy for subacute bacterial endocarditis is well borne even in far-advanced cases.

2. It has not so far been followed by a permanent sterilization of the blood stream in cases in which blood stream infection has existed.

3. Nevertheless, in every one of our cases life was unquestionably prolonged and made more comfortable. The physical and psychic improvement is most impressive. Even if the infectious process should continue in the heart, and it is possible that even this might be favorably affected, it seems that the general condition of the patient is improved.

4. Perhaps if the operation were done earlier in patients with palpable spleens and with hearts not too badly damaged, the results might be better.

5. As death seems to be due in the majority of cases to embolism, the prevention of this complication should be taken into consideration. Nothing, we admit, may come of the attempt.

6. Treatment should not rest with splenectomy. Repeated small transfusions should be continued and bacteriophage therapy tried.

7. Splenectomy may prove to be a method of dealing with intractable forms of sepsis without discoverable focus in which splenomegaly is a prominent feature. This group, in which subacute bacterial endocarditis may be suspected but is unproved, at present promises the best results from the operation.

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CARDIAC MURMURS DURING ATTACKS OF BILIARY COLIC [1]

A few years ago I called attention in a short paper [2] to the development of heart murmurs during attacks of biliary colic. Some time later, Dr. Babcock,[3] of Chicago, published an exhaustive article on the relation of the heart to diseases of the biliary tract, and within the past few months Dr. William J. Mayo,[4] in a brief but masterly discussion of diseases of the gall-bladder, made reference to concomitant heart affections. Aside from these, the literature is meager, and yet the subject has considerable practical importance. It is not my purpose to envisage the relation of the heart to the biliary tract in its entirety, but to recur briefly to the perplexing murmurs, of which, since my first paper, I have seen several additional examples. Among 56 cases of gallstone disease from private and consulting practice, 6, or 10.7 per cent., showed cardiac murmurs. This percentage does not express the real frequency of the murmur, as not all of the 56 cases were seen during or soon after an attack of colic. I believe that if the heart is carefully examined at such times the murmur will be found in a much larger proportion of cases. Of the 6, 4 were operated upon; 1 passed five stones in the feces, and 1 has had several typical attacks, but has so far not had an operation. In 5, either the physician in attendance or I myself had examined the patient prior to the attacks and had determined that a murmur was not present. In the sixth case, a woman who had suffered from gallstone colic for seventeen years, the murmur had existed for some time before I first saw the patient.

The murmur is usually quite loud and blowing, systolic in time, and is heard best at the apex. It is not transmitted far, but at times may be heard near the anterior border of the axilla. The heart is nearly always somewhat enlarged, but the dilatation is not extreme. Soon after the attack, or after an operation if one is undertaken,

[1] Read at the fourteenth annual meeting of the American Gastro-enterological Association, Philadelphia, April 19, 1911.
Extracted from the American Journal of the Medical Sciences, November, 1911.

[2] The development of Cardiac Murmurs during Attacks of Biliary Colic, Jour. Amer. Med. Assoc., May 11, 1907.

[3] Chronic Cholecystitis as a Cause of Myocardial Incompetence, Trans. Assoc. Amer. Physicians, xxiv, 43.

[4] Jour. Amer. Med. Assoc., April 8, 1911.

the murmur disappears. In one of the cases, cited in my first paper, the patient, who had had a loud blowing murmur at the height of the attack, when seen again fifty-one days later, had normal heart sounds. An operation had been performed soon after I had seen him and a large solitary stone had been removed from the common bile duct.

Regarding the significance of the murmur, the point of chief practical importance is the bearing the discovery of the murmur may have on the attitude of the physician or surgeon toward a contemplated operation. This attitude will depend to some extent on the explanation given for the cause of the murmur. Several explanations are possible. The murmur might be due to an old-established valvular heart disease antedating the formation of the gallstones. Personally, I cannot recall such a case. I have seen active pulmonary tuberculosis and gallstone colic together—and a more pathetic picture than that presented by the unfortunate woman so afflicted can scarcely be imagined—but never have I observed a genuine attack of biliary colic in a patient with typical endocarditis that had preceded the gallstone disease. (I do not, of course, mean to infer that such a condition is impossible.) In the sixth case cited above, in which the murmur had probably been present for some time, the gallstone disease had existed many years before the murmur appeared.

The murmur, I take it, is a sequel or an effect of the gallstone disease. It is probably not due to an acute endocarditis, since it disappears, as I have said, soon after the attack of colic or after an operation. It cannot be attributed to the jaundice, for it is found in cases without, as well as in cases with jaundice. I am of the opinion that the murmur depends on a myocardial weakness with temporary relative insufficiency of the mitral valve. At first I was inclined to attribute it chiefly to the pain, but wider experience has led me to the conclusion that the chronic infection of the biliary passages present in many cases of gallstone disease leads to a degeneration of the myocardium.[5] During the attack of pain there is a sudden rise in blood pressure, and this is the exciting cause of the dilatation and of the mitral murmur.

I was confirmed in the views here expressed by the following case: Mrs. R. M., aged sixty-one years, had had one or two attacks of biliary colic prior to the one in which I first saw her. I found a mitral murmur and a slight degree of jaundice. The murmur disappeared within a few weeks. After a period of several months' comfort, another attack of colic occurred, and the murmur

[5] A condition somewhat analogous is found in certain cases of fibroid tumor of the uterus.

returned. Though the pain and the acute tenderness in the gall-bladder region accompanying this attack quickly subsided, the patient was left with a peculiar condition characterized by sudden alarming attacks of cardiac dilatation. These would come on without warning and be accompanied by intense dyspnea—orthopnea, marked cyanosis of the lips and face, usually a fear of impending death, and great prostration. The murmur, though less loud, persisted. No medicine or regimen seemed to have any influence on the condition, and gradually the patient became more and more despondent and feeble. Fearing that the attacks would ultimately prove fatal and that surgical intervention involved the lesser risk, the patient was advised to have an operation. Because of the cardiac attacks rather than because of the presence of the murmur itself, we were anxious as to the outcome, but the patient had a good convalescence, despite an ether pneumonia of limited extent. A single stone was found in the common duct. Since the operation about ten months have elapsed and the patient has had no return of her former attacks and the murmur has long since ceased to be audible.

There can be no doubt that the gallstone disease and the alarming attacks of cardiac dilatation stood in relation of cause and effect. When the one was removed, the other disappeared—*sublata causa, tollitur effectus.* The murmur, which disappeared with the improvement in the condition of the heart, must have been the result of the myocardial degeneration induced by the gallstone disease.

The case further indicates that even in the presence of serious weakness of the heart muscle, an operation may be well borne. With regard to the murmur, experience leads to the conclusion that it should not be looked upon as a contraindication to operation. Rather should it be viewed as an indication for surgical intervention, as it implies the existence of a myocardial degeneration that will grow worse if the gallstone disease is allowed to continue. Care should of course be taken to make the operation as brief as possible, and to have a competent anesthetist. The immediate after results of the operation do not seem to be complicated by the cardiac condition.

It has occurred to me that the murmur might also have a diagnostic value. Given a case of repeated attacks of severe epigastric pain of obscure nature, in which angina pectoris and the crises of locomotor ataxia have been ruled out, the development of a murmur should put us upon our guard as to the possibility of gallstone disease.

DISEASE OF THE CORONARY ARTERIES [1]

From the days of Morgagni and of John Hunter until comparatively recent times disease of the coronary arteries remained a casual autopsy finding of little practical interest. Lately, however, it has assumed an extraordinary clinical importance. The attention it is receiving is altogether deserved, for coronary disease strikes at life and at comfort in living as no other human ailment. It is responsible for a large number of tragically sudden deaths, although in such circumstances a diagnosis of coronary disease is not often made.

Our knowledge of the affection is still incomplete. We have not yet penetrated into the essence of cardiac pain which is the outstanding symptom of coronary disease, nor do we understand fully the physiology of the coronary circulation, despite much research by many investigators. Gross in his splendid monograph, and Eiman, as well as Oberhelman and Le Count [2] and F. M. Smith [3] have emphasized the important fact that the coronary arteries are not really end-arteries in the Cohnheimian sense, but have many actual and potential anastomoses.[4]

The coronary arteries are branches of the aorta and the blood they carry returns to the heart by way of the coronary veins and sinuses. They possess an unusually rich nerve supply, both vasoconstrictor, coming from the vagus, and vasodilator, of sympathetic origin. The time when the coronary artery fills is a question much discussed and investigated, and though a definite answer is still wanting, the preponderating opinion is in favor of their filling during the systole of the heart. Smith, Miller, and Graber [5] hold that the coronary flow to a large extent depends on the height of the diastolic pressure. It is a pathologic peculiarity not yet explained that the coronary arteries may be diseased while all other parts of the vascular system are unaffected.

We may classify coronary disease from the anatomical point of view as follows:

[1] Cardiologic Seminar Lecture, delivered before the Philadelphia County Medical Society and before the New Utrecht Medical Society of Brooklyn.
[2] Jour. Amer. Med. Assoc., April 26, 1924.
[3] Amer. Jour. Med. Sci., July, 1918, October, 1923.
[4] See also Anrep, Phys. Rev., vi, 4, October, 1926, p. 596.
[5] Arch. of Internal Medicine, July 15, 1926.

(a) Sclerosis—coronary endarteritis.
(b) Thrombosis with or without complete occlusion.
(c) Embolism.

Very extensive sclerosis may exist without clinical symptoms during life—this is one of the mysteries of medicine. Whatever its ultimate significance, it is proof that the heart possesses large factors of safety. The sclerotic process may affect the coronary opening or it may appear in the form of scattered patches or as a diffuse endarteritis with or without calcification. An interesting fact has been brought out by Wolkoff.[6] He found that the thickening of the intima of the coronary artery surpasses that found in other arteries at the same age.

Clinical symptoms may be produced in one of three ways:

1. By sudden stoppage of the flow through thrombosis or embolism.
2. By progressive endarteritis narrowing the lumen.
3. By spasmodic closure.

Whatever the method, the result is either a sudden or a gradual ischemia and suboxidation (histanoxia[7]) in the supplied territory.

Causes of Coronary Disease—The causes of coronary disease, as of angina pectoris, are as obscure as those of disease in other arteries of the body, as indeed of all degenerative processes. From a clinical point of view the following conditions possess more or less significance:

1. *Cardiovascular heredity*—by that I mean the inheritance in families of tissues which the Germans call *minderwertig*. Osler has said that the members of some families are born with poor tubing. The defect need not express itself in identical ways in all the members of a family. It may be angina pectoris in one, apoplexy in another, myocarditis in a third, and coronary occlusion in a fourth. For example, the mother of one of my patients with coronary occlusion which proved fatal, died of Adams-Stokes disease; another lost a brother with coronary occlusion, and had a sister suffering from mitral stenosis who developed pneumonia and died of spreading gangrene of the extremities.[8] The famous case of the Arnold family is well known.

2. A second factor is *mental strain*. This may explain the anomalous fact that angina pectoris is a rare disease in public hospitals, the patients of which are largely recruited from those who labor with their hands more than with their brains.

[6] Virchow Arch., 241, 42, 1923.
[7] A word I have proposed for local or tissue anoxemia.
[8] Riesman, Med. Clinics of North America, Philadelphia, January, 1923, vi. 861-870.

3. *Overeating.*—This, I think, is a very fruitful cause. It usually leads first to hypertension and then to disease of the coronary vessels.

4. *Tobacco.*—For some men tobacco is a poison. It might not be if used in moderation, but if used in excess it certainly in my opinion is harmful and in those who are predisposed racially or familially to arterial disease, whether it be of the extremities or of the heart, tobacco even in moderate amounts is injurious.

5. *Syphilis,* while important as a cause of aortitis and aneurysm of the aorta, does not, in my experience, occupy a prominent place among the etiologic factors of coronary disease or coronary occlusion. If it did play a significant rôle, one would expect to find coronary occlusion frequently in hospital patients, especially in negroes in whom lues is so common. Neither Hines [9] nor Wearn [10] found syphilis a factor of importance in coronary thrombosis and infarction. Scott,[11] on the other hand, found one-fourth of his cases dependent upon syphilis.

While I do not believe that syphilis is important in the etiology of coronary disease under ordinary circumstances, I think that it is a factor in cases of the affection occurring in early life, i. e., under the age of thirty-five.

6. One other factor of possible importance in the production of coronary disease is *focal infection.* I have seen evidence to the effect that disease of the gall-bladder may produce anginal symptoms of a severe character and that these symptoms are abolished by the removal of the gall-bladder.

Coronary thrombosis is more common in men than in women, the male preponderance being greater than it is in ordinary angina pectoris. Some have said that women do not die of coronary occlusion, but I have seen it happen. (See Case II.)

While a disease of middle and advanced life, the majority of deaths occurring between sixty and sixty-nine,[12] cases in very early youth are on record. Klemperer [13] reports an instance of coronary sclerosis with rupture of the left ventricle in a girl of thirteen.

Regarding occupation, I would say that in my experience, business men came first, then physicians, then lawyers, and then housewives. In White's 62 cases [14] the distribution was as follows: business men, 26; housewives, 10; physicians, 8; artisans, 5; lawyers, 2; engineers, 2; others, 9.

[9] Medical Clinics of North America, September, 1924.
[10] Amer. Jour. Med. Sci., 165, 1923, 250.
[11] Transactions of the American Association of Physicians, 1924.
[12] Nathanson, Amer. Jour. Med. Sci., 170, August, 1925, 240.
[13] Berlin Letter, Lancet, January 3, 1925, p. 47.
[14] Jour. Amer. Med. Assoc., 87, November 6, 1926.

The symptoms produced by closure of a coronary artery depend upon:

1. The rapidity of the closure.
2. The size of the vessel occluded.
3. The state of the myocardium.
4. The potentialities of the collateral circulation.

Slow closure, especially of a small branch, produces degenerative and fibroid changes in the myocardium which may or may not give rise to signs that are clinically recognizable as of coronary origin, although they may be revealed by the electrocardiograph.

Sudden closure produces symptoms of great violence and of extraordinary gravity. When the vessel is a large one or if the heart has been the subject of long-standing disease, death may be instantaneous or it may follow after a short interval.

Coronary occlusion with its sequels, infarction and myomalacia cordis, is the most common cause of rupture of the heart.[15] [16]

Symptomatology.—In describing the symptomatology I shall confine myself to that of acute, sudden closure of a coronary vessel.

The patient is usually a man past fifty years of age, often thick necked, heavy set, and of florid complexion, who has for some time had either definite seizures of angina pectoris or slight attacks of cardiac oppression with eructations of gas. In rare instances the previous history is devoid of suggestive features; or there may have been one or two remote attacks of severe angina pectoris—perhaps themselves the result of occlusion of a small coronary branch.

A patient of the type described is seized suddenly with an unendurable pain, in its devastating severity unlike anything he has ever experienced before. His face becomes ashen, exsanguined, and pinched. A cold sweat breaks out over his face and body. The extremities are cold, the pulse is small—it may be regular, of normal rate or even slow;[17] usually it is rapid and thready. If the patient survives the attack the pulse may remain rapid for days and weeks. The heart-sounds are feeble; the first sound at the apex may be scarcely perceptible. Frequently a murmur not heard before is found at the mitral area or over the body of the heart. Respiration is shallow and restricted due to the fact that the patient is afraid to breathe just as he is afraid to make any unnecessary effort. Sometimes there is intense dyspnea or the breathing is of the Cheyne-Stokes type. Râles may be heard over

[15] Locke, Med. Clinics of North America, May, 1925.

[16] Lewis (Ann. Clin. Med., July, 1925) reports seven cases of rupture of the heart among the insane.

[17] Oppenheimer and Mann (Cardiac Arhythmias, New York, 1925) have noted marked bradycardia after thrombotic or embolic closure of a coronary artery.

the bases of the lungs; sometimes pulmonary infarction occurs. The whole condition is one of profound physical and mental shock. This is borne out by the state of the blood-pressure, which will often fall precipitously as much as 60 to 100 mm. or more. I have seen it drop from 220 to 90 systolic in the course of a few hours in a patient who nevertheless recovered.

The pain is unspeakably intense and is not relieved by nitroglycerin and scarcely by morphin in large doses. It is of a crushing, crunching, or tearing character and may be situated behind the upper, middle or lower sternum, in the precordia in the region of the parasternal lines on both sides of the chest, or in the epigastrium. It may radiate to one or both arms or to the upper back or it may not radiate at all. In several of my cases the pain in the left elbow was even more severe than the substernal pain.

It is not surprising that the patient is in the highest state of angor mortis. He is panic-stricken by the fear of death; yet there are many individual differences in this respect. After all, a patient's state of mind depends on his character, temperament, and racial background. While the majority are paralyzed by the fear of death, others have no such fear. They realize that their time has come, but are unafraid and calm except in so far as the agony of pain may force a moan from their reluctant lips.

I made mention of the fact that the pain may be epigastric. Sometimes it is accompanied by vomiting and marked distention, so that it may simulate very closely an acute abdominal catastrophe, such as perforation of an ulcer, biliary colic, acute pancreatitis, mesenteric thrombosis, or the gastric crises of tabes.

Either the intensity of the pain or the disturbance of the cerebral circulation may cause syncope at the beginning of the attack or convulsions toward the end. The temperature falls at the onset, but soon rises to 100° or 102° F. It is probably caused by the absorption of proteins from the infarcted area of the heart. There is usually a leukocytosis which, as Libman has shown, is detectable as early as one and three-quarter hours after the onset of the attack.[18] It may reach as high as 30,000, but usually ranges between 12,000 and 20,000. If the leukocytosis persists or increases in the absence of a responsible complication, it indicates progressive necrosis or intraventricular thrombosis, or both. Progressive necrosis may lead to acute aneurysm or to rupture of the heart.

If the obstructed artery is the anterior coronary, a small patch of to-and-fro pericardial friction may be detected, corresponding in all probability to the area of infarction. The pericarditis not rarely,

[18] Libman, Amer. Heart Jour., i, October, 1925.

however, extends far beyond the infarcted area. Enlargement of the liver, which is quite common, is indicative, in the absence of congestive heart-failure, of closure of the right coronary artery. Slight jaundice has been observed in a few instances; albuminuria usually occurs and, in rare cases, sugar appears in the urine.

Although in many cases the attack of coronary occlusion follows effort, in several I have observed the acute seizure was precipitated by no actual physical cause. In some the attack began on the golf links, in some at night after a particularly heavy dinner, but neither the meal nor the play could be looked upon as unusual for the patient.

While the picture I have sketched above is the most common, coronary occlusion may cause instant death without preliminary agony or evidence of pain. Such apparently painless deaths are by no means uncommon. They occur most often in those in whom attacks of characteristic anginal pain have given warning—a warning that was not always heeded or understood. Until the autopsy it is impossible to tell whether such a sudden death is due to a real coronary obstruction or to angina pectoris without actual obstruction—which goes to show how closely in their pathologic physiology angina pectoris and coronary occlusion are related. What is commonly called "status anginosus" is most often a progressive coronary occlusion and not simply cumulative attacks of angina pectoris.

The electrocardiogram may give valuable information. We have learned through the work of Willius, Pardee, Rothschild, Oppenheimer, Mann, M. H. Kahn, and numerous others that acute coronary disease produces recognizable changes in the Q.R.S. complex and in the R-T interval and in the origin and position of the T wave. Inversion of the T wave in a single lead or in all leads must be found unrelated to digitalis administration to be of significance, for digitalis itself may cause quite similar inversion. If the patient recovers, these abnormal responses may continue for some time after the subsidence of the attack. However, the changes described are not constant.[19]

Congestive heart-failure may follow an attack of coronary occlusion. If the congestive failure continues, pain may remain in abeyance. This is in line with an observation of the late Dr. J. H. Musser. He found that angina pectoris would disappear when dilatation of the heart supervened. In cases of decompensation secondary to coronary occlusion, feebleness of the heart-sounds and rapid or irregular pulse or gallop rhythm, as well as a leaden

[19] Longcope, Ill. Med. Jour., 41, 186-192, March, 1922.

hue of the countenance, remain as suggestive features of the coronary block.

In some cases of coronary occlusion, after a twenty-four- or thirty-six-hour period of profound collapse, during which life seems to hang in the balance, the patient being perhaps in a stupor, there is a sudden, almost miraculous improvement in the symptoms, giving rise to the hope that all danger is past. Such hope, unfortunately, is not often well founded—the patient while talking cheerfully may suddenly drop back dead. It is usually possible in this tragic type of case to detect during the interval of bien-être the objective signs of gravest myocardial damage.

Aside from the severe cases from which recovery is exceptional, there are undoubtedly milder cases in which a small twig instead of a large branch of a coronary artery is occluded. The symptoms are those of angina pectoris, but they persist longer and leave the patient in a state of exhaustion with signs and symptoms of a damaged myocardium. In time these effects may disappear. After recovery the countenance retains its sallow pallor for a long time; the patient drags himself along at a slow gait and exhibits in every direction a marked lessening of vitality.

What is the relation of coronary occlusion to angina pectoris? Personally, I hold the view that angina pectoris is a "coronary affair"—*une affaire coronarienne*, as the French say. It differs from true coronary obstruction in the fact that there is in angina pectoris no organic, at least no permanent closure of a coronary vessel. There is, however, a temporary closure due to spasm, with consequent histanoxia.

I am aware of the controversial nature of this subject, but as I am dealing in the present essay with actual coronary obstruction and not with ordinary angina pectoris, I shall omit further discussion of the pathogenesis of the latter affection.

Adams-Stokes disease when not due to gumma is usually caused by fibroid changes in the conduction system.[20] As these changes are usually secondary to sclerosis of the small coronary branches that supply the two principal nodes or the bundle of His, it might seem germane to the subject of this paper to include Adams-Stokes disease, but nosologically it is such a distinct and different affection that it is proper to omit its clinical discussion here.

I shall now cite a few cases of coronary obstruction that illustrate the principal symptoms.

Case I.—J. M. H., widower, aged fifty-nine years, was seen in consultation with Doctors Long and Mengel of Wilkes-Barre. While sailing along

[20] This condition might for the sake of brevity be designated as "hisitis."

the coast of Maine he was caught in a storm and thoroughly drenched. He had some difficulty in landing, but succeeded after a considerable effort. The next day he was seized with pain first in the right, then in the left chest. A physician was called, who found his systolic pressure 170; the temperature 101° F.; two days later the blood-pressure was 100, the temperature 99° F. The pulse was irregular and of poor volume; the skin was covered with a profuse sweat. He remained in bed four weeks and was then brought in a private car to his home in Pennsylvania. He tried to walk about the house and grounds, but a recurrence of the pain forced him to go back to bed. When I saw him, about six weeks after the onset, he was still having prolonged periods of precordial pain. He disclaimed any fear or anxiety as to his condition, but his actions and his facial expression indicated more plainly than words how greatly he was alarmed. Upon inquiry it was found that some weeks before going to Maine he had had pain in both shoulders and arms, especially in the left arm, which was thought to be muscular. He was a dynamic individual, with heavy managerial burdens that had been greatly aggravated by the coal-strike. I might add that X-ray, blood, blood-chemistry, and urine were normal; the Wassermann negative. Physical examination showed a somewhat enlarged and rapid heart, with a gallop rhythm of the anapest type. There was no murmur. Lungs and abdomen were negative. There was a slight elevation of temperature up to 100° F. This subfebrile condition continued for about two months. The blood-pressure varied from 108 to 130 systolic and from 60 to 90 diastolic. An electrocardiographic examination was made by Dr. S. Calvin Smith and gave the following results: "There is evidence of coronary artery defect in the heart records. The T wave is inverted in Lead I, the R wave in Leads II and III, and the T wave flat in Lead II."

At the end of four or five months I saw the patient again; he was much improved, although he had not entirely regained his pristine capacity. There could be little doubt as to this patient's case—we all concurred in the diagnosis of coronary obstruction which had been made by Dr. Cues who saw him during his attack in Maine.

Case II.—Mrs. C. W., seen with Dr. Donnelly, of Conshohocken, Pa., was a widow, fifty-two years old. She had had heart trouble for many years. Ten days before my visit she had an apparently definite seizure of angina pectoris. In speaking of the attack she said: "I thought I would go insane with the pain." She had had five attacks in one day; since then the precordial pain had been increasing steadily. Her blood-pressure during the first seizure was 60 systolic and 40 diastolic. I found her in a condition of extreme shock with a pale, frozen look, with a blood-pressure of 86 systolic, feeble heart-sounds, a soft systolic murmur and a definite patch of pericardial friction. The liver was enlarged and had a tender edge; the lungs were clear. It was evident that the end was near; the patient died before the close of day.

In this case the very first attack, which gave the impression of angina pectoris, was probably due to the closure of a large branch of the coronary artery with infarction of the heart.

Case III.—Mr. T. S. G., a widower, sixty-two years of age, was seen in consultation with Dr. J. T. Ullom. Mr. G., a short, florid, heavy-set man, had always enjoyed good health. On October 12, 1925, he ate a hearty dinner, ending the big meal with a large quantity of nuts. The next day

he experienced a little substernal pain reflected into the left arm. At 11 P. M. a dull ache in the precordial area caused him to send for Dr. Ullom, who administered morphin. The pain was somewhat abated, but returned at 4 A. M. with much greater severity. The blood-pressure was 160 over 100; the urine contained albumin and granular casts. Morphin was again given hypodermically, but brought no easement of the pain.

I had the opportunity of seeing the patient a few hours later—his systolic blood-pressure was from 120 to 130, the pulse 132. I was asking the patient a few questions, when suddenly he became purple and dropped back dead. Artificial respiration and adrenalin intracardiacally were of no avail. In this patient the fatal attack, which covered all in all a period of about thirty-six hours, was apparently the first the man ever had.

Case IV.—M. A., aged forty-five years, had been well except for several attacks of sciatica. He was once told he had diabetes, but many examinations of the urine made afterward failed to show sugar. The postwar collapse imposed heavy financial losses upon him—the resulting nervousness caused him to smoke excessively, something he had never done before. On October 5, 1921, while in a department store, he suddenly had a queer sensation in his chest which rapidly changed to a pain of increasing severity. On arriving home he sent for a physician, who tried amyl nitrite and morphin, but without success. Finally, chloroform was administered—it stopped the pain, but only as long as the patient was under its influence. When I saw the man with Dr. Clyman and Dr. Rosenfeld two days after the onset of the attack, the pain was unmitigated—it was most severe in the center of the upper chest, a little less severe in the precordial region. The blood-pressure which had been as high as 200, had dropped to 84 systolic; I found it 110. The heart was a little enlarged to the left, the sounds feeble; pulse 100; temperature 101.4° F. The liver was a little enlarged and tender to touch. Râles were present at the bases of the lungs. The pulse in the dorsalis pedis arteries was absent. The face had a pale leaden hue, the lips were almost greenish in color. The whole picture was that of the most profound shock.

As from a medicinal standpoint nearly everything possible had been done, I ordered the application of leeches to the precordia. Almost immediately the pain began to disappear. General improvement was slow, but eventually the man's condition approached his norm. A year later, however, he had another attack, even more severe—this time with a definite pericardial friction. He asked to have the leeches reapplied—it was done, with the same result.

The man is still living, six years after the first seizure, having in the interim passed through a severe attack of pneumonia. His case which I have previously reported [21] is made doubly interesting by the fact that a brother died in an attack of acute coronary obstruction, the terminal event being a convulsion.

Case V.—F. F., aged sixty-six years, was seen with Dr. Major on March 29, 1927. The man, a hard worker and an equally hard player at golf, had never been seriously ill. On Sunday, March 27, 1927, he experienced "a little indigestion feeling" and a soreness in the right arm on putting on his coat. He started to play golf and had driven three balls when he felt pain in both arms and lower sternal region and broke out in

[21] Med. Clinics of North America, Philadelphia, January, 1923, vol. vi, 861-870.

a profuse sweat. He laid down in the club-house and the sensation passed off. Thereupon he went home. During the night he was seized with terrific pain in the left arm, epigastrium, and lower sternal region. He was a little short of breath, due, he thought, to the soreness. Under morphin he was comfortable until Monday evening, the 28th. Then the pain recurred and would not yield. When I saw him on the following morning, the pain, now of moderate severity, was located in the midline between the xyphoid and the umbilicus. The heart-sounds were weak; there was no murmur, only an occasional extra-systole; the lungs were clear; the abdomen negative; the reflexes normal; the prostate enlarged. The blood-pressure was 134 systolic, 80 diastolic, pulse 100.

When I asked the patient whether he smoked, his answer was: "I smoke like the devil." Dr. Major and I enjoined absolute rest, but the patient insisted upon going to the toilet later in the day and dropped dead, forty-eight hours after the onset of the trouble. I believe that what he called an indigestion feeling was the actual beginning of the coronary closure.

Differential Diagnosis—In the beginning the attack might readily be considered one of angina pectoris, but (a) the persistence of the pain; (b) the profound shock; (c) the enfeeblement of the pulse; and (d) the fever soon point to the graver condition.

When the pain is in the epigastrium or elsewhere in the abdomen, the possibilities of error are manifold. Biliary colic, perforation of a peptic ulcer, acute pancreatitis, mesenteric thrombosis, and the gastric crises of tabes are some of the false diagnoses that may be made.

It is impossible to lay down absolute criteria of differentiation—the important thing is always to have in mind the various possibilities when one sees a patient who is in profound shock and suffering from agonizing pain in the upper abdomen.

As a rule, the fear of impending death, the angor mortis, is greater in coronary occlusion than in other conditions. Moreover, there is often a history of previous anginal attacks; a to-and-fro pericardial friction points strongly to cardiac infarction; the electrocardiograph may help. In coronary thrombosis with abdominal symptoms, there is only transient rigidity, even though the tenderness may persist. Preservation of the liver dulness militates against perforation of a peptic ulcer.

Sometimes it is extremely difficult to decide between coronary occlusion and biliary colic. This fact has been emphasized by Faulkner, Marble, and White.[22]

As a rule, the gall-stone cases are younger and the history of painful seizures somewhat longer. Arm radiation of the pain, poor heart-sounds, and arhythmia are in favor of coronary thrombosis; back radiation and jaundice of biliary colic. Jaundice may, however, occur also in coronary obstruction.

[22] Jour. Amer. Med. Assoc., December 27, 1924.

The resemblance between coronary occlusion and acute pancreatitis is often exceedingly close. Aside from the various points already mentioned, it is well to bear in mind that the spleen may be greatly reduced in size in the latter affection. I have also noted a peculiar subcyanotic hue in acute pancreatitis.

The electrocardiograph may prove helpful in the differential diagnosis, but, as I have pointed out, the alterations attributable to coronary occlusion are not invariably present.

There is one objective finding to which I have learned to attach a good deal of significance, namely, absence of the dorsalis pedis pulse. It is indicative of a widespread endarteritis and constitutes circumstantial evidence of coronary disease.

Pneumothorax may cause acute pain in the precordial area closely resembling an attack of angina pectoris or, in rare instances, a coronary occlusion. I have seen one case of this type. The man was a builder, and while on his job he was suddenly seized with violent pain in the left chest. His physician was sent for and diagnosed angina pectoris, but the pain persisted and did not yield to ordinary measures. When I saw him the man was in partial shock; careful physical examination showed pneumothorax which had come on after he had lifted a heavy weight.

Brachial neuritis of the left side may, in rare instances, resemble anginal attacks or attacks of coronary closure. The pain may be very severe. The absence, however, of pain in the precordia and the lack of evidence of any cardiac weakness, the presence of marked tenderness over the brachial plexus—on pressure above the clavicle—guide the diagnosis in the right direction.

Prognosis—Coronary occlusion accounts for a large number of sudden deaths, particularly for many of the deaths that the newspapers ascribe to acute indigestion. Recovery is possible in bad cases, and sudden death may occur in those that seem to be on the road to recovery. One must, therefore, be guarded in one's prediction. Persistent feebleness of the heart-sounds and increasing pulse-rate justify a grave prognosis.

The pain itself is not a good criterion—it may be as severe in occlusion of a small as of a large branch. In the case of the former, collateral circulation may be established and the patient recovers. The occurrence of definite decompensation usually means that the attacks of pain are at an end; but as the heart has been badly damaged by the coronary thrombosis, the outlook for eventual recovery is not good.

An individual who has recovered from an attack of coronary obstruction is always in danger of another, although the attack may

remain in abeyance for a long time. In one of my cases there was an interval of seven years between the first and the second attack—and that proved fatal.

Treatment—This naturally divides itself into two parts—treatment of the attack and treatment of the interval. During the attack there is but one overpowering indication—to relieve pain. Unfortunately morphin in reasonable doses is often powerless to do so. The Germans have recommended papaverin, a derivative of opium which is supposed to have the quality of dilating the coronary arteries. I have used it a few times without much success. Sometimes heroin, the importation of which should never have been stopped, acts fairly well. Chloroform has been used, but if an anesthetic has to be employed, I should give the preference to ethyl chlorid.[23]

I have mentioned above the case of the patient in whom we applied leeches and who, in a second attack, at once asked that they be applied again. It is, to be sure, a somewhat fantastic remedy; I cannot explain the good results it accomplished in that patient's case, but whenever leeches are available there can be no harm in using them. A large number is required—the precordial area should be pretty well covered.

Absolute rest is a sine qua non—in no affection is it more important. External heat should be applied; the room should be kept dark and all disturbances eliminated. Whisky or, when there is much distention, brandy may be given.

What about the use of digitalis? There is here a difference of opinion among clinicians.[24] My personal practice has been to withhold digitalis or to use it only in minimal doses at the beginning of the attack. I have had recourse to caffein sodio-benzoate, to camphorated oil, and to adrenalin, reserving the digitalis for a later period—for the weakness following the acute attack or for congestive myocardial failure.

If distention is marked, one may use, in addition to brandy, turpentine stupes, the rectal tube, or pituitrin.

The diet is important—I have found buttermilk and acidophilus milk better than ordinary milk. If there is vomiting, iced buttermilk or iced ginger ale is best.

I have usually prescribed sodium citrate in 1 gm. doses, three or four times a day, believing it might prevent the formation of larger clots. It may of course have no such action when administered by the mouth.

[23] Lately diathermy has been recommended. I have had no personal experience with it.
[24] See Harry Gold, Arch. Int. Med., 1925, 35, 482.

Interval Treatment—The patient should be kept in bed for three or four weeks or longer and, as Sir Clifford Allbutt eloquently expressed it, he should crawl before he walks. For the remainder of his life he should make it a practice to lie down for an hour's rest in the afternoon. He should never hurry, least of all after eating. Smoking, except in greatest moderation, is forbidden.

If need be, the bowels should be regulated with mineral oil or other mild laxative. The diet should be one low in protein and salt; starches and other foods productive of gaseous distension should be restricted. Overeating, especially at the evening meal, should be avoided. If there is obesity, a careful attempt should be made at weight reduction.

Surgical Treatment—Whatever may be the ultimate position of the operation devised by Jonnesco for angina pectoris, namely, section of the cervical sympathetic, I do not feel that the operation is indicated or warranted in cases that are definitely diagnosed as advanced coronary disease or as coronary obstruction. The operation at best only does away with the pain. It does not remove any organic disease in the heart. Patients that have been operated upon for angina pectoris have died a painless death from coronary obstruction.

Exercise—None should be taken for some time after the attack. Walking and golf on a non-hilly course may be permitted after a few months.

In all cases search should be made for foci of infection and their removal attempted if a possible connection between the focus and the disease of the coronary vessels can be established—provided, of course, that the procedure does not involve an unwarranted risk.

And finally, every patient who has gone through the agony of a coronary seizure should remember the words of John Hunter: "My life is in the hands of any rascal that chooses to plague me."

DISEASE OF THE CORONARY ARTERIES WITH A CONSIDERATION OF DATA ON THE INCREASING MORTALITY FROM HEART DISEASE *

Different diseases occupy the center of the stage at different times. In my early days in medicine typhoid fever was of paramount interest. Its conquest achieved in the course of a few years—one of the greatest triumphs of medicine—brought another disease into the limelight, namely, tuberculosis. Tuberculosis has now fallen low among the causes of death and bids fair within the lives of persons now living to join the list of deceased diseases. Pneumonia, never far removed from the center of the stage, has not greatly changed its position in the last half century. For the aged it is still the Captain of the Men of Death, but in youth and middle life it is perhaps less of a menace now than formerly. What occupies the center of the stage today? Undoubtedly heart disease.

Everywhere heart disease has leaped to the top of the list of causes of death and this is only in part due to the lowered mortality from other diseases. The actual increase in deaths from heart disease, however, in reality represents a triumph of preventive medicine. Young adults are escaping the ravages of tuberculosis and of occupational diseases. More are now living to the age period beyond 40 when heart disease, vascular degeneration and cancer prevail. By the prolongation of the average span of life, to 59 years as it now is, more individuals are kept alive to die in the higher age groups from those diseases that afflict advancing years. It should be mentioned that C. F. and N. W. Bolduan [1] seek to show that the "appalling increase" in heart disease is fictitious. The registered increase in heart disease is, they believe, merely due to a change in terms used in death certificates, such conditions as apoplexy, Bright's disease and senility frequently being listed

* Read by invitation before the Medical Society of New Jersey, Atlantic City, N. J., June 8, 1933, by the senior author.

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Written in collaboration with Stanley E. Harris, A.B., M.D.

as heart disease. I cannot feel that this is the correct, certainly not the complete explanation. The tables I have gathered from various sources * are so concordant that one must conclude there is an actual and not merely a relative increase of deaths from heart disease (Table 1).

TABLE 1

INCREASING MORTALITY FROM HEART DISEASE (HEALTH DEPARTMENT OF NEW JERSEY)

(Rates per 100,000 Population)

Age Periods	1922	1932
30 to 39	8	10
40 to 49	13	19
50 to 59	24	38
60 to 69	39	56
70 to 79	41	62
80 to 89	21	30
90 and over	2	5

It should be borne in mind considering these figures that the rates are based upon total population and that the percentage of the population in the given age groups for 1932 may vary considerably from the percentages for 1922.

TABLE 2

INCREASING DEATHS FROM HEART DISEASE IN CERTAIN AGE GROUPS IN DETROIT

(Rates per 100,000 Population)

	1923		1932	
Age Groups	No.	Rate	No.	Rate
Under 5	22	18.7	13	9.3
5 to 9	21	22.5	11	7.8
10 to 14	31	42.8	21	16.5
15 to 19	26	34.9	24	20.5
20 to 24	46	39.8	28	19.4
25 to 29	51	36.8	48	29.6
30 and over	1374	314.0	2416	364.0

The Detroit statistics show the same thing. They demonstrate a tremendous falling off in deaths from heart disease in the early years of life up to 29. After 30, however, there is a much heavier toll now than a decade ago—364 per 100,000 as against 314 (Table 2).

I do not know how to explain the uniformly high figures after 40 for the year 1926, unless one attributes it to the prevalence of acute respiratory infections during that year, since statistics show that such infections influence the death rate from other diseases

* Dr. Dublin, of the Metropolitan Life Insurance Company; Dr. Lehrfeld, of the Department of Health of Philadelphia, and Dr. Mahaffey, of the Health Department of New Jersey, have kindly furnished us valuable data.

unfavorably. Very striking is the increase of 1932 over 1931. In England and Wales there seems also to be a steady increase in deaths from heart disease since 1921, but with an encouraging decline in 1931 and 1932.

The following table gives the relevant statistics for Philadelphia:

TABLE 3
PHILADELPHIA DEATHS FROM HEART DISEASE
1923 to 1932

Year	Total Deaths	Rate per 100,000 Population	Under 10 yrs.	10 to 20 yrs.	20 to 30 yrs.	30 to 40 yrs.	40 to 50 yrs.	50 to 60 yrs.	60 to 70 yrs.	70 to 80 yrs.	80 to 90 yrs.	90 to 100 yrs.	100 and over
1923	4580	245.3	79	116	134	269	464	819	1122	1028	480	66	3
1924	4349	231.4	77	134	143	218	448	788	1035	996	455	53	2
1925	5097	269.4	53	135	184	288	531	898	1242	1143	544	78	1
1926	2937	311.7	55	101	182	291	648	1027	1566	1387	586	89	5
1927	4762	248.4	56	106	139	279	508	844	1214	1098	446	69	3
1928	4394	227.7	56	80	120	258	485	809	1113	975	451	46	1
1929	4418	227.5	63	103	148	230	441	823	1089	1019	433	68	1
1930	4454	228.0	40	75	132	223	452	806	1132	1091	443	59	1
1931	4363	221.9	33	50	118	208	420	786	1106	1096	484	59	3
1932	5709	288.5	30	91	125	266	528	1019	1594	1339	631	86	

To sum up: Whether there is or there is not an "alarming increase" in deaths from heart disease, the fact is that heart disease stands at the head of the list. This makes it a definite problem in health conservation in the sense that efforts should be made to postpone as late as possible death from those degenerative diseases among which that of the heart and bloodvessels is the most important. Degeneration is the price of old age and mankind prefers to pay that price as late as possible. From a detached biologic point of view this may not be a desirable aim—an old tree bearing no fruit or only a few green leaves had better give place to a younger one—but society today with its humane instincts seeks to keep alive the cripple as well as the lean and slippered pantaloon.

I shall not go into the history of coronary occlusion. Nearly everyone who writes exhaustively on the subject finds as he proceeds an earlier reference than his literary predecessors. I believe, however, that I have discovered the earliest recorded case—and yet some future writer may find an earlier one. In Homer's Odyssey,[2] it is stated that Phoebus Apollo shed down his gentle darts upon Phrontis, son of Onetor, Menelaus' navigator, and "he dropped

dead with the steering oar of the moving ship within his hands." This impresses me as an instantaneous painless coronary death.

No one in recent years has contributed more to our understanding of the subject of coronary disease than J. B. Herrick of Chicago. Credit also belongs to George Dock, E. R. LeCount and many others. The first case of coronary thrombosis diagnosed during life as far as I have been able to ascertain, was reported by Hammer [3] who had observed it in 1876. It was confirmed at autopsy although the pathologic description is not very clear. Hammer incidentally cites a sentence from Cohnheim written in 1877 which shows the fallacy of prophecy. "It is a fact that Bezold through experimental closure of a coronary artery was able to bring the heart to a stop. Whether, however, a similar phenomenon will ever be observed in human pathology seems to me very improbable." *

Not much space need be given to a consideration of the causes for the simple reason that we know so little about them. We can say under what conditions coronary disease may occur but that is far removed from explaining its etiology. Coronary disease, particularly coronary thrombosis, prefers the male sex between the ages of 50 and 70, although it may occur much earlier. Smith and Bartels [4] report two cases and collect 20 from the literature of ages from 12 to 40. Coronary occlusion is more common in private than in charity hospital practice, indicating that social status is a factor. High blood pressure is an important element, but typical cases occur also in persons with low blood pressure. Syphilis, strange to say, is not a significant factor either in my personal experience or in the literature. It is important only when it produces atresia of the coronary ostia by extension from the aorta. Diabetes is by many considered an important factor (Nathanson [5]), although in my own series it does not appear to play a conspicuous role. Nephritis and thromboangiitis obliterans play their part. An embolus derived from a mural thrombus or rarely from a diseased valve may also cause occlusion.

That polycythemia through inspissation of the blood might favor coronary thrombosis is theoretically possible and has been demonstrated in one of my cases. (See also Boyd.[6])

Whether infectious diseases in earlier life play a role is a question that needs further investigation.

Heredity was an apparent factor in 27 per cent. of my own cases of coronary disease. But in what heredity consists, whether it merely predisposes, the environment doing the rest, or whether it

* Those interested in the history of coronary disease will find a fairly complete account in Warburg's articles (Acta med. Scand., 1930, 73, 425).

carries on through generations the actual elements of the disease, we do not know. Heredity and the closely related constitution are subjects in which as far as any real knowledge is concerned we are still, to use Dean Brown's phrase, in the Desert of Moab. Habits, such as a too sedentary or too athletic mode of life, are also possible agents but as they are far more widely prevalent than is coronary disease, some additional factors must be operative and that X factor is perhaps the inherited constitution. Whether that is something chemical or something anatomic remains to be discovered.

Regarding habits, I believe that worry is one of the most effective in producing the coronary syndrome; overeating, overindulgence in sexual relations, especially if these are not accompanied by complete gratification, overambitiousness, also are prominent in the histories of coronary cases if we but search for them. The alcohol habit of itself, if not a by-product of the others mentioned, does not seem to me to lead to coronary disease. I cannot give the same clean bill of health to tobacco. One-fourth of the patients with coronary occlusion that I have seen were heavy smokers. Here again it must be admitted that not all who smoke to excess become victims of coronary disease but the number that do is sufficiently large to make me rank tobacco definitely among the causes.*

Acute coronary closure may be precipitated by any unusual physical effort, by emotional excitement,† during coitus, during public speaking, through fatigue after an arduous journey or from play, or by any trying experience.‡ Sometimes, however, no immediate exciting cause is discoverable. When the attack occurs during sleep I have thought it possible that a harrowing nightmare was the *agent provocateur*. MacWilliams has shown that the blood pressure may rise 20 to 30 mm. during dreams or uneasy sleep.

There is no physical or bodily habitus characteristic of patients destined to have coronary disease. Perhaps the stocky, short-necked, overweight, hypertensive individual predominates but the slender and spare are not exempt. Many have tortuous temporal arteries and arcus or annulus senilis. The radial arteries may be soft but in many instances they are thick and leathery, rarely beaded.§ The majority of "coronary" individuals are active and athletic,

* The work of Sulzberger and Harkavy [7] shows that many persons have tobacco sensitiveness. Harkavy found 13 patients among 36 suffering from coronary artery disease sensitive to tobacco by skin tests. The average age of the patients who reacted to tobacco was 45 years; the average age of coronary patients who failed to react to tobacco was 60 years.

† As John Hunter said over a century and a half ago—"My life is in the hands of any rascal that chooses to plague me."

‡ Fitzhugh and Hamilton [8] believe that drugs, such as thyroid extract, may bring on an attack; insulin and adrenalin may also do so.

§ It should be borne in mind that soft radials are no proof that the arterioles of the heart or of the brain are normal—they may be in a state of advanced sclerosis.

often passionate golf players, but the disease as I have said occurs among the sedentary as well. The greater proportion are heavy eaters. Many are given to liberal night suppers, and the excessive use of tobacco is a common habit.

As coronary anastomoses are said to be richer in persons of advanced age, it is not surprising that individuals over 70 rarely die of coronary occlusion (Barnes [9]).

Symptomatology. The symptoms of acute sudden closure of a coronary artery of considerable size are dramatic in the extreme. The patient, usually a man past 50, florid, thick-necked and heavy-set, is seized suddenly with an unendurable pain, in its fearful severity unlike anything he has ever experienced before. His face becomes ashen or bluish-gray, exsanguined and pinched. A cold sweat breaks out over his body, the extremities become cold, the pulse small and thready, and usually rapid although sometimes it is slow. In certain cases no pulse is obtainable. The patient is apprehensive to the highest degree; he is sure death is in the offing. He may lose consciousness and may have a convulsion. The heart sounds are feeble, the first sound at the apex scarcely audible; frequently a systolic murmur not heard before is found at the mitral area or over the body of the heart. Respiration is shallow and restricted; there may be shortness of breath and air hunger; sometimes the breathing is of the Cheyne-Stokes type. Rales may be heard over the bases of the lungs; sometimes pulmonary infarction occurs with spitting of blood. The blood pressure usually drops precipitously, sometimes to a point when none is obtainable by the auscultatory method. I have seen it fall from 220 systolic to 90 in the course of a few hours in a patient who nevertheless recovered.

The pain is of a crushing, crunching or tearing character and is situated usually behind the middle or lower sternum, or in the region of the parasternal lines on both sides of the chest, or in the epigastrium, or even in the umbilical region. It is as a rule stationary, but it may radiate into one or both arms, to the lower cervical region in the back or up into the jaws. In several of my cases the pain in the left elbow was more severe than the substernal pain.

The attack may be accompanied by vomiting and marked abdominal distention, so that it closely resembles an acute abdominal catastrophe such as perforation of a peptic ulcer, biliary colic, acute pancreatitis, mesenteric thrombosis or the gastric crises of tabes.

As the outstanding features are those of shock, the temperature is low in the beginning but it soon starts to rise to 100° F. or higher, rarely above 103°. This is probably a protein fever caused by the absorption of degradation products from the infarction in

the heart. To the same cause is to be ascribed the leukocytosis that appears soon after the onset of the thrombosis. Libman has detected it as early as 1¾ hours after the commencement of an attack. It usually ranges between 12,000 and 20,000 but may reach as high as 30,000. If the leukocytosis persists or increases in the absence of a complication it is indicative of progressive necrosis of the heart wall which may lead to cardiac rupture or to aneurysm. In some cases, especially if the obstructed artery is the anterior coronary, a small patch of pericardial friction, corresponding in all probability to the area of infarction, can be detected; at times the pericarditis extends far beyond the infarcted area. Enlargement of the liver is indicative, in the early stages before any congestive heart failure has taken place, of closure of the right coronary artery. In such cases slight jaundice may occur. Albuminuria is usually present and in rare cases sugar has been found in the urine.

I have said that the patient is panic stricken by fear of death yet I have seen individuals who although convinced of the close approach of death, were never emotionally or psychically paralyzed with fear. They realized that their time had come but were unafraid.

While the picture I have sketched is perhaps the most common, it is not the invariable one. Coronary occlusion may cause instant death without any preliminary pain. Such apparently painless deaths are not uncommon on the golf links and in other public places. Sometimes if the patient has had a little bloating and belching of gas before, the death is attributed, at least in the newspapers, to acute indigestion. It is of course impossible when confronted with an instantaneous death to be sure before the autopsy of what has actually taken place—whether there is a coronary obstruction or whether death was due to angina pectoris without obstruction.* This goes to show how closely the two conditions, coronary thrombosis and angina pectoris, are allied. What is commonly called "status anginosus." is most often a progressive coronary occlusion and not simply cumulative attacks of angina pectoris. In the acutely fatal cases there is no time, even if a thrombus is present, for infarction to form.

In some cases after a 24- or 36-hour period of profound collapse during which life seems to hang by a thread, the patient being perhaps in a stupor, there is a sudden improvement in the symptoms, giving rise to the hope that all danger is passed. Such hope, however, is often illusory. The patient while talking or eating may suddenly drop back dead. If one is watchful one can detect

* Sudden death has, of course, many other possible causes—apoplexy, rupture of aneurysm, etc.

in this type of case during the interval of improvement definite signs of grave myocardial damage.

Psychic disturbances are not rare in the severer types of coronary occlusion. They may take the form of confusional and hallucinatory states, of delusions, of acute maniacal outbursts and of attacks resembling delirium tremens. In every surviving case that I have seen the psychosis disappeared completely.

Larval Coronary Disease. In addition to acute coronary closure there is a form of coronary disease that does not present a sufficiently striking picture always to be recognized. Anatomically it consists of a gradual narrowing of the coronary vessels due to a progressive endarteritis. The result is a lessening of the blood supply with a consequent oxygen deprivation of the tissues, a condition I have called histanoxia. This histanoxia may lead to degenerative changes in the muscle fibers and their replacement by fibrous tissue. Clinically it may manifest itself in various ways. One is the usual type of chronic congestive heart failure; the other is more specifically coronary and presents the following symptoms:

There may be a sense of substernal oppression which, as a rule, is relieved by rest. As belching is not infrequent, patients as well as physicians often interpret such seizures as due to indigestion, an error from which there is a sad awakening, not for the patient, but for the doctor. Attacks of fainting may also be produced by this type of chronic coronary artery disease. And then there are sudden mild attacks of heart failure approaching fainting, with pallor, sweating and great restlessness, but with absence of pain.

Any of the mild forms may without interruption pass into a grave form. Thus in the case of Mr. W. (seen with Dr. H. S. Read) the patient experienced a peculiar empty or vacuum feeling, as he called it, in his chest and soon afterward went into collapse with *angor animi*, falling blood pressure and with electrocardiographic findings of coronary occlusion, although he never had any acute pain. He was compelled to remain in bed for nine weeks.

Acute pulmonary edema with inky cyanosis may be a manifestation of coronary disease. This condition, in its suddenness and violence, often tests the doctor's resourcefulness and intelligence. The best measures for combating it are: Venesection, morphin and atropin, and, if need be, dry cupping over the chest.

The fluoroscope may give evidence of coronary disease in showing feeble contractions, a see-saw type of contraction (Ernstene [10]). It would seem to be unwise, however, in the early stages at least, to subject the patient to the strain of such an examination. Ernstene [10] points out a lessened vital capacity in cases of coronary

disease. In several instances I found absence of the dorsalis pedis pulse as collateral evidence of arteriosclerosis; in a few cases there was a history of intermittent claudication.

Electrocardiographic Evidence

Angina Pectoris. There are no characteristic changes in the electrocardiograms in patients suffering from angina pectoris during the intervals between paroxysms and in many cases during the attack. In others, however, certain alterations in the ventricular complexes occur. During the paroxysm the *T* waves in Lead I or in Lead II, or in both, may become diphasic or inverted when they are upright between attacks or more deeply inverted if they are already abnormal.* The severity of the pain does not seem to determine whether or not changes in the electrocardiogram will occur, but the degree of change when present is greater during more severe attacks.

Coronary Sclerosis. The electrocardiogram is not necessarily altered in sclerosis of the coronary arteries. Conduction defects, however, not infrequently occur. Thus the commonest cause of intraventricular block is coronary disease, and various types of arrhythmia, auriculoventricular delayed conduction, low voltage, and splintering of the *Q R S* complexes are sometimes seen.

Coronary Occlusion. In coronary occlusion the electrocardiographic changes vary with the size of the infarcted area and with its position in relation to the plane of the leads employed. The most common site of thrombosis—the descending branch of the left coronary artery, the infarct being near the tip of the left ventricle—gives rise to characteristic changes in the electrocardiogram. Soon after closure of the vessel the *Q R S* complex becomes slurred or decreased or widened and the *T* wave in Lead I takes off high on the downstroke of the *R*, with an initial upward deflection and a terminal depression. Coincidently the *S–T* interval in Lead III is depressed and the *T* wave inverted. Similar though less characteristic changes occur in Lead II. During the succeeding days the *T* wave in Lead I and often in Lead II becomes deeply inverted, with an elevated *S–T* interval, while in Lead III the *S–T* interval remains depressed and the *T* wave becomes upright. In favorable cases the electrocardiogram may return to normal with repair of the infarct, but often some evidence remains in an altered *S–T* interval or *T* wave in Leads I and III.

* These changes are similar to those seen in electrocardiograms of dogs when branches of the coronary arteries are experimentally occluded and support the theory that during attacks of angina the blood supply of the myocardium is deficient.

In cases where the right coronary artery has been occluded the electrocardiogram shows first a high origin and later inversion of the *T* wave in Lead III, and depression of the *S–T* interval in Lead I.

Thrombosis of other branches of the coronary arteries shows no changes or less characteristic alterations when the conventional leads are used. Thus it has been pointed out recently that an abnormal *Q* wave in Lead III in the absence of right axis deviation is often the only electrocardiographic evidence of occlusion. The use of anteroposterior leads as suggested by Wolferth and Wood,[11] the electrodes being placed directly on the chest, or of multiple leads as employed by Hyman, have shown abnormalities of the *S–T* intervals and *T* waves in a number of cases where the infarct was present in an area "silent" to the usual leads.

Differences Between Angina Pectoris and Coronary Thrombosis

Although at times it is difficult to distinguish between these two, since they are closely related pathogenetically, there are certain differences that should be borne in mind from their importance both in diagnosis and in prognosis. While in all probability angina pectoris is a "coronary affair," to use a French phrase, it may occur in persons who give no evidence by any known test of coronary disease. Pathogenetically it differs from coronary thrombosis in that it is due, so we believe, to a transitory spasm of coronary artery and not to a real plugging of the vessel.

Pericarditis independent of coronary occlusion is not often painful but it may be. While one would be likely to conclude that an acute painful pericarditis had a thrombotic or embolic infarct as its cause, in young persons and even in the elderly an acute pericarditis of infective or uremic origin may be painful and simulate angina pectoris or coronary occlusion.

Pneumothorax. In one case seen in consultation a diagnosis of angina pectoris had been made. When I saw the patient some hours after he had been seized he was still suffering severe chest pain. The man was a builder and the attack had come on while he was at work on a building. Upon examination I found that he had a spontaneous pneumothorax.

The important clinical differences between angina pectoris and coronary thrombosis are indicated in the following table:*

* Modified from Warburg (Acta med. Scand., 1930, 73, 547), Parkinson and Bedford (Lancet, 1928, 1, 4; Heart, 1928, 14, 195) and Keefer and Resnik (Arch. Int. Med. 1928, 21, 769).

TABLE 4

CLINICAL DIFFERENCES BETWEEN ANGINA PECTORIS AND CORONARY THROMBOSIS

	Angina pectoris	Coronary thrombosis
Beginning of attack	During effort	During rest
Seat of pain	Behind middle of sternum	Behind lower sternum or in epigastrium
Radiation	To left shoulder and down left arm	May be absent
Dyspnea	Not present	Marked
Behavior of patient	Quiet	May be restless
Duration of attack	Few minutes	Hours to days
Shock	Absent	Present
Vomiting	Rare	Frequent
Pulse	Unchanged or tense	Small, often rapid
Arrhythmia	Rare	In about 15 per cent.
Temperature	Normal	Elevated
Blood pressure	Unchanged or rises	Falls or remains stationary
Heart sounds	Normal	Frequently soft; pericardial friction often present; at times gallop rhythm
Congestive signs	Absent	Often present
Electrocardiogram	Often normal	Usually characteristic
Nitrites	Useful	No effect
Leukocytosis	Absent	Present

In another case *herpes zoster* of the thorax produced a picture that had led to a diagnosis of angina pectoris or rather of coronary thrombosis. There were only a few papules visible at the time I made my examination, but as they began at the spine and were present in the axilla, the correct diagnosis was readily made.

Angina pectoris and coronary occlusion may also be simulated by *myalgia, intercostal neuralgia, nervous dyspepsia,* and *hysteria.* The hysterical mimicry is illustrated by the following case:

A woman, about 52, a very important member of my early clientéle, whose sister was suffering from angina pectoris, began to have similar attacks of precordial pain radiating into the arms and having a considerable duration. They usually came on after a domestic scene, a frequent occurrence. I took them to be hysterical. One day while conducting a dispensary clinic I received a message to come at once, as Mrs. D. was having a terrible attack and seemed to be dying. My first thought was, "Have I been mistaken in my diagnosis?" The taxicab seemed to crawl at a snail's pace. As I approached the house I fully expected to see the undertaker's wagon at the door. I rushed upstairs and found the patient sitting by the open window moaning with pain and declaring herself convinced that the end

was near. Finding her pulse good and no evidence of shock I tested sensation with a pin and found her completely anesthetic for touch and pain up to the elbows. This lady lived for many years and died eventually from a delayed cerebral hemorrhage (Spätapoplexie) after an automobile accident.

Differential Diagnosis from Abdominal Conditions. As I have said, coronary occlusion may closely simulate an acute abdominal accident. The following are the more important:

Gall Stone Colic. Although differential diagnosis is sometimes exceedingly difficult, the history of previous substernal oppression, the profound degree of shock, the absence of tenderness in the gall bladder area, the male sex, are useful guides. If fever, leukocytosis and pericardial friction develop the diagnosis can no longer be in doubt. It must, however, be borne in mind that if the right coronary artery is obstructed, there may be a rapid swelling of the liver with tenderness, which might mislead.

In one case in which our diagnosis see-sawed between an acute cardiac seizure and a gall stone attack, the patient could only find comfort by getting on all fours. We decided in favor of a cardiac attack but the autopsy revealed a ruptured dissecting aneurysm.

Mesenteric Thrombosis. In one case coming under my observation the question of the possibility of mesenteric thrombosis arose.

A man in the early forties, who had a history of pernicious anemia from which he seemed to have recovered except for symptoms of combined spinal sclerosis, was seized with sudden sharp pain in the epigastrium with vomiting, blood in the bowel movements, and marked abdominal distention. At autopsy the man had no definite cardiac infarct but a firm antemortem thrombus in the apex of the left ventricle. There was no thrombosis either of the mesenteric arteries or veins.

Rupture of a peptic ulcer may resemble acute coronary thrombosis. The diagnosis has to be made on a careful history and on a thorough physical examination.

A tabetic crisis may conceivably simulate coronary occlusion. One should always make it a habit in every obscure case of severe epigastric pain to test the ocular and tendon reflexes.

Acute Pancreatitis. I have seen one case in which it was very difficult at the moment to tell whether the patient had coronary occlusion or acute pancreatitis. The conclusion was finally reached that the man had had some abdominal catastrophe and at operation acute pancreatitis was found.

Diabetic Acidosis. It is sometimes very difficult to tell whether a severe chest pang in a patient suffering from diabetic acidosis is or is not due to coronary block. As the use of insulin is dangerous in coronary occlusion, the diagnosis has much more than academic

interest. It might be well in a doubtful case to treat the patient with alkalies and orange juice. If the symptoms disappear with lessening of the acidosis, then they were in all likelihood not due to coronary thrombosis.

Prognosis is often a more difficult art than diagnosis, and yet the doctor's reputation to a large extent stands or falls by it. In coronary occlusion it is particularly hazardous to venture a prediction as is shown in the two following cases:

Mr. H., a Philadelphia merchant, aged 54, who seven years before had had an attack of angina pectoris, was seized with a violent pain in his chest. He was in Paris at the time. A physician was called who appreciated the gravity of the case and summoned a renowned cardiologist. The latter correctly diagnosed coronary occlusion and in a rather brutal way said to the wife, "Madam, your husband will die." The distracted lady insisted that the family doctor stay all night. The next morning the patient was very much better. The consultant on his second visit was amazed at the man's improvement and turning to the wife said, "Madam, I think I was mistaken. Your husband is going to recover." That night the patient had another violent seizure and died.

The second patient, a man with polycythemia rubra, had a typical coronary attack, with fever and leukocytosis and pericardial friction. Within two or three days the symptoms had entirely subsided. About a week later, when apparently convalescing, he sat up to eat his lunch and dropped over dead.

It is probable that in both these patients there was a ventricular rupture at the site of the infarction or a sudden ventricular fibrillation.

There are, however, certain features that permit a fairly definite prediction. A persistent tachycardia especially with gallop or other disturbance of rhythm, a continuing fall of blood pressure, unyielding pain, and hyperpyrexia,[12] make the prognosis unfavorable. Great severity of pain is, however, not of necessity a fatal omen. In one of my cases morphin utterly failed to control the pain; chloroform held it in check just as long as the patient was under its influence. Nevertheless, the man recovered and lived for a number of years, in fact lived through a second attack and through an attack of pneumonia. A rise in blood pressure is a favorable sign.

Patients that have shown symptoms of coronary disease either of the mild or of the painful type are not good subjects for operation. The mental strain may produce angiospastic disturbance in the coronary circulation and may precipitate an attack, the patient dying on the table or shortly afterward. Hence all operations of election should be avoided.

The earlier we can see these patients the better, but whenever we see them we must recognize the true condition and not be misled by the prominence of gastric symptoms. It is in the early stages that

much can be done and the catastrophe of sudden occlusion either obviated or postponed to a late period when life no longer is very important. In any patient passed 50 an unaccustomed, uncomfortable feeling behind the sternum coming on during walking or on any physical effort should awaken a suspicion of some cardiac abnormality. True, nothing may be discovered on physical examination, though there is often a slight enlargement to the left, a snappy second aortic sound or a systolic murmur at the aortic area. An elevated blood pressure helps in directing the medical mind in the proper channel. The electrocardiogram may show some abnormality, a change in the *Q* or in the *T* wave. But the experienced and careful clinician does not need that; he reads the writing in the patient.

Treatment divides itself into two parts, treatment of the attack and subsequent treatment. That of the attack is more or less stereotyped and presents perhaps but one controversial feature and that is the use of digitalis. I shall refer to this in a moment. The following is an epitome of the treatment of the attack.

Absolute rest, mental and physical, the most absolute conceivable. It may be inadvisable to undress the patient at the outset. He should have no company and should not be allowed to talk. He should of course use the bed pan and urinal and should have a night and a day nurse when the circumstances permit. External heat should be applied.

For the relief of pain nothing compares with morphine in large doses. When morphine fails hardly anything else is likely to be successful, although in two instances I have applied leeches to the precordia and found that the pain immediately abated. Nitroglycerin is contraindicated and yet patients sometimes take it because they have been in the habit of using it for attacks of angina pectoris. If the heart should stop suddenly and the doctor is at the bedside, he might resort to an intracardiac injection of 1 cc. of adrenalin chlorid 1 to 1000 solution. Under ordinary circumstances adrenalin and probably ephedrin are contraindicated in patients with angina pectoris and coronary occlusion. The dangers of the use of adrenalin in angina pectoris and coronary sclerosis have been pointed out by Levine, Ernstene and Jacobson,[13] and by Cottrell and Wood.[14]

Another agent of value in my experience is glucose or sugar. The glucose can be given intravenously. I have been in the habit of ordering ginger ale, water-ice, apple sauce, pineapple juice and orange juice for the purpose both of supplying fluid and of supplying sugar.

Levy has recommended oxygen inhalations during the acute attack. I have used them, employing the well-known oxygen tent for

the purpose. The patients were made more comfortable but I have not seen that the procedure had any effect as regards saving life.

A question that nearly always comes up is—Shall digitalis be used? Having in my mind's eye the pathologic condition of the heart in acute coronary occlusion—infarction with softening—I have been afraid of using digitalis in adequate doses and I am glad to see that that is the opinion of most writers. If, however, there is auricular fibrillation or congestive failure as a sequel of the coronary attack then digitalis is indicated as it would be if coronary occlusion had not occurred.

If cardiac stimulation is necessary and very frequently it is demanded, my favorite remedy is caffein sodiobenzoate hypodermically, using an ampule containing 0.5 gm. (7½ grains) of the drug. When conditions are less pressing, the caffein sodiobenzoate may be given by mouth in doses of 0.12 to 0.20 gm. (2 to 3 grains).

If diabetes exists insulin should be withheld as it is dangerous in cases of coronary occlusion. Its use would be justified in threatening coma.

How long should the patient stay in bed? From five to six weeks is the minimum in a severe case of coronary occlusion. A cardiac scar is thought to be firm after eight weeks. It may not be wise to tell the patient at the beginning of his incarceration the length of the sentence. The tactful physician will achieve his end by giving an answer which is true but not necessarily specific. The getting-up process should be gradual and so should be the resumption of the ordinary vocations and avocations of life. The man who has had a coronary occlusion should avoid physical strain and should not indulge in competitive athletics. I am also averse to permitting such patients to drive their own cars, although one may have to make concessions in keeping with the patient's circumstances.

The post-thrombotic or interval treatment has been in the main covered in the foregoing section. A few additional suggestions may now be given. Of greatest importance is encouragement. Psychotherapy, of enormous help in most diseases, is of transcendent value in patients who have had anginal or thrombotic attacks.

The diet should be sensible and restricted in quantity if the patient has been habitually a big eater. A little whisky may be allowed to the man who has been accustomed to drinking alcohol.

Drugs are not of much moment. Whether the euphyllin derivatives are of any value in dilating the coronary vessels, as is believed by many or, more properly speaking, is stoutly maintained by the manufacturers, is still a moot question. Until more exact knowl-

edge is available, I shall, however, continue ordering for short periods at a time one or two tablets of metaphyllin or similar product a day. I also believe that small doses of digitalis, 5 or 10 drops thrice daily, are useful.

TABLE 5

PERSONAL CASES OF CORONARY THROMBOSIS

Number of cases (men 74, women 14)	88	Cigar smokers	16
Number of cases living	38	Tobacco chewers	2
Number of cases dead	34	Tobacco habits not recorded	24
Number of cases unknown	16	Non-users of tobacco	16
Greatest duration of life after onset of those known to be living	16*	Family history of heart disease or hypertension	24
Greatest duration of life after onset of those known to be dead	11*	No heart disease known	41
Average age of onset (youngest 32, oldest 81)	57*	Definitely negative history of heart disease	23
Hypertension (5 blood pressures not recorded)	49	Occupations—men:	
Pericardial friction	7	Merchants	18
Typhoid fever	7	Manufacturers or executives	18
Renal calculi	7	Physicians	10
Rheumatism	7	Bankers	4
Diabetes	4	Salesmen	3
Syphilis	3	Clerks	3
Polycythemia	2	Lawyers	3
Used tobacco (excessively 22)	46	Brewers	2
Cigarette smokers	20	Various (1 each)	13
		Occupations—women:	
		Housewives	10
		Nurse	1
		No occupation	3

* Years.

The patient who has had a genuine attack of coronary thrombosis must ever after shape his life in accordance with his narrowed limitations. He should not exert himself unduly and should cease playing golf, tennis or similar active sports. Short business hours and a long postprandial siesta are very desirable, and a five-day week is an excellent thing for the coronary individual. If economic conditions permit the patient should take a winter as well as a summer vacation. Many spend their vacations unwisely. Instead of resting they work just as hard only in a different way.

I believe men who have been heavy smokers should reduce their smoking to a minimum or better give it up entirely.

Re-examination at fairly frequent intervals, including electrocardiographic study, is important in discovering any signs of cardiac weakness.

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VASCULAR CRISES *

Almost before we were aware of it, a striking innovation appeared in medical nosography and medical practice. A new specialty has developed which was hardly dreamed of three or four years ago—a specialty dealing with diseases of the blood vessels.

In our textbooks the subject of these diseases, particularly insofar as it concerns the arteries, is dealt with largely as static—uninterestingly and briefly. But within an unbelievably short space of time, disease of the blood vessels has become a dynamic, active branch of medicine with a rapidly growing literature of its own. Some may decry such intensive specialization in medicine, but it cannot be denied that concentration upon one field broadens our knowledge, though it may narrow the broadeners. The new specialty, which might be called angiology, has already a large number of devotees in this country and abroad, and is bringing under its aegis diseases that previously did not seem to have any connection with it. In a number of hospitals special vascular clinics have been created and the men in these clinics are taking their place beside the cardiologists and the allergists.

When we look into the history of the subject we find, as in nearly every other phase or department of medicine or science, that its roots go far back and that we are by no means the pioneers that we may fondly think ourselves. As is pointed out so wonderfully in Thomas Mann's "Joseph and His Brothers," when we come to what seems the beginning of anything in history, it's not the beginning though want of knowledge may make it seem so. Therefore when I start in 1773 with Stephen Hales' "Haemodynamics," it is in implied recognition of Mann's thesis. Hales was seemingly the first to advance the notion that the arteries were contractile. With plain water he perfused an aorta and its mesenteric vessels at a constant pressure head and noted the outflow to be greater when the fluid was warm. Investigating also the effect of alcohol and extract of cinchona bark, he was led to conclude that some drugs caused constriction and some dilatation.

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E. H. Weber appears to have been the first to assume a nervous control of contraction, advancing the hypothesis to explain blanching and pallor on one side and blushing on the other.* Perhaps before Weber I ought to mention Allan Burns, who in 1809 explained angina pectoris on the basis of a spasmodic contraction of the coronary arteries—a very ingenious and fertile thought. The muscular coat of the arteries was not described until 1840, when Jacob Henle reported its existence, and then Claude Bernard in 1851 noted the effect of cutting the sympathetic nerve on the vessels of the rabbit's ear and the effect of stimulation of the nerve. With these cumulative observations, the relation of the sympathetic nervous system to the caliber of the blood vessels became firmly established.

The earliest clinical observation—I use the superlative with the reservation mentioned above—is probably that of Charcot in 1858 on Intermittent Claudication,[2] a condition described as occurring in horses by Boulay in 1831. Four years after Charcot's publication, there appeared what is still the most important essay in the entire field of vascular diseases, namely Raynaud's classical thesis "On Local Asphyxia and Symmetrical Gangrene of the Extremities."[3] Goltz in 1874 suggested the existence of a vasomotor mechanism in the peripheral vessels, in the ganglion cells of vasomotor nerves.

The next milestone is represented by Pal's epochmaking monograph on Vascular Crises.[4] After the lapse of a dozen years, Buerger's[5] masterly article on Thromboangiitis Obliterans appeared and marks another milestone. Since then the literature has grown so fast that it is impossible to do it justice. I shall mention only a few outstanding contributions: Krogh's pioneer work on the capillaries, that of Lériche, the father of sympathectomy, that of Cannon on the sympathetic nervous system and the endocrine glands, that of Sir Thomas Lewis and his associates on the capillaries, that of Brown, Adson and other members of the Mayo Clinic, on various phases of vascular disease, the work of Lichtwitz, Alice Bernheim, Starr, Landis, Scott, Kramer, Herrmann, Bastai and Dogliotti, and many others,

The vasomotor nervous system which has its centers in the medulla and in the spinal cord, is distributed chiefly to the arterioles and capillaries but also to the veins and large arteries. The nervous apparatus in the vessel walls regulates the tonus of the vessels. This tonus, which together with the force of the heart

* Thomas Willis (1621-1675) had a working hypothesis of the vasomotor nerves. "These small lines and cords of nerves do variously straighten, compress, or it may be sometimes quite shut these blood-carrying vessels" by acting on the muscular coat of the vessels to which they are distributed.[1]

maintains the blood pressure, is very sensitive and is readily influenced by many factors such as hormones, temperature, emotions and sensations, activity of the muscles or of the internal organs, poisons, etc. While the tonus influences the blood pressure, the corollary is also true that the state of the blood pressure reacts upon the sympathetic nervous system and thereby affects the tonus of the vessels. Although the vascular tonus is directly under the influence of the sympathetic nervous system, the latter in turn is brought into action or inhibited, as the case may be, by hormones of various ductless glands—the adrenals, pituitary, parathyroids, sex glands, and thyroid. The study of the interrelation of these glands, a factor in what Cannon calls homeostasis, constitutes one of the most difficult and important biological problems.

The vasomotor nerve impulses seem to reach the vessels along their whole length and not only in a single trunk at the beginning. This is important in connection with sympathectomy—cutting the perivascular nerves of any one segment does not wholly deprive the vessels of their vasoconstrictor innervation. The predominant vasomotor impulses are constrictor in nature; dilatation of the blood vessels has by some been looked upon as a passive process resulting from inhibition of the vasoconstrictor mechanism, but there is considerable experimental proof that dilatation itself may at times be active. In animals dilatation can be produced by stimulating the central end of the depressor nerve after all vasoconstrictor fibers have been severed. Such a result would imply the existence of a vasodilator center but this conclusion cannot be applied to man without some corroborative observations that are still lacking.

At its bifurcation the carotid artery is somewhat enlarged—the carotid bulb or sinus—and is here surrounded by a plexus of nerves. Pressure upon the sinus causes slowing of the heart and lowering of blood pressure. (Czermak's phenomenon.) At first it was believed that the effect was due to direct pressure on the vagus nerve, but Hering, Hymans and others have shown that the effect is due to a reflex stimulation of vagus inhibitory fibers through pressure on the carotid sinus nerves. Very little is known of the share of the carotid sinus in the vascular tonus in man, whether it is constrictor or dilator, or actually whether it plays any role whatever.

The vasomotor system, including in this the intrinsic and extrinsic mechanisms, is very sensitive. This sensitiveness is well shown in a simple experiment devised by Landis and Gibbon.[6] When the hands and forearms are immersed in warm water, a decided rise in surface temperature occurs in the cool lower

extremities within 15 minutes—from 26° C. (78.8° F.) to 32° C. (89.6° F.). The reflex effects of cold, acting through the medium of the vasomotor system, are demonstrated in the experiments of Hines and Brown.[7 8] By putting one hand in ice water for 20 to 30 seconds, an immediate rise in both systolic and diastolic pressure is produced. The response is not augmented by placing both hands or both feet or all four extremities in ice water. It is interesting and for future studies very significant that persons with established essential hypertension and even those in what might be called the functional or preclinical stage of hypertension give an exaggerated response, showing an increased vasomotor irritability.

In a virtually new and not yet overclassified subject such as diseases of the blood vessels a variety of classifications is possible. From a clinical point of view we shall find it advantageous to speak first of all of general and of local vascular crises, which may again be subdivided into constrictor and dilator crises.

1. **General Constrictor Crises.** These are exemplified by the sudden rises of blood pressure that occur both in apparently healthy and in hypertensive individuals. Among the former it is the lively, excitable, intense type that is subject to sudden rises of blood pressure. These crises are of brief duration and usually pass off without any deleterious effects. It is possible, however, when these crises are oft repeated, especially under the influence of psychic stimulation, as pointed out by Schreiber, that they eventually lead to a permanently heightened tonus, to hypertrophy of the muscular coat of the arterioles, and to hypertension.

In the hypertensive group—and it should be remembered that the blood pressure need not be extremely high—sudden vascular crises may produce a variety of nervous symptoms: headache, vertigo, tinnitus, aphasia, monoplegia, hemiplegia, hemianopsia, convulsions. It may not always be easy to decide whether these symptoms are due directly to a general hypertensive crisis or to localized functional or anatomic changes that precede and cause the rise in blood pressure.

The relation of general hypertensive crises to angina pectoris has recently been studied by Sir Thomas Lewis.

General vascular crises are common in women at the time of the menopause—which makes it highly probable that some endocrine imbalance resulting from atrophy of the ovaries or changes in related glands plays an etiologic role.

General dilator crises manifest themselves in a sudden fall of blood pressure. In practice it may be difficult to decide how much of the fall is due to vascular dilatation—whether from constrictor

paralysis or dilator stimulation—and how much to cardiac weakness. In the collapse of acute infectious diseases and in traumatic shock vasomotor paralysis is the predominant mechanism, although in the former some element of heart weakness is added. A preliminary vasomotor spasm of the surface usually attends shock. In sudden coronary obstruction, in acute cardiac dilatation, in rupture of the heart, there is a tremendous fall of blood pressure from direct depression of the cardiac function. The symptoms of dilator crises resemble those of severe hemorrhage—profound weakness, pallor, sweating, sighing respiration, dizziness, thready pulse, at times unconsciousness. Dilator crises are produced as already indicated, by acute infections, by shock, traumatic and surgical—toxic agents such as histamine may here play a part—at times by changes in posture (postural hypotension), and by Addison's disease.

2. **Local Vascular Crises.** These are chiefly of the constrictor type, but blushing and other forms of erythema, even the redness of inflammation, are examples of local dilatation. While local vascular crises or angiospasms are usually brought about by stimulation of the nervous vasoconstrictor mechanism, a myogenic contraction excited by hormones or other agents is conceivable. Just as we have in the heart a myogenic contraction but one profoundly influenced by nerve impulses, so we may assume a similar mechanism in the arterioles, the muscular coat of which is large in proportion to lumen. Certain individuals, according to Lichtwitz,[9] suffer from an angiospastic diathesis. They are in consequence subject to angiospasms in various parts of the body, particularly in the veins of the liver and spleen. Spastic closure of these prevents an adequate amount of blood from getting out of the natural reservoirs which in turn leads to anemia or ischemia elsewhere.

The results of spastic contraction as well as of any other form of vascular occlusion depend upon a variety of factors: the size of the occluded vessel, the duration of the spasm, the previous state of nutrition of the part, and the possibilities of prompt and adequate collateral circulation. I once saw the pulse suddenly disappear completely at the wrist through spasm of the radial artery without any observable after-effects. In some organs there is so little anastomosis between the vessels of contiguous territories (end arteries) that even a brief obstruction produces functional and usually also structural changes. Diseased vessels, unless they have entirely lost their contractile power, are more sensitive to vasomotor influences than normal vessels but, while more responsive, they return more slowly to their previous state. Under some conditions vessels, the coats of which are anatomically entirely normal,

show a vasomotor hypersensitiveness. Such conditions occur in certain constitutions, often on a racial basis, and in individuals of peculiar psychic and physical makeup.

It has usually been held that the functional effects of cutting off the blood supply to a territory depend upon the lack of nutritive material, but it is highly probable that it is principally the local deprivation of oxygen that is responsible for the primary results of vascular obstruction.*

The subject of local vascular crises is rendered somewhat difficult by the fact that in some territories identical functional results are produced by angiospasm, by embolism, and by thrombosis. This is particularly true of the brain. What I have to say about the symptoms of cerebral angiospasm may therefore be applied in large measure also to those other forms of obstruction.

Cerebral Angiospasm. On account of the complexity of the cerebral functions, angiospasm produces a multiplicity of symptoms which have one feature in common—they are as a rule of short duration. They occur most frequently in hypertensive individuals, but also in persons whose pressure is not markedly abnormal. According to location, we may have monoplegia, hemiplegia, aphasia, hemianopsia and other visual defects, convulsions, and possibly also psychomotor and psychic disturbances. There is a good deal of evidence that migraine is dependent upon angiospasm, perhaps allergic in ultimate origin.

I have just said that convulsions may be due to angiospastic states. The type of seizure I have in mind occurs most often in persons of middle or late life who have suffered long from hypertension; not exclusively, however, for I have seen them in individuals with blood pressures but little above the normal.

Those unfamiliar with the convulsions in question are apt to diagnose them as genuinely epileptic or as uremic, the latter especially because a little albumin is usually found in the first urine passed after the fit. If one studies the history of these patients, one finds that the convulsions had no connection with childhood and adolescence, that the first seizure occurred in the sixth or seventh decade, and that they repeated themselves at irregular intervals. As a rule, the convulsions leave no aftermath; occasionally some disturbance of speech, of vision, or of mentality persists for a while. If the patient is seen just before or during an attack his blood pressure, both systolic and diastolic, will be found raised considerably above its habitual level. To distinguish this

* For the local deprivation of oxygen to the tissue I have proposed the word histanoxia (from histos, tissue; anoxia, without oxygen). The term anoxemia sometimes used for oxygen starvation connotes rather a general state of the blood than a local condition.

epileptiform convulsion from true epilepsy, it has been called epilepsia tarda or senile epilepsy.[10]

The best treatment for the attack is bleeding from the arm; preventive treatment involves the general measures applicable to hypertension as well as those made use of in true epilepsy.

Uremia and eclampsia are very similar to epilepsia tarda and may also represent vascular crises. In the diagnosis the convulsions of general paralysis of the insane must also be borne in mind. When they are the inaugural symptom, they may, as I have seen, give rise to much perplexity until a positive Wassermann test is obtained with the spinal fluid.

A variety of transient sensory and psychic disturbances may have an angiospastic origin—vertigo, tinnitus aurium, hemianopsia, quadrant anopsia, disorders of color vision, amaurosis, and headache. Migraine or hemicrania, as already mentioned, is perhaps an angiospasm on an allergic basis. Spasm of the homolateral temporal artery has been observed during the migrainous attack. Among psychomotor and psychic phenomena producible by angiospastic states, sensory aphasia, amnesia and brief psychotic outbursts may be mentioned.

Vascular Crises in the Eye. Aside from intracerebral conditions, local vascular crises may produce disturbances of vision. These local crises are traceable to spasm and embolism of the central artery of the retina.

Vascular Crises in the Ear. It is possible that angiospasm may play a role in some forms of sudden tinnitus and vertigo, but little is known about it. It is a subject in which the coöperation of otologists and clinicians is necessary for a better understanding.

Vascular Crises in the Lungs. We know comparatively little about these in man; in animals they can be induced by anaphylactic shock. There is, however, a condition in the human subject that has the hall-mark of a vascular crisis, although its true pathogenesis, its morbid physiology, is but imperfectly understood. I refer to acute or fulminant pulmonary edema. Its chief clinical cause is myocardial disease usually associated with hypertension. It is also met with in mitral stenosis and after the removal of pleural fluid by tapping. Acute pulmonary edema, which has a striking tendency to recur, puts the patient's life in great peril—he may drown in his own juices. While the attack endures, dyspnea, air hunger and cyanosis are very marked and the chest, back and front, is full of moist râles. The patient often but not invariably expectorates quantities of clear or faintly blood-tinged sputum which coagulates on boiling.

Treatment promptly instituted usually brings about speedy recovery. The best measures are a hypodermic injection of morphine sulphate, gr. ¼, and atropine sulphate, gr. 1/150; venesection and dry cupping over the chest.*

Whether there is vascular as well as bronchial spasm in asthma is as yet undetermined.

Vascular Crises in the Heart. From the clinical as well as from the scientific point of view, this is one of the most important phases of my subject. The whole matter culminates in the question—what is the relation of coronary spasm to angina pectoris? Personally I believe it is that of cause and effect. While other causes may be operative, perhaps in the end they act as angiospastic factors or agents. Lichtwitz [9] believes that besides coronary spasm, angina pectoris may be produced by the failure of the physiologic dilatation during increased activity, and by the non-appearance of the increase of the circulating blood during work and under conditions of low temperature. This last circumstance may be brought about by pathologic closure of the veins of the liver and spleen whereby the blood reserve of these great reservoir organs instead of being added to the circulation is retained. This little understood mechanism, angiospastic in character, in itself does not eliminate the possibility of coronary spasm.

Vascular Crises in the Abdomen. Angiospasm analogous to that supposedly at the basis of angina pectoris may occur in the abdominal vessels (angina abdominis). I have seen this in a case reported elsewhere.

Some writers attribute the gastric crises of locomotor ataxia and the colic of lead poisoning to angiospasm, a view that has much in its favor, although it may not be the whole explanation,—it hardly accounts for the obstinate constipation of lead poisoning or for the persistent, uncontrollable vomiting of tabetic crises.

Vascular Crises in the Skin. Blushing and pallor of the face are vascular crises. The causes are manifold, but emotional factors seem most important.

Another dermal vascular crisis is urticaria or hives. This is a capillary crisis brought about, it is believed, by the liberation through toxic or toxico-traumatic action (bee sting, wasp sting, etc.) of histamine-like substances which act upon the smaller vessels and capillaries in such a way that fluid exudes into the

* Dry cupping is best done by taking a half dozen smooth wine or whiskey glasses, moistening the inside with grain alcohol, lighting the alcohol with a match and slapping the glass on the chest, either front or back, while the alcohol is still burning. Six or eight of such cups may be applied in a few minutes. When the raised skin inside the cup begins to look purple, the cup is removed. The procedure has virtue although we do not know its modus operandi.

perivascular tissues. Angioneurotic edema is of the same nature as urticaria. For reasons at present beyond our ken, urticaria is attended by intense itching, angioneurotic edema is not. Dermographia also belongs to the same category of skin conditions.

Vascular Crises in the Extremities. It is in this special field that the subject of vascular diseases has in a short space of time won its greatest triumphs. The progress, it must be admitted, has accrued more to the advantage of diagnosis than to that of treatment, but better diagnosis is bound to lead eventually to better treatment. The objectives of study have been in general the following:

1. The causes of vascular disease of the extremities.
2. The extent of the disease, i. e., how far down or high up it has reached; also the type of vessel or vessels involved.
3. The character of the disease, whether spastic, i. e., functional, or organic.
4. Treatment, which is subdivisible into:
   (a) Cure or palliation.
   (b) Arrest of the process.
   (c) Prevention of gangrene.
   (d) Treatment of gangrene.

Causes of Vascular Disease of the Extremities. Under this head I shall consider the principal clinical entities or syndromes in which vascular disturbances play the leading role.

One of the earliest to attract attention was intermittent claudication, the symptoms of which are quite uniform. The patient after walking a short distance is seized with a painful cramp in the calves that compels him to stop walking. After a brief rest, from a few seconds to 10 minutes, he can proceed with ease. The amount of exercise causing the cramp, as Goldsmith and Brown [11] have shown, is remarkably constant. One of my patients experienced the cramp only on the street; he could walk about his factory all day unhindered. A large proportion of sufferers have flat feet; many are heavy smokers; nearly 50 per cent. of those affected are Jews of eastern origin, and, of course, the male sex preponderates greatly. Examination usually shows thin, cold feet with absence of pulsation in the dorsalis pedis and posterior tibial arteries; the roentgen-ray may reveal more or less extensive calcification of the vessels.

The pain in intermittent claudication is the result of a temporarily inadequate blood supply to the working muscles, but whether it is due directly to ischemia, to histanoxia, or to certain changes in the muscles has not been definitely determined. The

production of vasodilatation by the means now employed does not seem to have much effect on the disease, and certain tissue extracts that exert a favorable influence upon it do not seem to do so by vasodilatation.

Intermittent claudication is a percursor (75 per cent.) or accompaniment (98 per cent.) of that terrible disease, thromboangiitis obliterans. As a primary disease, it occurs in later life than thromboangiitis obliterans and is associated with or is dependent upon arteriosclerosis. In thromboangiitis, calcification of the blood vessels is rare, the process being a diffuse inflammation with thrombosis of arteries and veins. In the primary form of intermittent claudication complete recovery is possible under proper treatment; the more spasm and the less sclerosis, the better the prognosis.

False diagnoses are often made—rheumatism, metatarsalgia, flat feet, sciatica. As regards sciatica, one should bear in mind that "bilateral sciatica" is almost never sciatica. It may be intermittent claudication, diabetic or nephritic neuritis, cord tumor or pelvic pressure. Perhaps the most important point to bear in mind is that intermittent claudication may be an inaugural symptom of Buerger's disease.

Thromboangiitis obliterans should perhaps be excluded from consideration here as it is not a vascular crisis, a functional condition, but an organic disease. However, it deserves inclusion for there is in addition to the marked structural changes a tendency to angiospasm. Naturally this is most marked in the early stages of the disease. Thromboangiitis, so well described by Buerger, was at one time believed to occur almost exclusively in Russian Jews, but the great experience of the Mayo Clinic has shown that this undesirable prerogative no longer belongs to that racial group. Only one-half the thromboangiitis patients seen in that clinic are Jews; the others represent all races including native American stock. It has not been observed in full-blood negroes.[12] The disease occurs in men between the ages of 25 and 50 years; in the Mayo Clinic there were only six patients aged more than 60 years in a series of more than 500 cases.[13]

The cause of thromboangiitis is unknown. The nature of the process suggests an infective agent but beyond that and a limited number of experiments, such as successful transplantation of resected veins the seat of phlebitis, there is no definite evidence. A second hypothesis ascribes the disease to excessive cigarette smoking. It is true that, as Barker[14] has shown, the majority of patients, 91.5 per cent., who had thromboangiitis obliterans used cigarettes. On the other hand, Brown[12] has observed the disease

in a group of patients who never used tobacco in any form. There is no doubt, however, according to the researches of Maddock and Coller [15] and of Barker [14] that the smoking of cigarettes exerts a vasoconstrictor effect, and Harkavy, Hebald and Silbert [16] and Sulzberger [17] have demonstrated a marked skin hypersensitiveness to tobacco in patients suffering from Buerger's disease.

I shall not describe the symptomatology of the disease in its entirety, as in this article I am concerning myself chiefly with vascular crises. Angiospastic phenomena are common in thromboangiitis; they result from sensory vasomotor reflexes and cause blanching and cyanosis, and a numb, dull, aching sensation on exposure to warmth. The frequency of these spastic disturbances has been the cause, as pointed out by Brown, of errors in diagnosis —Raynaud's disease being diagnosed in male patients, despite the fact that most of the patients who have Raynaud's disease belong to the female sex.

Before describing the methods of determining the vasospastic element and the location of the lesion, I shall discuss the subject of Raynaud's disease inasmuch as the same procedures are employed for its study. In fact, these procedures are now used in the investigation of all peripheral vascular disturbances, including diabetic and arteriosclerotic gangrene, embolic obstruction, and other affections hereafter to be mentioned.

Raynaud's disease has undergone hardly any changes in description since it was first described in 1862 by Maurice Raynaud, the man whose name it bears. The disease is a bilateral, symmetrical affection, occurring almost exclusively in women (men 5 per cent.) and is characterized by intermittent attacks of changes in color, from pallid or dead-white to deep purple or black, and by trophic changes ending at times in gangrene. Additionally characteristic is the absence of occlusive lesions in the peripheral arteries. Very little is known of the etiology of Raynaud's disease. That the endocrine glands, particularly the ovaries, play a role, might be inferred from the preponderance of the female sex. Bernheim and Garlock (personal communication) believe that there is a disturbance in the calcium metabolism for which the parathyroids may be responsible. They have seemingly cured a number of cases by parathyroidectomy.

Scleroderma begins as an angiospastic condition; it may be preceded or accompanied by typical Raynaud's phenomena. But a mere angiospasm hardly accounts for the profound changes in the skin and subcutaneous tissues—with atrophy, adhesion and contraction of the integument—not only in the extremities but in the face, especially about the mouth, over chest and clavicles, indeed

over any and all parts of the body. In a doctor's wife now under my care there is hardly an area that is not hide-bound. Severe trophic changes have occurred at the finger tips, over the digital joints, elbows and knees, and about the mouth. It is difficult to decide whether the primary process is a spastic occlusion of the vessels or whether the trophic changes, atrophy and tightening of the skin, squeeze the blood out secondarily.

Acrocyanosis is an obscure condition which affects the hands and feet, producing a bluish or reddish color and coldness. The affection is very annoying. I have seen it in two sisters, saleswomen, who were embarrassed as customers would comment on the appearance of their hands. It is most marked in cold weather but in some persons it persists even in warm weather. While resembling the asphyxial stage of Raynaud's disease, it cannot be classed with that condition as it is more permanent, especially in cold weather, and is without pain and without trophic changes. It would appear to be due to an angiospasm that reduces the capillary flow through the skin.

Erythromelalgia, a vascular disorder first described by Mitchell,[18] represents a vasodilator rather than a vasoconstrictor type of disease. It has the following features: attacks of pain and burning in the extremities, with throbbing and pulsation in the arteries and arterioles and usually with redness from dilatation of the surface capillaries and venules. The condition is bilateral and is intensified by heat and by exercise, and is relieved by rest, cold and elevation. As thus defined it constitutes a clinical entity, although its cause is unknown. Symptoms resembling erythromelalgia may be met with in other diseases, in thromboangiitis obliterans, in polycythemia rubra, but under such conditions it does not constitute the real disease.

The Cause of Pain in Angiospasm. Perhaps the question should be put in another form: why is the stopping of the blood supply to a part painful? The answer is difficult; the cause of the pain may not always or everywhere be the same. Sir Thomas Lewis explains the pain in intermittent claudication on the basis of an accumulation of metabolites in the muscles. This view is to some extent corroborated by the result obtained with injections of pancreatic tissue extract * in muscle pain of ischemic origin.[19] It was found that pain was relieved even though no dilatation of the vessels took place. There are, however, circumstances in which the metabolite theory would seem to be inadequate. A sudden blocking of a vein may be accompanied by violent pain as if the part had been struck.

* The active substance in the extracts may be adenylic acid or adenosin.

It is difficult to see how metabolites can be formed so promptly. The pain that follows the sudden closure of an artery has been attributed to a stretching of the artery proximal to the seat of closure. This would postulate a pain comparable with biliary and ureteral colic.

One of my patients suffering from polycythemia rubra was one day seized with violent pain in the left testicle. I found what seemed to be a thrombosis of the veins. Subsequently he had a similar attack about the ankle. In the case of the testicle the formation of metabolites is not likely to play an important role.

The conclusion seems warranted that the causes of pain in vascular occlusion, whether spastic or obturative, are multiple:

1. The accumulation of toxic metabolites in active tissues, especially muscles.
2. Histanoxia, ischemia or local anoxemia.
3. Pressure upon sensory nerve endings in the walls of vessels either through stretching proximal to the obstruction or through an actual squeezing of the nerve endings during spastic contraction. In either case, there would also be an inadequate blood supply to the vessel itself and to the surrounding receptor organs.

We may now take up the newer methods of determining the seat of obstruction and the presence or absence of angiospasm as an element in the ischemic process. In discussing these methods I shall borrow considerably from articles by Brown,[8] Kramer,[20] Starr,[21] Scott and Morton,[22] Pearse and Morton,[23] and others.

1. **Inspection and palpation** give information of great value. Coldness up to a certain point indicates how far the circulation, direct and collateral, is inadequate. Absence of pulse in the dorsalis pedis artery is an important finding in most cases of intermittent claudication and advanced arteriosclerosis. Such absence is not infrequent in cases of coronary sclerosis.

2. **Measurement of surface temperature,** by means of delicate instruments. This is particularly useful when one wants to differentiate between angiospasm and mechanical occlusion. Readings are taken before and after nerve block. The pressor or vasoconstrictor impulses may be blocked either by spinal or general anesthesia or by local infiltration of the nerves to the part to be studied, or inhibited by artificial fever induced by intravenous injection of a foreign protein, e. g., typhoid vaccine. The block is normally followed by a rise of several degrees in the surface temperature, such rise being an indication that the spasm has been overcome. If there is no rise, then the obstruction of the blood vessels is not spastic but organic. Tests for the angiospastic element

are of special importance in cases in which surgery is contemplated—sympathectomy, ganglionectomy or ramisectomy. If the surface temperature does not rise adequately, little can be expected from these operations.

The surface temperature of the lower extremities may also be raised reflexly by immersing the forearms and hands in warm water.[6] Landis and Gibbon found that if the forearms are immersed for 35 minutes in water at a temperature of from 43 to 45° C., a vasodilatation is produced in the lower extremities. If the surface temperature rises to above 31.5° C., significant structural disease of the arteries of the lower extremity is definitely absent. If the surface temperature fails to rise to this level, organic arterial obstruction is probably present.

3. **Oscillometry.** The oscillometer determines the magnitude of pulsation of the arteries and is helpful in determining in the case of organic obstruction the point to which the circulation is adequate.

4. **Calorimetry.** By determining the amount of heat loss in a given time and by skin temperature observations, calorimetric methods give indirect information of the volume flow of blood through an extremity.

5. **Histamine Test.** When a minute amount of histamine is introduced into the skin a reaction occurs which Sir Thomas Lewis [24] and Lewis and Grant [25] have classified as (1) local dilatation, (2) flare, or (3) wheal. Starr [26] has employed this reaction as a test for circulatory deficiency in the feet. In cases in which the circulation to the feet is impaired, the reaction to histamine is delayed, reduced or incomplete.

6. **The Roentgen-Ray.** This will show calcification of the arteries if it is present, but calcification may exist with good circulation.

Visualization of the arteries by means of the injection of opaque solutions has been tried by a number of investigators.[27 28] Allen and Camp, using a preparation of thorium dioxide called thorotrast, were able to demonstrate by means of arteriography, thromboangiitis obliterans in two cases in which all other methods of examination had given inconclusive information. The attitude of the profession toward the introduction of radioactive substances into the body is distinctly one of fear. The method as employed by Allen and Camp, excellent as it is in its immediate results, will not become widely used until more is known of the effects of the prolonged presence of thorium in the body.

Treatment. The vasomotor crises in the extremities, characterized as they nearly always are by pain, must be treated both casually and symptomatically. I need not discuss the casual treatment in such cases as are due to diabetes mellitus and shall limit myself to those measures that improve or restore the circulation when it is cut off or greatly reduced through arteriospasm.

To improve the peripheral circulation in vessels the seat of constrictor spasm several means are at our disposal.

1. Alternate elevation and lowering of the limb. This exercise is capable of producing a better inflow and outflow of blood. It is applicable to practically all cases of obscure pains in which the cause is a local ischemia.

2. Alternate applications of heat and cold.

3. The use of dry heat applied by means of electric bulbs. Great care must be exercised in not exposing the parts to too much heat.

4. Alternate suction and compression in an air-tight chamber, a method, suggested by Herrmann and Reid.[29] It is too early to speak of its value in angiospastic conditions in the limbs. The limb is placed in a glass chamber and by means of a special motor air is alternately sucked out and forced in. Herrmann's apparatus, called Pavaex (from Passive Vascular Exercise) and the device of Landis work on slightly different principles, but have the same underlying objectives.

5. The injection of sodium citrate solution. This is most useful in thromboangiitis obliterans; it probably acts less by relieving spasms than by altering the state of the blood.

6. The administration of calcium has been found useful in Raynaud's disease and allied conditions. The dose must be fairly large, from ½ to 1 gram of calcium gluconate twice daily. The calcium should be given an hour before meals.

7. Acetyl beta-methylcholine chloride, commercially known as mecholine or mecholyl, has experimentally and clinically been found to cause vasodilatation. Its administration is made a little difficult by the fact that it is exceedingly deliquescent. The dose by mouth is 0.2 to 0.5 gram, three times a day; best dissolved in a little water and then mixed with milk. It may also be given subcutaneously—never intravenously—in doses of 5 to 10 mg., to be increased up to 25 mg. according to patient's tolerance. Recently Kovacs[30] and Doane[31] administered it by the method of iontophoresis, which introduces the substance electrically into the limb.

In some cases, especially in acrocyanosis, endocrine preparations may be useful. Theelin has been tried.

8. Parathyroidectomy in the treatment of Raynaud's disease has given encouraging results but further observations are necessary before a final judgment can be reached.

I shall not go into details of the surgical operations that have been recommended for angiospastic conditions but merely mention them—sympathectomy, ganglionectomy, ramisectomy. The usefulness of these procedures is very limited and in the case of sympathectomy the results are rarely permanent.

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A CASE OF INTERMITTENT CLAUDICATION *

In 1858, Charcot [1] read a paper before the Société de Biologie, in which he reported the following interesting case: A man, aged 54, who had early in life received a bullet wound in the right flank, complained of a peculiar difficulty in walking. After walking for more than a quarter of an hour he would experience throughout the entire right leg a feeling of weakness and numbness; and if he continued on his way, pain and tingling began in the penis and extended to the right thigh and down the left leg to the foot. Finally, cramps and stiffness supervened and rendered the limb useless. After a few moments' rest he could continue his walk, but for only a short time; in 20 minutes the symptoms described returned, and again arrested his progress. Death ensued from gastrointestinal hemorrhage. At the autopsy the right common iliac artery was found to be the seat of an aneurysm in its upper two-thirds. The lower portion was obliterated and converted into a fibrous cord.

Charcot attributed the functional disturbances in the right leg to an ischemia or anemia of that member, produced by the arterial obstruction, and termed the condition intermittent claudication or intermittent limping. The expression was borrowed from veterinary medicine, in which it was employed to designate an intermittent painful limping or paralysis occurring in horses. Bouley,[2] in 1831, was the first to point out the equine form of the affection, and attributed it, as did Charcot afterward, to arterial obstruction.

Charcot's paper, although classic in the clearness of its diction and reasoning, remained almost unnoticed both in France and elsewhere, and it was not until he had on several occasions recurred to his original observation and had recorded others, that cognizance was taken of the disease. The most elaborate studies have since been made by Erb [3] and by Goldflam.[4] As the former has but recently reviewed the literature, I would refer to his masterly paper for an historic account of the affection.

The cardinal symptoms of intermittent claudication are as follows: The patient starts out to walk, and does so for a short distance with perfect or almost perfect ease. Then he begins to

* Read at a meeting of the Philadelphia Neurological Society, April 22, 1901. Reprinted from American Medicine, May, 1901.

experience pain and numbness, often a distinct cramp, in one or both legs, usually in the calves or in the feet. Further walking becomes difficult or impossible, and he is compelled to rest. After a few minutes, however, locomotion can be resumed, only to be again interrupted by a return of the pain and cramp in the legs. The patient thus becomes intermittently limping, or rather lame. In horses the objective symptoms are similar. The animal starts out well, but after a short trot of a quarter of an hour or less it begins to limp, and if spurred on, the hind legs become stiff and rigid, and it falls to the ground in evident pain. After a short rest it can go on, but the same symptoms recur within a few minutes, and the animal becomes useless for service.

Examination of human beings suffering from intermittent claudication has shown as a very characteristic objective feature an absence of pulsation in the arteries of the feet—chiefly the dorsalis pedis, often also the posterior tibial, in rare instances the popliteal and the femoral. Pulsation of the dorsalis pedis is practically never absent in health; nor in disease, except in conditions such as edema, elephantiasis, and analogous affections which interfere with the satisfactory palpation of the artery, and in arteriosclerosis of marked degree. Erb examined a large number of hospital patients, and found pulsation present in 99%. In 1% it was absent, by reason of the causes just mentioned. Goldflam found pulsation of the artery absent in nine out of 200 heterogeneous cases examined by him. None of these nine showed symptoms of intermittent claudication. This indicates that obliteration of the pulse may occur without intermittent claudication; but Goldflam's and Erb's cases of the disease showed that intermittent claudication very seldom exists in the absence of obliteration of the pulse in the dorsalis pedis artery. Thus, in 24 cases observed by Goldflam, the pulse in either one or both dorsalis pedis arteries was absent in all but one case; the posterior tibial did not pulsate in either leg in seven, and in four each the right and the left were pulseless. In Erb's 12 cases the arteries of the feet were examined in 11; and of these eight showed absence of pulsation in one or more of the arteries in question—the dorsalis pedis and the posterior tibial behind the inner malleolus. In one case no pulsation could be detected in the popliteal; this artery is, however, so deeply placed that, as Goldflam remarks, a negative result is of but little value.

Aside from the intermittent hindrance to walking, there are, as a rule, no other motor symptoms in intermittent claudication. Sensation is also normal—objectively, at least; subjectively, the patient often experiences various paresthesias—formication and

numbness, as well as pain and coldness. Vasomotor symptoms are common, and consist of pallor, coldness, and dryness of the skin; at times there is a peculiar bluish mottling, and rarely signs of local syncope, in the shape of pallid, anemic areas, like the "dead fingers" of Raynaud's disease, are manifested.

That it is important to recognize the disease, is shown by the fact that gangrene occurred seven times in Goldflam's 24 cases. It is very probable, moreover, that a number of instances of spontaneous gangrene reported by surgeons were really cases of intermittent claudication.

The majority of the patients are men; 11 of Erb's 12, and all of Goldflam's 24. The interesting case reported by Gordon,[5] in which the disease was associated with paresthetic meralgia, occurred also in a man.

Regarding the age, Erb's patients varied from 32 to 60 years; of Goldflam's 24, 14 were under 40; my own patient is a man of 39 years.

From the point of view of pathologic anatomy, the most important lesion is an obliterative endarteritis of the peripheral arteries. This endarteritis is associated with hypertrophy of the muscular coat, and often with corresponding alterations in the veins. The changes are similar to those found by Mitchell and Spiller[6] in the arteries of the toe from a case of erythromelalgia, which is likewise a very painful affection of the distal parts of the limbs, and may in some respects be considered as belonging in the same category as intermittent claudication. The digital nerves in Mitchell and Spiller's case were decidedly diseased, but in the cases of intermittent claudication hitherto studied, either at autopsy or after amputation of a gangrenous limb, no changes were found in the nerves. In one case Marinesco noted peculiar alterations in the muscles, the interpretation of which is not entirely clear.

The etiology of the disease coincides in a large measure with that of arteriosclerosis, which, as I have stated, is the principal anatomic lesion found in the disease. Syphilis, alcohol, exposure, tobacco, and perhaps diabetes, play a role. Regarding syphilis, it is interesting to note the contrast between the cases of Erb and those of Goldflam. The former found four out of nine (44.4%) patients to be syphilitic, while only one of Goldflam's 24 had had the disease.

As arteriosclerosis is common and intermittent claudication rare, it is necessary to assume that other factors contribute to bring about the latter affection. These factors presumably are vasomotor disturbances, which may in turn be connected with endarteritic changes in the vasa nervorum.

When we come to explain the symptoms, it is very natural to

attribute the various functional disturbances to the anemia and stasis produced by the arterial obstruction. The latter is in part organic—due to the endarteritic process; in part it is dependent upon vasomotor spasm. "The cry of the nerves for blood" expresses itself in pain; the muscles, on the other hand, seem to respond to the same privation with a painful contraction or a cramp. Charcot inclined to the belief that the muscles lost their irritability, and possibly suffered a change analogous to cadaveric rigidity—such as, for instance, is produced by occlusion of the abdominal aorta in the well-known Stannius' experiment. Whether the arterial spasm is in itself painful—by stimulation either of sensory nerves or of touch corpuscles in the vessel-walls—is a mooted point. There is abundant evidence that acute arterial obstruction is excessively painful, and some have attributed the pain to such a form of irritation.

The intermittent character of the symptoms is not surprising; during repose the amount of blood supplied is sufficient for the functional demands, but during the use of the limbs in walking the supply becomes inadequate; as soon as the patient rests the waste products are removed, and the parts again receive their needed share of blood.

It is an interesting fact that the majority of patients with intermittent claudication have been excessive users of tobacco and have been of the Hebrew race. Both of these statements apply to my patient, whose case I now proceed to relate:

Mr. D. A. G., a native of Iowa, 39 years old and married, is the head of a large manufacturing establishment. He denies having had syphilis. He worked hard for many years as a traveling salesman, and while thus engaged was much exposed to cold and wet. His mother was a diabetic, but died of an accident; his father died of apoplexy; a sister died of diabetes. Three brothers and several sisters are living and well. His wife has had one miscarriage, and has borne one child, now 11 years of age, who has had St. Vitus' dance. All his life, the patient has used tobacco to excess, both in chewing and in smoking.

Fourteen months ago he had an attack which was by one surgeon diagnosticated as appendicitis, and by another as muscular rheumatism. He was in bed 10 days, and, for reasons that the history fails to reveal, lost in the next three weeks 35 pounds in weight. A blood-examination was made, and the patient was told that he had malaria.

One day, while walking on Chestnut street, he suddenly had a sensation as if water were running down the left leg, and experienced a sharp pain in the sole of the left foot. So severe was this that he had to take a cab to go to his office. Ever since then he finds that although his legs feel natural when he starts, as soon as he walks a few squares he has pain in the calves, especially the left, and the legs feel, to use his own words, if they weighed 100 pounds. After resting a few minutes he is able to resume his walk, but the pain and heaviness quickly return. These annoying occurrences have caused him to form the habit of riding in the street-cars for even the shortest distances; he will thus take a car to cover two blocks.

About two weeks ago I visited him at his factory, which is on Arch street, between Third and Fourth streets. He told me that he had gone for luncheon to the Bullitt Building—only about 2½ squares away. When he got as far as Fourth and Market streets he could scarcely lift his feet on account of pain and a sense of weight; after resting a few moments he could proceed to his destination.

A very curious feature is that while in his factory he walks about a great deal with scarcely any trouble. I attribute this largely to the fact that his mind is intensely centered upon his business, and this gives him no time to think of his ailment. Possibly, also, the greater resilience of a wooden floor, as compared with asphalt or stone pavement, may be a factor.

The patient's feet often feel cold, and perspire profusely when he is walking. There is, however, no numbness and no formication, but occasionally he has a feeling as of pins and needles in his fingertips. The pain is not influenced by atmospheric changes or by excitement. Last summer he was much benefited by a sojourn in the Pocono Mountains. Before going there he had a good deal of pain, but after a short stay he was much relieved, and was able to walk four or five miles without suffering.

There is also a distressing shortness of breath on slight exertion, and he has to be very careful of his diet on account of a sensitive stomach. It was the dyspnea and the trouble with his legs that first caused him to consult me last November. I should also state that in June, 1900, he had a peculiar attack, during which he lost speech, and power in the right arm; the leg and face were unaffected, and consciousness was not impaired. After two weeks' treatment, apparently with the iodids, he recovered.

On examination I found the patient to look at least 10 years older than his actual age. He had a sallow complexion and dark rings under the eyes. The heart-sounds at the apex were weak; the second pulmonic sound was accentuated, but the second aortic was not increased in loudness. After walking up and down the office a few times, the first sound at the apex became reduplicated. The radial arteries were thickened. The pulse was 100 to the minute: this rapidity of beat was noted on a number of examinations. The pulse was small, and the tension increased. The temperature was normal. The knee-jerks were present, but feeble. Tactile sensation was good over the lower limbs, and there was no disturbance of the heat-and-cold sense. He did not have Romberg's symptom nor the Argyll Robertson pupil. Examination of the arteries of the feet showed that *pulsation was entirely absent in both dorsalis pedis vessels.* The posterior tibials pulsated, the left less strongly than the right. This is interesting, as the left leg was the worse. The popliteal vessels could not be felt; but as I have already stated, this is no criterion, since they may be deeply situated. There was no swelling and no discoloration of the limbs. The urine, about 35 ounces a day, contained a trace of albumin, but no tube casts and no sugar; it had a specific gravity of 1,008, and a strongly acid reaction. Fehling's solution was turned green and a precipitate of phosphates formed.

Treatment directed to the relief of the trouble in the patient's legs proved for a long time unavailing. Nitroglycerin and the iodides wrought no change, nor did massage produce any improvement. Lately, however, benefit was secured by a combination of iodids and mercury—the so-called mixed treatment. The relief, however, has been but temporary. He is now taking bromides and nitroglycerin, which have seemed to help him more than anything previously given. When I last saw him he was better than

he had been for months, and could walk four or five squares without a return of the pain. Following a suggestion of Erb's, I shall add strophanthus to the treatment. This strengthens the heart, without contracting the vessels, as does digitalis. It goes without saying that the patient has been instructed to lessen his indulgence in tobacco; but he is so addicted to its use that he has been unable to carry out my wish for an entire discontinuance.

To complete the discussion of the treatment of intermittent claudication, I shall add a few words regarding diet, exercise, etc. The diet should be that suited to arteriosclerosis in general; namely, one largely vegetable. Red meats, alcohol, tea and coffee, and rich foods, should be excluded. The alkaline mineral waters are helpful. With regard to exercise, the advice of Erb that great moderation be used is certainly judicious. If the nature of the affection is not appreciated, the temptation to urge the patient to practice walking at all hazards might easily arise. This would be a serious mistake, in the light of the pathology of the affection. Fatigue should always be carefully avoided. The patient should—to quote Erb—walk with the watch in hand. He should also protect himself carefully from cold and dampness. Massage may prove beneficial; my own patient was not, however, helped much by it. Galvanism is useful, the feet being placed in separate buckets of salt water, in which the electrodes are also immersed. The current is passed first in the one and then in the other direction, for a period of from three to six minutes.

The iodides and nitroglycerin are indicated; so are cardiac stimulants of the strophanthus order. As has already been mentioned, my patient was benefited by the bromids and nitroglycerin.

The case I have reported is, I think, a typical one of intermittent claudication on an arteriosclerotic basis. The shortness of breath on exertion, the transient aphasia, and the gastric symptoms are probably likewise connected with arterial changes. The only ascertainable factors are tobacco and exposure, together with much mental strain. Whether the man is in danger of that most deplorable complication, gangrene, I cannot say; it is to be hoped that he will be spared this terrible calamity.

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EVALUATION AND TREATMENT OF ABNORMALITIES IN BLOOD PRESSURE [1]

Recently, so I am informed, a life insurance company instructed its medical examiners to dispense with blood pressure readings. If true, that is as irrational a practice as the other extreme which gives to blood pressume abnormalities the value of disease entities and bases a definite prognosis upon them. As a general rule, hypertension is merely a symptom and one that must not be overestimated in an analysis of morbid conditions. So much has been said and written about it, however, that the laity have become nervous and not a few physicians uncertain in their attitude toward it. There is much that is unknown about hypertension, due in part to the fact that we have not completely mastered the enigma of the remarkable constancy of the pressure in health.

The heart, the arteries, the capillaries, all share in the maintenance of blood pressure, but above and supreme sits the nervous system, through which the proper interaction of all the forces, heart, vessels and capillaries, is regulated and controlled. The very fact that the blood pressure is instantly and adequately responsive to changes in the external and internal environment makes it improbable that purely mechanical agencies are at work. Like the heat regulation in warm-blooded animals, it is a profound, complex, biologic phenomenon.

I have said that hypertension is usually a symptom. By that I mean that it is part and parcel of a general process and is not the essence of it. There is, however, one form of hypertension in which the high blood pressure is apparently the only abnormal phenomenon. Here it seems to constitute the essence of the process. The following case will illustrate this type.

Mrs. L., 54 years old, consulted me a short time ago on account of headaches; otherwise she is well. She had her periods regularly up to two or three months ago; none since. She is a slender, animated woman, weighing 95 pounds; has a good complexion and is really the picture of health,

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except that she is thin and has always been thin. To my surprise I found a blood pressure of 260 systolic, 160 diastolic, almost three times her body weight and five times her age. The heart was somewhat enlarged, the second aortic sound moderately accentuated with a slight, rather doubtful systolic whiff at the aortic area. The arteries are perfectly soft, the pulse if anything, small and not of high tension. Vision is good, the eye-grounds are healthy. The urine is practically negative and the renal function tests show no impairment of the activity of the kidneys. From her son, a physician, I learn that she had a high blood pressure for many years.

How shall we interpret Mrs. L.'s hypertension? Her case is interesting from three points of view: cause, prognosis and treatment.

With regard to the cause of the hypertension—we would naturally look first for the two conditions which, singly or together, are most frequently in close relation to hypertension, namely Bright's disease and arteriosclerosis. As far as our tests go, there is no evidence in Mrs. L. of either of these conditions. There are those who hold that every case of hypertension, if the blood pressure is over 200, is nephritic in origin. Schlayer (Münch. med. Woch., 1913, page 63) says that he has never seen a case of hypertension without visible changes in the kidneys at autopsy. The late Theodore Janeway held the same view. I cannot see why we should assume that the kidneys are diseased when there is no evidence of disease. To be sure, at the end of life, at autopsy, the kidneys show structural changes; but may they not be secondary to a long-continued hypertension, since the kidneys are directly and decidedly responsive to changes in the general blood pressure? Kalb (Deutsch. med. Woch., June 2, 1922) examined 288 cases of hypertension without finding evidence of affection of the kidneys.

In this type of case arteriosclerosis is not demonstrable during life in the accessible vessels—the temporals, the radials, the retinal arteries—or in the aorta roentgenologically. The hypothesis has been advanced by a group of German clinicians, Romberg, Hasenfeld and Hirsch, that the primary cause is arteriosclerosis of the splanchnic area, but that is by no means proved. The hypertrophy of the heart which some might consider to be a cause of the hypertension is a consequence of it, though when once established, it may have a share in keeping the blood pressure high. Nevertheless, it is important to realize that for the height of the blood pressure the difficulty of outflow at the periphery is probably more important than the action of the heart. The narrowness of the peripheral vessels is not necessarily due to sclerosis, but may be due to a lessened elasticity, either the result of an actual vasomotor constriction or of a heightened general tonus, as suggested by Pal.

If we rule out Bright's disease and arteriosclerosis, what is there

left to explain the hypertension? The best explanation, it seems to me, is that which assumes the presence in the blood of a toxic agent that has the power of raising the vascular tone. We know that the adrenal secretion and the pituitary secretion are both powerful pressor agents. It has further been shown that certain amins in small doses have pressor properties. The toxic substances may be of intestinal origin or they may have something to do with the endocrine glands for it is an outstanding fact that the type of hypertension with which I am dealing is found oftenest in women about the menopause. As a rule, the gonad insufficiency or nonfunction is associated with obesity as well as hypertension. In the case I have described adiposity does not exist.

It must not be imagined that the hypothetic toxin produces a vasomotor spasm. That is difficult to conceive as a permanent thing. Rather, as suggested by Pal, there is a heightened general tonus; in other words, a new rest position for the vessels by which the peripheral resistance is increased and the pressure raised.

Since the epoch-making work of Krogh on the capillary circulation, the thought has suggested itself that the hypertension is dependent upon increased capillary resistance. According to Boas and Frank, however (Journal American Medical Association, October 21, 1922), the capillary pressure is generally low in the so-called essential hypertension, which is the type with which I am dealing. In glomerulo-nephritis with hypertension, the capillary pressure is usually decidedly above normal.

A rather novel theory, based so far chiefly on theoretical considerations, is beginning to attract attention. The depressor nerve has its origin in the wall of the aorta and runs through the vagus to the medulla. It is believed to have an important function in regulating the blood pressure. Bittorf and others have suggested that disease of the nerve in sclerosis of the aorta might deprive the body of this regulatory mechanism, thereby leading to hypertension, with all its consequences. Wenckebach, with the same thought in mind, has recently advocated section of this nerve for the treatment of angina pectoris. Histologic evidence of disease of the depressor nerve in cardiac hypertrophy is still wanting. Ludwig (Berl. klin. Woch., 1912., 1461) examined the nerve in 100 cases of cardiac hypertrophy without finding any changes in it.

To sum up, we are ignorant of the fundamental cause of the hypertension in cases like Mrs. L.'s, and are compelled to designate it by the terms essential, arterial or vascular, terms that are both a confession and an avoidance.

Essential hypertension is in many respects the most important

with which we have to deal, because if properly appreciated, it is not a serious condition and is compatible with long life, provided the patient is not overtreated. It seems to be in the typical case the only abnormal condition, whence we are quite justified, it seems to me, in classing essential hypertension as a distinct disease.

Let me epitomize the chief features of the condition: (1) The patients are chiefly women at or past the menopause. (2) The majority are overfat and below average height. (3) As a rule, they belong to the better circumstanced classes of society and have borne children. (4) They show few untoward symptoms. When symptoms do appear, they are quite trivial—ringing in the ears, usually in one ear; a little dizziness, headache, irritability, fatigability. Later on, of course, graver symptoms develop, because the function of one or another organ becomes impaired. (5) The systolic pressure varies from 180 to 250, or even up to 300 systolic; the diastolic from 120 to 170. (6) The heart is usually enlarged, the second sound may be accentuated but often is not nearly as loud as one would expect from the height of the arterial pressure. The accessible vessels are soft. (7) The urine shows nothing abnormal, either quantitatively or qualitatively. The treatment I shall discuss later.

I shall now illustrate another type by the brief recital of a case.

Mr. H., 53 years old, came to me in November, 1913, on account of twitching of the eyelids, and also because, two months before, he had been denied life insurance by reason of high blood pressure and of albumin in the urine. He seemed healthy in appearance but physical examination showed some enlargement of the heart and a definitely accentuated second aortic sound, and very stiff arteries. The blood pressure was 165 systolic. The eye-grounds were normal, the Wassermann negative. Aside from traces of albumin, the urine at that time contained nothing abnormal. Occasional occipital headaches brought him to me infrequently in the following years. In May, 1918, he consulted me because of frequent urination at night. The urine showed traces of blood and a few leukocytes; the blood pressure was 175/105. An X-ray examination showed a stone in the right kidney. In 1920, the first symptoms of angina pectoris appeared. The blood pressure was unchanged. In April, 1923, the patient came for a health examination, saying he felt fine, had no headache, no vertigo, no anginal or other attacks. I found the blood pressure 194/120; the arteries much harder and tenser than they had been. The urine still contained a little blood, at times uric acid and oxalate of lime crystals, and had a specific gravity ranging from 1009 and 1022.

The type of hypertension exhibited by this man is quite different in origin and prognosis from that presented by the previous patient.

In Mr. H. we are dealing with a progressive arteriosclerosis and probably mild renal changes. As far as one can tell, the pres-

sure here is associated with arteriosclerosis, but it is difficult to say which is the primary and which is the secondary condition. Personally, I believe that the hypertension precedes the arterial thickening.

Friedrich Müller (Münch. med. Woch., 1923, No. 1) believes that arteriosclerosis and hypertension are both due to the same cause—some vascular poison. Dr. J. M. DaCosta, many years ago, in a classical paper, spoke of the albuminuria and Bright's disease due to uric acid. The patients in this group belong to the type so well described by him, although uric acid is no longer looked upon as the *agent provocateur*. In DaCosta's day, the taking of blood pressure was unknown.

We find this form of hypertension in patients who are subject to great nerve strain, nerve strain coming in accesses, each one of which causes a jump in the blood pressure. They are also habitual over-eaters, often excessive smokers. Many used to drink, and perhaps still drink a considerable amount of alcohol, but I have never been able to persuade myself that alcohol is a cause of high blood pressure.

Much has been written about focal infection. While I am convinced of the importance of this in the production of localized forms of vascular disease, I do not think that it plays any part in a general hypertension. It is, however, capable of bringing about disagreeable or even serious incidents in an existing case of high blood pressure.

The characteristic features of *arteriosclerotic hypertension* are as follows: (1) The male sex decidedly predominates. (2) The ages range from 40 to 60 and over. (3) The kidney function, as demonstrated by the usual tests, in the early stages is normal. There may be traces of albumin, a few red blood cells and occasional hyaline casts. Uric acid and oxalate of lime crystals are abundant. (4) The heart is slightly enlarged; the second aortic sound loud and sharp. (5) The blood pressure ranges from 160 to 220 systolic, and from 80 to 140 diastolic. (6) The temporal arteries are thick, tortuous and prominent; the radials tense and hard, feeling like thick-walled rubber tubing. (7) Symptoms are absent for years; at times, there are attacks of renal colic due to the passage of gravel. Headache is rather common, especially in the occipital and nuchal regions. Later, transient palsies, aphasia, and other symptoms of vascular crises appear. The patients are usually plethoric and choleric. (8) Death occurs from angina pectoris, apoplexy or circulatory failure, rarely from uremia.

The most serious of all types of hypertension is one that

I would call *primary or pernicious nephritic hypertension,* which Volhardt has justly called malignant.

The primary cause of the hypertension appears to be a progressive glomerulonephritis, the origin of which is often shrouded in obscurity. A striking feature of the condition is its occurrence in comparatively young persons, from 25 to 35. I think I may safely say that hypertension in individuals under 40 is nearly always due to glomerulonephritis.

While the disease of the kidney in this form is apparently the primary thing, we do not know how it brings about the hypertension and the associated arteriosclerosis. Whether it is the absence of an internal secretion of the kidney or whether it is the failure on the part of the kidney to eliminate metabolic as well as exogenous poisons, I do not know. There is, it seems to me, an analogy between the islands of Langerhans of the pancreas and the renal glomeruli. When the former are diseased, diabetes mellitus ensues through the loss of insulin. May there not be a *glomerulin* which has an important function in the body, the absence of which expresses itself in wide-spread arterial disease with hypertension? Or, do the glomeruli in health excrete a poison which, retained when they are diseased, causes hypertension and cardiovascular disease with hyperthrophy of the heart?

The clinical features are so typical that I think we are warranted in calling the condition a disease entity. These features are: (1) The patients are comparatively young, from 25 to 40 years, men more frequently than women, the ratio being, I conjecture, about four to one. (2) The systolic pressure reaches great heights, from 250 to 280 or more; the diastolic is also very high, being 130 to 170. (3) The accessible arteries are tense, hard, thick, tortuous and prominent. The heart is greatly hypertrophied; the second aortic sound is loud and metallic; gallop rhythm at the apex is common. (4) There is usually pronounced anemia, so marked at times that progressive pernicious anemia is suspected. (5) Late in the disease a tendency to the hemorrhagic diathesis develops. (6) The urine is pale, watery or opalescent, fairly abundant and contains large amounts of albumin. (7) The concentration in the blood of nonprotein nitrogen (urea, creatinin and uric acid) reaches extraordinary heights. The phenosulphonphthalein output is greatly reduced, sometimes nil. (8) Changes in the ocular fundus and exophthalmus are common. (9) Convulsions occurring in series are common. (10) Psychoses, usually of the maniacal type, may occur. (11) Slight dropsy is frequent. (12) Pericarditis or hemopericardium is a common terminal condition.

Senile Hypertension: I am not altogether certain that we ought to rank senile hypertension as a special type, and yet there are certain features that make its incorporation in other groups difficult. We find in many persons of advanced life, past the age of 70, a hypertension with blood pressure as high as 200 or 220 systolic, which is altogether symptomless and well borne, unless an unwise physician interferes with it. As a rule, the diastolic pressure is low, ranging from 80 to 100. I have in my care a woman of 89 years, whose blood pressure is from 180 to 220 systolic, 100 diastolic. Except for a little intestinal indigestion and occasional nocturnal cramps in the legs, she feels perfectly well, has a keen mind and an excellent memory. Such a patient should be left alone. As Thompson and Todd (Lancet, Aug. 26, 1922), well put it: "It is best not to tamper with the individual in order to treat a diagnosis."

Midway between the primary pernicious nephritic hypertension and the arteriosclerotic hypertension, is a type that I would call *hypertension with mild nephritis.* The following case illustrates this type:

Mrs. F. S., 62 years old, widow. Her complaints are trivial and frequently she comes merely for an examination when there are no complaints. She has had from time to time a little vertigo, coldness and numbness of the extremities, fugitive pains of rheumatic character, a little shortness of breath. Her blood pressure is 240 systolic, 100 to 105 diastolic. Her weight 135 pounds. Albumin has been found in the urine since 1907. It has been present in moderate amounts ever since she came under my care, six years ago. Occasionally there are hyaline casts, pus cells and red blood corpuscles. The specific gravity ranges from 1005 to 1022. The daily quantity is normal, at times a little increased. On rare occasions, traces of sugar have been found. The heart is moderately enlarged; on auscultation there is a loud rough systolic murmur over the entire precordia, without accentuation of the second aortic sound. The accessible arteries are as soft as in youth.

Here we have a patient who has had high blood pressure for many years, evidences of nephritis for sixteen years, and who is yet in a fair state of health. The hypertension here is undoubtedly a conservative process.

The features that characterize this type are as follows: (1) The majority of patients are beyond middle age, short but not unduly stout. (2) The heart is enlarged, and systolic murmurs are often present. (3) The accessible vessels are soft. (4) Symptoms are absent, except mild ones, such as dizziness, ringing in the ears, slight shortness of breath on exertion, and nervousness. (5) The energy and endurance of the patients is often surprising. (6) The blood pressure ranges from 160 to 240 systolic and from 100 to 140 diastolic. (7) The urine is usually normal in quantity or dimin-

ished, contains considerable albumin, a moderate number of tube casts, at times red blood cells, frequently leukocytes in large numbers, occasionally sugar. (8) Duration, many years. (9) Death usually occurs from circulatory failure—hydrothorax, dropsy and other modes of decompensation.

One other group may be separated from the great hypertensive family, namely that in which the hypertension is associated with *hyperthyroid* symptoms. In this group fall some cases of exophthalmic goiter, but it is made up chiefly of cases that do not have a palpable goiter. The characteristic features are as follows:

(1) The patients are usually women past middle life. (2) Arteriosclerosis may or may not be present. (3) The heart is moderately enlarged, but usually without valvular defect. (4) The blood pressure, both systolic and diastolic, is high—140 to 240 systolic, 120 to 150 diastolic. (5) The following symptoms of thyroid overactivity are present: (a) tachycardia, (b) tremors, (c) nervousness, (d) sweats. The eyes are strikingly bright, but not exophthalmic; the basal metabolism is either normal or somewhat elevated. (6) There may be albuminuria. (7) Some of the patients in this group have shown extremely swarthy complexions. The signs and symptoms point to endocrine origin or to endocrine association. The menopause, however, is not a factor of prominence. I believe the thyroid is overacting although it may not be demonstrably enlarged. Substernal goiter was looked for in my cases but not found in those in which cervical goiter was absent. Death occurs usually from apoplexy or cardiac failure.

Treatment

In the treatment of hypertension, certain fundamental principles should be borne in mind.

Hypertension is in many cases a conservative process which is necessary if the blood is to be forced through a greatly restricted vascular territory. Therefore, it is often unwise to depress it by direct action upon the circulation, just as it is unwise, as a rule, to lower the temperature in fever by antipyretics.

Prophylactic treatment would be the ideal one if it were possible. It will become to some degree practicable when the families for whose health we are more or less responsible form the habit of coming to us for examination when they are supposedly well. If a tendency to a rising blood pressure is recognized early, much can be done to check its progress by the removal of all harmful influences, particularly those that cause frequently repeated accesses of increased blood pressure. Excitement, overexercise, gluttony,

sexual excesses, must be eliminated. Likewise, worry and overwork with their concomitants of poor sleep and disturbed digestion. I am quite convinced that in persons in whom the blood pressure is gradually rising, tobacco in any large amount is harmful. (Bates: Journal of Comparative Psychology, Dec., 1922. Journal of American Medical Association, Sept. 29, 1923.)

Since anxiety is often due to the patient's fear of high blood pressure, the physician must take time to explain that high blood pressure has often no serious significance. Brooding causes a vicious circle in which the process "revolves the faster the more introspective the patient becomes." (Thompson and Todd, loc. cit.)

1. Under certain circumstances it may become necessary to interfere directly with the blood pressure, either by the use of drugs such as the nitrites or by other means. When the pressure is very high, 270 or over, or when a high blood pressure suddenly rises 20 to 40 points, nothing is as useful as venesection. Nature sometimes comes to the patient's aid with a nose bleed or with a hemorrhage from the intestines or from the uterus. Unfortunately, the hemorrhage is sometimes in the eye or in the brain.

Instead of bleeding from the elbow, one may leech from the temporal or mastoid regions. This method is particularly useful in patients whose symptoms indicate marked cerebral congestion.

Lumbar puncture, as recommended by Kahler (Wien. Arch. f. inn. Medizin, Nov. 15, 1921) and by Foster (Journal American Medical Association, Sept. 30, 1922) is also a valuable measure for bringing about a prompt reduction of the blood pressure.

2. Bowels. Daily free action without strain is important. Small doses of the salines or the saline mineral waters are useful. In some instances, however, excellent results are obtained, as Bishop points out, by means of castor oil. I am in the habit of giving an ounce once a week or once in ten days at the patient's convenience.

3. Rest. In certain individuals, especially in women with arteriosclerotic hypertension or with essential hypertension producing neurasthenic symptoms, the rest cure, complete or partial, is often of marked benefit. I have seen the blood pressure fall through a three weeks' rest in bed from 220 to 150, where it remained for quite a time after the patient was up and about.

When the rest cure is not applicable or when it is not indicated, an hour or two of rest after the noon meal and rest before dinner in the evening is beneficial.

4. Exercise. In all forms of hypertension, except when the kidneys are badly diseased, when the heart is incompetent, or when there is evidence of thyroid overactivity, exercise is permissible.

It should be mild golf or walking, and is best not followed by the cold shower. It is wise to have the patient present himself for observation after he has taken some exercise.

5. Diet. In the majority of patients with hypertension, it is more important to lessen the quantity than to change the quality of the food. In the overfat the reduction treatment is of great value. In the construction of diet lists, differentiation of the types is of importance. But there are certain general principles that are widely applicable.

The patient should avoid pastries, candies, rich dishes, fried foods, fresh bread, etc. It is well in many instances to restrict the foods rich in purins, such as sweetbread, liver and brains.

Of late years, there has been a growing tendency to limit greatly the salt intake, following in this respect the recommendation of F. M. Allen (J. A. M. A., March 6, 1920, page 652). Allen restricts the salt intake to 0.5 grams a day.

O'Hare and Walker (Arch. Int. Med., Aug. 15, 1923), after careful study in which they subjected hypertension cases to salt restriction after the method of Allen, found no noteworthy effect on the blood pressure. By studying the blood chlorides in connection with the vascular tension, they were able to show that there was no relation between the height of the blood pressure and that of the chlorides in the blood. Their conclusions are that hypertension is compatible with normal blood chlorides and normal tension with high blood chlorides.

Houghton (Med. Record, N. Y., Mar. 18, 1922) leans to the view of Allen, and recommends a low sodium chloride dietary. I think we may safely say that an excessive salt intake does harm and that the salt in the food should be reduced to as low a point as is compatible with the patient's comfort and the preservation of the appetite. I usually instruct the patient to add no salt or condiment to his food at table. There is no harm in a cup of tea or coffee.

Sansum, Blatherwick and Smith (J. A. M. A., Sept. 15, 1923) have recently called attention to the value of a basic diet in the treatment of hypertension in nephritis. They found that a diet rich in animal proteins, oysters, oatmeal, rice and some of the bread stuffs, has strongly acid properties and greatly increases the acidity of the urine compared with that of the body, as determined by the hydrogen-ion concentration. A highly acid diet may make the urine one hundred times as acid as the body. Ordinarily the urinary acidity should not be greater than twice that of the body.

Vegetables, fruits, especially melons and oranges, potatoes, raisins and almonds, are strongly alkali producing.

By means of a basic diet, it has been possible to reduce the blood pressure and to lessen the albumin and casts in the urine.

With the foregoing principles in mind we may construct a dietary somewhat as follows:

Breakfast Stewed fruit (without sugar)
A cup of tea or coffee
One egg
One slice of toast

Luncheon A sandwich of lettuce, tomatoes or sardines, or
Half a dozen oysters, or
Poached or scrambled eggs, or omelet
Cup custard, or water ice, or sherbet, or stewed fruit as dessert
A glass of buttermilk or a cup of weak tea.

Dinner A vegetable broth or cream soup, chicken, lamb chop or a small amount of fresh fish
A green vegetable
Salad or celery
Stewed fruit.

6. Baths. It has been found, of late years, that the continuous warm bath has a very beneficial effect upon a hypertension case. The treatment is started with a continuous hot immersion bath. The first bath should be of five minutes duration and have a temperature of 105 degrees. While the patient is in the bath, the pulse rate and the blood pressure should be carefully noted. The treatment may be given daily, increasing temperature and time until the temperature reaches 110 degrees and the immersion three or four hours. Very good results have been obtained by the method at the Mayo clinic. (George E. Brown, Medical Clinics of North America, July, 1923, 221.)

Hypotension

Hypotension has not received as much consideration as hypertension. As a rule, it is a subordinate symptom, although many persons are now beginning to show as much concern over their low pressure as others have been accustomed to show over their high pressure.

In certain races, as in the youths of Canton (Cadbury: Archives Int. Med., Sept., 1922), and in certain Hindus from Lower Bengal (Francis McKay: J. A. M. A., Nov. 4, 1922) and in the Filipinos,

the normal blood pressure is from 20 to 30 mm. less than in the people of Europe and North America. The diastolic pressure is also lower than the generally accepted normal but only by from 10 to 22 mm.

There is a form of hypotension associated with subnormal temperature, bradycardia and great muscular fatigue which occurs at all ages and quite frequently in young and otherwise healthy persons. As a rule, the pulse is very slow, down to 50, 45 or even lower. The cause is difficult to find; it may be a sequel of an acute infectious disease, even simple tonsillitis, or of great muscular exertion.

Having seen a few cases of this type, I have come to look upon it as dependent upon an acute suprarenal insufficiency and on that basis have used suprarenal extract, apparently with success. It is possible that in those in whom the condition follows great activity of the muscles, some fatigue poison is circulating in the blood. But we know too little of the so-called kenotoxins.

Another form of hypotension that has interested me for some time is one I would call *constitutional hypotension.* This is found as a permanent feature in persons who are otherwise in fairly good health. They are subject to colds and have cold hands and feet, "poor circulation," and exhaust physically and mentally very quickly. I have been struck by the fact that in many of the patients under my observation indecision seems to be a noticeable attribute of their character. Hypotension is a marked symptom of Addison's disease. It is also seen in severe shock.

A profound hypotension is met with in cases of coronary thrombosis. I have seen the pressure drop from 220 to 100 in the course of a few hours and yet recovery took place.

Hypotension is also found associated in some instances with angina pectoris, perhaps through coronary disease.

I need say little about the *treatment of hypotension.* In cases of coronary thrombosis, the treatment is that of acute shock.

A word might be said about constitutional hypotension. That requires a general making-over of the patient. Exercise, especially mountain climbing, massage, a sea voyage, and tonic medication are usually beneficial. Of course all depressing factors, all focal infections must be removed.

I may end by saying that there is no absolute standard for blood pressure by which one can predict what will happen to patients in the natural course of events. In many individuals high blood pressure serves them better than a normal blood pressure, but on the whole a low blood pressure, low for the individual's weight and age, gives a better prognosis as regards the endurance of the heart and

the resistance of the blood vessels than a high blood pressure, although cerebral accidents can occur with either.

Finally, be it remembered, the human body possesses enormous factors of safety that are not easily exhausted by pressure either far above or far below the normal.

HIGH BLOOD PRESSURE AND LONGEVITY [1]

When the late Dr. William Stanton of Philadelphia invented his mercury blood pressure instrument, I immediately began to use it with the same zeal and curiosity with which, presumably, the contemporaries of Laënnec used the crude wooden stethoscope of his invention. Just as they heard things that must have seemed terribly ominous to them—so well brought out in the poem of Oliver Wendell Holmes—so I often saw things on the manometer that sent a chill into my heart.[2] When I observed a systolic blood pressure of 180 or 200 or higher, I became, not at all in keeping with my innate optimism, depressed as to the patient's future prospects. I was sure that individuals with such blood pressures were doomed. But as my years of practice lengthened I began to realize that there were worse things than high blood pressure. There were patients who survived for an unexpectedly long time and enjoyed good health and undiminished vigor for years. That was a valuable lesson, a lesson similar to the one I had learned with regard to insanity: I had found, contrary to received teachings, that many of the worst cases of insanity recovered completely.

But there were other patients with high blood pressure who were less fortunate; who died within a few years after their hypertension was first discovered. This is an experience that all medical practitioners have had.

On the whole, high blood pressure is no blessing. Insurance statistics show that the mortality among cases of high blood pressure far exceeds the normal death rate. This is illustrated in Tables 1 and 2.

Mr. J. Mills, assistant superintendent of the bureau of statistics of the Equitable Life Assurance Society, has kindly supplied me with recent figures that confirm what Hunter had previously found in a larger series of cases. Mr. Mills says that all persons to whom

[1] Address in medicine read before the State Medical Society of Wisconsin, Milwaukee, Sept. 11, 1930. The substance of this paper, together with a consideration of low blood pressure, was presented before the clinical congress of the Connecticut State Medical Society, New Haven, Sept. 18, 1930.

Reprinted from the Journal of the American Medical Association, April 4, 1931, Vol. 96, pp. 1105-1111.

[2] A history of the development of "blood pressure" has been written by Brim: Medical Life, February, 1930.

policies were issued from 1909 to 1927 for which the insured was charged an extra premium were observed to their 1928 policy anniversaries. Table 4 shows the observed blood pressures in these substandard risks. The deaths expected on the basis of his experience with all standard lives over the same period were calculated and compared with the actual deaths observed in this group with the results given in Table 5. After a small number of lives had been eliminated for lack of data on the diastolic pressure, the experience was analyzed in three sections according to diastolic pressure (Table 6).

It is evident, therefore, that high blood pressure is not conducive to longevity. Nevertheless, as is shown by my experience and by that of many others, high blood pressure is compatible with longevity. The difficulty is that it is not always easy to tell to which class, favorable or unfavorable, a given patient belongs. I shall try farther on to point out the ways and means of making that important differentiation or at least of attempting to make it, because it is not always possible to make it absolutely.

High blood pressure or hypertension is not a disease—like disturbances of the basal metabolic rate, like fever, it is a symptom of something more fundamental. To the laity, however, it is a definite disease, and many a patient comes to his physician saying "Doctor, I've got blood pressure," as he might say "Doctor, I've got malaria."

In estimating the blood pressure one must not take any single reading as the absolute figure. This is especially true in the case of patients paying their first visit to the doctor.[3] Under excitement and fear, the systolic blood pressure may be raised as much as 40 mm. It is well to take several readings while conversing with the patient on indifferent matters. If the pressure is high, it is usually wiser not to say anything until the pressure has been checked at a subsequent visit. One should, however, make a note of cases in which the blood pressure rises unduly from excitement—such instability may presage some vascular trouble in later life.

Naturally it is important to be sure of one's instrument. For office practice it is well to have both an aneroid and a mercury manometer to compare the one with the other. It is also advisable to take the blood pressure in both arms. Not infrequently it varies on account of sclerotic processes, cervical rib, or aneurysm. The blood pressure on the weaker side would then give a false impression.

[3] Heywood Broun, the columnist (Philadelphia Record, Sept. 24, 1930), states that one doctor found his blood pressure to be 100 and told him it was too low. He immediately went across town to another physician, who found it was 145 and said it was a little too high.

It is hardly necessary nowadays to advise the taking of the diastolic pressure as well as the systolic. The majority of physicians who take blood pressures at all estimate both. The diastolic pressure is of great significance; in fact, it is more significant from the point of view of prognosis than is the systolic. It indicates the steady irreducible minimum load against which the heart is compelled to work, and few hearts can endure long a constantly high diastolic resistance; hence to that extent at least the diastolic pressure gives a clue to the patient's prospects.

TABLE 1.

RISKS REJECTED, FOR HIGH SYSTOLIC BLOOD PRESURE ONLY, BY NORTHWESTERN MUTUAL LIFE INSURANCE COMPANY*

Number of Mm. Over Average Systolic Blood Pressure for Age	Extra Mortality
+10 to +24	69%
+25 to +34	100%
+35 to +49	145%

* The statistics in tables 1, 2 and 3 are taken from Blood Pressure: What Affects It? by Arthur Hunter, Chief Actuary, New York Life Insurance Company, New York.

TABLE 2.

RISKS ACCEPTED, WITH AN ADDITIONAL PREMIUM FOR HIGH SYSTOLIC BLOOD PRESSURE ONLY, BY NEW YORK LIFE INSURANCE COMPANY

Number of Mm. Over Average Systolic Blood Pressure for Age	Extra Mortality
+10 to +25	46%
+26 to +35	88%
+36 to +50	148%

Hypertension, while occasionally transitory, is usually a permanent and progressive condition. More or less transitory states of high blood pressure are due to emotion, to physical exertion, to prostatic hypertrophy and rarely to suprarenal tumors. Such hypertension usually disappears with the removal of the cause. I shall not dwell further on this type.

Permanent hypertension is not a unitary condition but is due to a variety of causes which it is important to know, as the cause to a large extent determines the prognosis, the longevity.

Classification of Hypertension

The most important clinical types are: (1) accidental; (2) nephritic; (3) arteriosclerotic; (4) essential.

1. *Accidental Hypertension.*—This accompanies aortic insufficiency, heart block and some cases of hyperthyroidism and is more or less normal in those conditions.

2. *Nephritic Hypertension.*—In this the hypertension is intimately connected with disease of the kidney and is apparently secondary to it. It begins rather early in life, about the age of 30,

TABLE 3.
AVERAGE BLOOD PRESSURE OF MEN IN THE UNITED STATES AND CANADA

Age	Systolic	Diastolic	Pulse Pressure
20	120	80	40
25	122	81	41
30	123	82	41
35	124	83	41
40	126	84	42
45	128	85	43
50	130	86	44
55	132	87	45
60	135	89	46

TABLE 4.
RELATION OF AGE TO SYSTOLIC BLOOD PRESSURE

Age at Issue of Policy	Systolic Blood Pressure
15-29	145 mm. or more
30-44	150 mm. or more
45-53	155 mm. or more
54-65	160 mm. or more

and is more common in the male than in the female sex. The peripheral arteries are thick and rigid; the heart in the later stages becomes greatly enlarged; both the systolic and the diastolic pressures are high; the blood usually shows nitrogen retention. Death occurs from intercurrent disease, from cardiac decompensation, from uremia or from acute pericarditis.

3. *Arteriosclerotic Hypertension.*—In many respects this is similar to the preceding, but in the earlier stages at least there is no evidence of renal involvement, although such involvement may

possibly exist. The condition seems to start as a spastic arteriolar process which eventually passes into the stage of sclerosis. The systolic pressure is high; likewise the diastolic. Eye-ground changes may or may not be present. Kidney function may be normal and the blood may not show any nitrogen retention. In these respects the condition differs from the preceding—the nephritic hypertension. Symptoms may be absent for a long time, the patients enjoying the best of health with a systolic pressure of from 200 to 230 and a diastolic pressure of from 115 to 145. Headache, disturbances of vision and various severe encephalopathies occur in the later stages—monoplegia, hemiplegia, aphasia and convulsions (epilepsia

TABLE 5.
ACTUAL AND EXPECTED DEATHS

Age at Issue	Actual Deaths	Expected Deaths	Ratio of Actual to Expected
15-39	32	18.50	173% ± 20
40-49	74	34.08	217% ± 17
50 and over	96	54.54	176% ± 12
All	202	107.12	189% ± 9

TABLE 6.
DEATHS ACCORDING TO DIASTOLIC PRESSURE

Diastolic Blood Pressure	Actual Deaths	Expected Deaths	Ratio of Actual to Expected
Under 100 mm.	104	63.88	163% ± 11
100-105 mm.	43	20.35	211% ± 21
106 mm. or over	33	9.86	335% ± 39

tarda [4]). Death may be due to apoplexy, cardiac decompensation, coronary occlusion or uremia.

4. *Essential Hypertension.*—This is the most common, the most important, the most obscure. I shall outline briefly its principal features:

(a) Essential hypertension occurs in both sexes about the midperiod of life.

(b) It is not connected with primary heart or kidney disease.

(c) The palpable blood vessels are soft, although the temporals may be tortuous and the brachials visibly pulsating.

(d) The eye grounds show nothing significant.

[4] Riesman, David; and Fitz-Hugh, Thomas, Jr.: Ann. Int. Med. 1: 273 (Nov.) 1927.

(e) The blood chemistry and the renal function tests are within normal limits.

(f) Symptoms may be entirely in abeyance, although the systolic pressure may be considerably above 200.

(g) Essential hypertension is compatible with long life and with full mental and physical vigor. For this reason it is often discovered accidentally; as, for example, during life insurance examinations, the individual applying because he considers himself a perfect risk.

(h) When symptoms arise they are usually either cardiac or cerebral—shortness of breath, cardiac pain, vertigo, headache or encephalopathies similar to those described under arteriosclerotic hypertension.

Essential Hypertension

Essential hypertension is attracting as much interest at the present time as any other clinical condition or disease. It goes by many names: vascular, arterial and benign hypertension, hypertensive cardiovascular disease or hyperpiesia, a name given to it by Sir Clifford Allbutt.

Little is known about the causes of essential hypertension, which explains the multiplicity of theories offered for its explanation.

Some attribute essential hypertension to a primary disease of the kidney, to a renal arteriolitis, and consider it, therefore, a form of nephritic hypertension. In favor of this view is the frequency with which renal arteriolitis is found at autopsy (in seventy-two out of seventy-two cases studied by Fishberg [5]).

I am, however, disinclined to accept this interpretation, for during life patients with essential hypertension, as already stated, show neither clinical nor chemical signs of renal disease. They rarely die a renal death; they live much longer than patients with the ordinary types of renal hypertension. I believe one would not go far wrong in interpreting the arteriolitis as a consequence of the high pressure that is constantly hammering against the small blood vessels. The arteriolar thickening on that basis is a protective mechanism through the medium of which the delicate glomerular vessels are guarded against the excessive pressure to which they would otherwise be subjected.

To assert that essential hypertension is not primarily a renal disease does not bring one much nearer to an understanding of it. Its pathogenesis is still one of the unsolved problems of medicine. However, essential hypertension has all the earmarks of being dependent on a vasoconstriction, a functional change affecting

[5] Fishberg, A. M.: Hypertension and Nephritis, Philadelphia, Lea & Febiger, 1930.

especially the arterioles, the precapillary vessels, which for their size have the largest amount of muscular tissue in their walls. It may be that this vasoconstriction is more pronounced in the renal vessels than elsewhere. If what maintains the normal vascular tone were understood, the cause of the heightened tone called hypertension might be better known.

As I have said, nephritic hypertension is usually considered a compensatory phenomenon, a necessary consequence of the resistance offered to the blood stream by the diseased arterioles and glomeruli. Urinary secretion depending on the "head" of blood pressure in the renal circulation and not on secretory nerves, it is necessary for the general pressure to be raised if the blood is to be forced through a constricted vascular territory.

Dr. Major of Kansas City believes that the hypothetic pressor substance in hypertension is guanidine or a derivative of it, a view that has been supported by Dale and Dixon and others but still lacks adequate confirmation. This same thing applies to hypercholesterolemia, considered by Westphal as the cause of hypertension.

The suggestion has been made that hypertension might be correlated with increased viscosity of the blood, but against this are several facts.

1. No noteworthy change in the viscosity has been demonstrated in essential hypertension.

2. Some diseases definitely associated with increased viscosity do not of necessity exhibit marked hypertension. This is true of polycythemia rubra, in which, though the viscosity is greatly increased, the blood pressure is usually not high. If there is any marked elevation, it seems to be related to the age of the patient or to accidental complications.

Bordley and Baker [6] have shown by careful anatomic studies the frequent association of lesions of the arterioles in the medulla oblongata with essential hypertension, and they look on this lesion as the immediate cause of the high blood pressure. In their view, the hypertension is necessary if the medulla is to be supplied with blood. Here, too, the matter of cause and effect, of chicken and egg, is not so simple. They themselves admit that the sclerotic changes in the medullary vessels might be secondary to the high blood pressure—a protective mechanism against it. But if this were the sequence of events, then all the other arterioles in the body should show such protective changes, which is by no means the case.

The hypertension of the kidney of pregnancy and of eclampsia

[6] Bordley, James III, and Baker, B. M., Jr.: Bull. Johns Hopkins Hosp. 39: 229 (Oct.) 1926.

is not fully understood. It may disappear after the pregnancy, leaving the patient perfectly well with normal kidney function, and subsequent pregnancies may proceed without mishap. In other cases the hypertension persists with increasing evidence of renal involvement. One can explain the recovery only by assuming that the hypertension was due to an arteriolar spasm. Whether this is primary in the kidney or whether it is a general process is a matter of doubt. In patients who do not recover, the disease of the kidney evidently plays an important role in the hypertension. But even here one cannot rule out entirely a primary spasm with secondary renal involvement.

A rather attractive hypothesis is based on the known action of the depressor nerve in the lower animals. This is an afferent nerve having its peripheral terminations in the wall of the aortic arch. Impulses arising in the terminals are conveyed to the vasomotor center in the medulla and cause a reflex vasomotor relaxation. Its function seems to come into play when the arterial pressure is raised above a certain level. The existence of an analogous nerve in man is predicated by the majority of physiologists. Granted there is disease of the aortic wall involving the endings of the depressor nerve, the signal for reduction of blood pressure would no longer be conveyed to the regulatory center in the medulla.

On the clinical side there are certain features that have a bearing on the production of essential hypertension.

1. For example, the majority of patients with essential hypertension are overweight. On this fact all insurance actuaries are agreed.[7]

2. Another common denominator is a history of stress and strain throughout life. That phrase includes many things, some not always remembered in the investigation of a given case—genteel poverty, the grinding need for maintaining what the French call a façade, prolonged worry, overweaning ambition especially if ungratified, irregular eating, and insufficient sleep. I do not believe that hard work per se is harmful unless it leads to irregular modes of life or is attended by repeated failures.

Race is an important factor, chiefly in that it determines the habits of life. To some extent, as in the Russian Jewish people, there is some innate tendency to cardiovascular disease, as shown in the frequency of thrombo-angiitis among them.

It is a clinically important fact that essential hypertension not infrequently sets in at the climacteric period in women.

[7] Hunter: Blood Pressure: What Affects It? Dublin, L. I.; Fisk, E. L., and Kopf, E. W.: Am. J. M. Sc. 170: 576 (Oct.) 1925.

A high protein diet is by many held responsible for hypertension, but neither the insurance statistics already quoted nor the clinical studies of Strouse [8] or of Mosenthal [9] bear out this assumption. Furthermore, Stefansson, the arctic explorer, lived for a year on a meat diet without any rise in his blood pressure.

F. M. Allen, as is well known, maintains that an excessive consumption of sodium chloride is responsible for hypertension. Other investigators have not been able to confirm his views.

Gout has been considered a factor by many, especially by English writers; but the type of gout, the so-called latent gout, that comes in question here is a vague thing. It is true that many cases of hypertension show high uric acid figures in the blood. Whether this is a cause or a consequence, or indeed whether it is important at all, is still a matter *sub judice.*

Two other theories are in the field—they always appear when the examiner is puzzled—focal infection and intestinal autointoxication. Medical practice and teaching would be decidedly uncomfortable if they did not have these two explanations to fall back on.

That focal infection can cause disease at a distance is now an axiom. It can lead to nephritis and by that token to hypertension. That it can cause hypertension without the mediation of the kidney is totally unproved. A number of investigations have been made by the large insurance companies on that score, attention being particularly given to the teeth and to the tonsils. The statistics showed that there was no connection between hypertension and focal infection through these two channels. That does not, however, entirely dispose of the matter; further studies are necessary, especially by family physicians, who, following the suggestion of Mackenzie, should keep careful records of their patients over periods of years.

Theoretically, intestinal autointoxication is an entirely reasonable cause. It is conceivable that toxic products may result in the intestines from bacterial or enzymatic decomposition of protein. In fact, many protein split products are definitely poisonous. Normally such toxic substances are detoxicated in the liver. A disturbance of hepatic function might permit them to go through into the general circulation without previous destruction. But the majority of diseases of the liver, if not complicated, are not associated with hypertension. The theory is attractive but unproved.

The fact that essential hypertension frequently arises in women about the time of the menopause suggests the thought that in such circumstances at least an endocrine factor is operative. Not much

[8] Strouse, Solomon; and Kelman, S. R.: Protein Feeding and High Blood Pressure, Arch. Int. Med. 31: 151 (Feb.) 1923.

[9] Mosenthal, in Nelson's Loose-Leaf Medicine 4: 508, 1922.

is known about the action of the gonads on the circulation. There is no inherent reason against an endocrine origin of hypertension, but the theory has not yet passed the stage of speculation.

One other factor needs to be considered, and that is heredity. If one takes careful family histories and especially if one has opportunities of observing entire families, perhaps into the second generation, one will note that essential hypertension often affects several members of a given family. The condition is of course not inherited but the tendency, the anlage, is hereditary.[10]

I shall now relate a few cases illustrating the compatibility of hypertension with longevity.

Case I.—The most interesting of all my cases is that of Mrs. H. D., aged 97, who came under my care more than twenty-five years ago. Throughout all these years her systolic blood pressure has ranged from 220 to 274, the diastolic pressure being always about 100. Last spring she had two attacks of bronchopneumonia without change in blood pressure. At present she is quite well physically, though at times a little confused mentally. She goes out nearly every day, although her blood pressure, September 7, was 274 systolic and 100 diastolic. There is no edema of the feet, and the urine is as normal as one can expect in a woman of her years. The heart is not materially enlarged; only lately a soft systolic murmur has appeared at the apex.

Case II.—Mrs. J. H., a physician's mother, aged 63, came under my observation in 1916; at that time she had a blood pressure of 202 systolic and 118 diastolic. She complained of nothing but pain in one knee. Her blood pressure has ranged from 188 to 234 systolic and from 80 to 120 diastolic. During the last few years a little enlargement of the heart has become evident; electrocardiographic tracings show marked left axis deviation. The urine contains a trace of albumin and a few hyaline casts. In all these fourteen years, which must have been preceded by a number of years of undiscovered hypertension, she has had no complaints except chronic arthritis of the knee.

Case III.—S. M., a man, who has been under observation for fourteen years, had a systolic blood pressure of 166 when first seen. Since then it has gradually risen, varying from 200 to 240 systolic and from 80 to 120 diastolic. The urine contains traces of albumin and inconstantly minute amounts of sugar. The patient has had no complaints and is as active in business as ever.

Case IV.—Mrs. B., a widow, aged 56, has been under observation for seven years but knows that she has had high blood pressure for a much longer time. The systolic pressure ranges from 200 to 220 and the diastolic from 100 to 115. Aside from corneal ulcers, recurring at long intervals, and increasing deafness, which is hereditary in the family, the patient has enjoyed the best of health. In fact, she is the most socially active woman of my acquaintance and has just gone to Europe for a gay winter in Paris.

[10] Barach, J. H.: Constitutional Factors in Hypertensive Diseases, J. A. M. A. 91: 1511-1514 (Nov. 17) 1928.

I shall cite one more case because it shows that the arteriosclerotic form of hypertension is also compatible with fairly long life:

Case V.—J. S., a lawyer, aged 69, has been under my care for seventeen years. His systolic blood pressure was originally 175; it has risen slowly, so that it now ranges between 200 and 208, the diastolic from 110 to 112. His arteries are leathery; the heart is a little enlarged. The urine contains a trace of albumin and an occasional cast. Functional urinary tests and the eyegrounds are normal. Of late years, signs of prostatic hypertrophy have appeared. The man's general health is good, though at times he is a little short of breath but never for long. All in all, despite years of high blood pressure and very stiff arteries, it looks as if he would live beyond three score and ten.

These cases, favorable as they are, do not alter the fundamental fact that high blood pressure is not a bodily virtue. It is necessary to pick out the good cases from the bad so that one may be able to say to a given patient whether he has a chance to live long or whether an early death awaits him and that he had better make his will. I believe that in teaching not enough emphasis has been placed on the art of prognosis. It is by the skill in this art that the public often judges the medical profession. For this reason I am going to indicate some of the means the physician has of foretelling the future of the hypertensive individual.

One must always correlate the blood pressure with the age of the patient. Old persons bear high blood pressure better than younger ones. There is a form of juvenile hypertension that has not been sufficiently studied, but I have not time to discuss it here.

The height of the systolic pressure is not a reliable criterion unless it is excessively high. The patient's whole constitution must be weighed in the balance. This is the rock on which so many insurance examiners founder. They concentrate their observations too much on the manometer readings. I can illustrate this by the report of a case related to me by an examiner for one of the large national companies.

A man applied for a twenty-five thousand dollar life insurance policy; in accordance with the company's ruling, he had to be examined by two physicians. Both found the blood pressure to be 145 and the company gave the man a standard policy on which he paid one premium. After leaving the office of the first company he went directly to that of another to get an equal amount of insurance. The examining physician there found his blood pressure to be 150 or a little over and rejected him. Three months later the man died of apoplexy on his way to Atlantic City.

More important than the systolic is the diastolic pressure. A high diastolic pressure is a bad prognostic sign. This is illustrated in the report of Lian, Broca and Clément,[11] who state that, of seventy-

[11] Lian, C.: Broca, R., and Clément, J.: Presse méd. 29: 743 (Sept. 17) 1921.

seven persons with a diastolic pressure of 135 observed during the five years 1914 to 1919, only two were living at the end of the period.

Heredity to a great extent determines longevity. Longevity as well as its opposite is largely an inherited trait. Not enough attention has been paid to this by geneticists, but it is as striking a familial trait as the color of the eyes, the conformation of the head, or any other physical feature. Therefore, when I see a hypertensive patient who exhibits nothing else of moment save the hypertension, my prognosis is favorably influenced if he comes of a long-lived family.

TABLE 7.
RATIO OF ESSENTIAL HYPERTENSION IN MEN AND IN WOMEN

Age Group	Systolic		Diastolic		Number of Cases
	Average Maximum	Average Minimum	Average Maximum	Average Minimum	
	Men				
40-50	244	205	127	115	5
50-60	241	192	116	92	17
60-70	228	182	110	94	23
70-80	229	191	116	88	6
Average	235	193	117	97	51
	Women				
Under 30	220	170	140	136	1
30-40	234	192	130	110	2
40-50	230	188	119	104	20
50-60	226	187	115	93	37
60-70	253	186	109	92	25
70-80	235	199	96	83	6
Average	233	187	118	103	91

Much can be learned about a patient's general prospects by studying his temper and the influences that play on it. Irascibility is not conducive to longevity in the face of hypertension. I believe that the more fully a physician explains these matters to his patients, the better will be their coöperation.

Changes in the eyegrounds are among the earliest and most important concomitants of hypertension. As pointed out by Wagener,[12] the first visible change in the retinal vessels is definitely

[12] Wagener, H. P.: Ann. Int. Med. 4: 222 (Sept.) 1930.

spastic in nature. Later on, edema and hemorrhage appear. Such changes always darken the prognosis, although no definite period of survival can be given.

From the physical standpoint the prognosis is influenced by the size of the heart, the state of the arteries, the kidney function, the eyegrounds, as already mentioned, and the coexistence of diabetes. I need not go into details as to these points, as they are almost self-explanatory.

In Table 7 are gathered a series of cases of essential hypertension chiefly from my office practice. Though covering the same period there are nearly twice as many women as men—fifty-one of the latter and ninety-one of the former. There is little difference between the maximum systolic and maximum diastolic and the minimum systolic and minimum diastolic pressure in the two sexes.

The patients represented by the table have been under my observation for periods ranging from a few months up to seventeen years. All were living when last heard from and those whom I have seen from time to time have not shown any noteworthy untoward symptoms.

In the table are not included a number of cases of juvenile hypertension, in patients under 30, as there was definite evidence in them of renal involvement. That, in fact, was the case in the majority of young persons whose systolic and diastolic pressures were materially raised. The conclusion is probably warranted that a high systolic blood pressure in a young adult is not essential hypertension but is probably nephritic hypertension.

Treatment

I shall limit my remarks on this phase of the subject to the treatment of essential hypertension. In the main, the methods here outlined are applicable to all forms of hypertension, whatever their origin.

Preeminent in the treatment is the psychologic approach—an understanding of the patient's frame of mind. It is absolutely necessary to quiet his fears, to convince him that hypertension is no sword of Damocles threatening his life at every moment. Countless experiences have demonstrated to what extent anxiety can raise both the normal and the more touchy abnormal blood pressure.

While as a general rule it is unwise to relate other cases to one's patients, only good can come from citing examples of long-lived hypertensive individuals to an apprehensive patient.

Whatever is revealed by the history and by the general physical examination that might be of importance and is correctable should,

if possible, be corrected. Such conditions are chronic constipation, infected teeth and other sites of focal infection.

No measure is as useful and generally applicable as rest, either complete or partial. The mere elimination of physical exertion, combined with regulation of the diet, suffices to lower the pressure; with rest in bed and with proper guarding from environmental disturbances the patient attains a greater peace of mind. A week is usually sufficient to produce whatever effect is obtainable from rest in bed. Naturally if the symptoms are fairly severe and indicate beginning cardiac fatigue, then the rest must be prolonged.

The permissible work must be made to fit as nearly as possible the patient's mental and physical status. Rarely is it necessary to pull him peremptorily out of his business. That tends to make him a confirmed hypochondriac and may indeed shorten his life. Usually it suffices to urge him shorten his hours of work—he goes to business later and comes home to rest for an hour or an hour and a half after lunch or before his dinner. He must have an adequate amount of sleep, and that precludes high-stake bridge and poker.

A vacation is an excellent symptomatic remedy. A winter vacation is often as great a necessity as one in the summer. One must of course cut his coat according to his cloth. It is useless to prescribe an expensive regimen to a patient who cannot afford it. Nevertheless, it is a good thing to have an ideal in mind.

Exercise.—Exercise within reason is a good tonic and takes the patient's mind off his problems but, like everything else, it can be overdone. One must individualize and must apportion the amount of physical exertion to the patient's age, previous mode of life, range of freedom and, especially, his response.

Those whose passion is golf often overplay. I seldom permit even on a summer vacation a daily game. There should be a day of rest intercalated and on the play days the exertion should not be such as to bring the patient home tired. Nor should the overheated, sweating player shower off with cold water as soon as the game is over. There are players not only at golf but also at other competitive sports to whom winning is so vital that in a hotly contested game they work themselves up to the highest pitch. Such a result is not at all conducive to reducing high blood pressure.

Diet.—It is difficult to find any constant dietetic error in patients with hypertension except that of overeating. Simplicity in quality is not always simplicity in quantity. I remember well an experience at one of the medical congresses in Washington. A distinguished foreign professor and his wife were eating breakfast with me at the Willard Hotel. I had ordered the usual American breakfast of fruit,

cereal, an egg, rolls and coffee. Perhaps I had an order of hot cakes as well. But of all of these things I ate moderately. My guest, the distinguished professor, ordered bananas, rolls and coffee. When he saw the number of dishes that surrounded me he thought I was an inordinate eater and commented on my apparently voracious appetite; but I watched him also and found that he ate at least half a dozen bananas and an equal number of rolls. Because he ate only of two articles he considered himself abstemious. Needless to say, he was possibly 50 or 60 pounds overweight and has long since died.

The fact that the vegetarian races of the East for the most part have a low blood pressure might suggest that our habits as to meat eating play a role but the evidence is not sufficient. I have already referred to the famous experiment of Stefansson.

All in all, it is not possible to write down any specific anti-hypertension diet, although there are a few points on which there is general agreement:

1. As already indicated, quantity is more important than quality. All meals should be light, especially the evening meal.

2. With a normal blood chemistry and a normal urine it is unnecessary to exclude meat entirely. I believe many patients have been dieted too strictly in this respect. A small portion of meat once a day is permissible.

3. The obese should cut down fats and starches and make up the deficit in bulk with vegetables.

Salt restriction: F. M. Allen, as is well known, claims to have obtained good results from a salt-free diet; that is, a diet under which the salt excretion does not exceed 0.5 Gm. per day. Many have tried the method without getting satisfactory results. Allen has countered by saying that the exact method advocated by him had not been employed. Without being convinced that sodium chloride is the cause of hypertension or an important factor in it, I am nevertheless in the habit of advising my patients to reduce the salt intake.

Alcohol: The hypertensive patient is, on the whole, best off without alcohol, although when he is abroad where the drinking of water is looked on as an anachronism, he make take a light wine with impunity.

Tobacco: It is my practice to restrict the use of tobacco or to forbid it entirely in hypertensive patients who have had cardiac pain. In other persons tobacco in moderation, a pipe or a good cigar, is a wonderful sedative to frayed nerves. However, I know this only vicariously.

Drugs: There is at present no drug that will reduce high blood

pressure to the normal permanently. The nitrites almost never fail if given in adequate doses in reducing blood pressure, but the reduction is not permanent. Nevertheless, there are times when even a temporary reduction is an advantage, such as when oppression of the chest, headache and vertigo manifest themselves or when even without symptoms the blood pressure suddenly rises to a rather dizzy height.

Of the nitrites, I have found glyceryl trinitrate and erythrol tetranitrate the most valuable; sodium nitrite has not given me as good results. Amyl nitrite is active but disagreeable and had best be used in the presence of some special emergency.

Potassium thiocyanate has recently been advocated in the treatment of hypertension. The dose is 0.1 Gm. (1½ grains) three times a day for five days and twice daily for a week, then once daily. Certain proprietary thiocyanate compounds are now on the market. The results are variable; occasionally they are very satisfactory.

Stieglitz,[13] an excellent student of hypertension, has recently advocated the use of bismuth subnitrate on the theory that this substance in the intestine gives off nitrite, which, like glyceryl trinitrate and other nitrites, tends to relax the blood vessels.

Bleeding.—When definite symptoms are present, and especially if there is an encephalopathy, nothing acts so quickly and so well as a fairly large venesection—from 500 to 750 cc. may be taken in a florid individual. I am in the habit, when bleeding a patient, to keep the blood pressure instrument on the other arm and to stop when the systolic pressure has fallen to 180 mm. The pressure often continues to drop afterward.

There are cases of severe hypertension that are not markedly relieved by venesection; in some of them I have found leeching from the mastoid process an almost sovereign remedy. Three leeches on each side are usually sufficient. It is sometimes difficult to obtain Swedish leeches in the ordinary pharmacies, but those in the foreign quarters of large cities usually carry them.

The iodides have long been employed in hypertension. In syphilitic cases they are undoubtedly useful, but they may be of value in cases that are not syphilitic. The ordinary potassium iodide solution has disadvantages; it is unpalatable, causes acne, and cannot be carried about. For these reasons I prefer one of the imported preparations either in capsule or in tablet form.

Electric Therapy.—The high frequency current seems to have the power of lowering blood pressure. My experience has been that

[13] Stieglitz, E. J.: Bismuth Subnitrate in Treatment of Arterial Hypertension, J. A. M. 95: 842 (Sept. 20) 1930.

the result is not permanent. There are, however, electrotherapeutists who claim more lasting results from the treatment than I have seen.

Comment

I cannot conclude this essay without giving expression to some reflections that have forced themselves upon me during the preparation of this paper.

Hypertension is not only a disease of the individual—it is a disease of American life. It extends to all our communal doings; it is reflected in the tension under which every individual in America lives.

What are the causes of this American disease? They are, I believe, connected with our striving for wealth. We have created false standards, have deprived ourselves of peace and leisure, and have lost the art of living wisely. We have had abundant material success, but have we not paid too dearly for it? It may be difficult to persuade the average American that the price has been too high, for he is still convinced that the civilization that he has created on this continent is the best in the world. There might be nothing wrong with such a sentiment if it did not blind us to some virtues still remaining in the Old World. Winston Churchill, the English statesman, accuses us of thinking that when we left Europe we took with us all the virtues and left all the vices behind. No doubt we took many virtues, but it must be admitted by every candid person that we have evolved a few vices of our own.

Unlike the European who, when he has enough for a comfortable living, retires to a life of leisure, the American, when he becomes rich, wants to become richer. He works hard and gambles with his savings. If he chances to be successful, he has in many instances shortened his expectation of life; he has surely done so if his ventures have ended disastrously.

It might be contended that, notwithstanding our way of living, the span of life has been greatly lengthened—nearly fifteen years since 1880. True enough; but when we come to analyze the relevant figures we find that the apparent prolongation of life to the age of 56 [14] is due primarily to the saving of child life and not to the saving of adult life. Statistics clearly show that the span of life after the age of 45 has not been lengthened. It is highly probable that it has been shortened, and that is the price of success.

I have just been abroad and have found that in the smallest as well as in the largest cities the majority of the shops are closed from 12 until 2. These two hours at noon have a tremendous

[14] Dr. Dublin of the Metropolitan Life Insurance Company, in a personal communication, says it is now 59 years.

recreative value. The custom explains why in Europe one sees few cafeterias and automats in which our people here snatch a hasty noisome meal. Where they exist they are pointed to as an illustration of the dreaded American invasion.

The European sits down leisurely and over his lunch discusses the problems of politics and world affairs for the discussion of which the American finds so little opportunity, either at his meals or at other times. How many of us sit down with any frequency to thrash out the important problems of municipal finance, of national policies, of the League of Nations, of the World Court, matters in which every intelligent man or woman should take a deep personal interest. Yes, perhaps at a dinner party the discussion may turn on the Great War or on the personality of our presidents or on our two great national philosophers—John Dewey and Will Rogers. Often, however, prohibition is the sole topic of conversation.

In a manufacturing town in England, 86 per cent. of the voting population in a recent election cast their ballots. Deducting those who for one reason or another were unable to go to the polls, that represents practically 100 per cent. of the voters. That, to my mind, is an expression of the interest in public affairs promoted by a well utilized leisure.

I have spoken of the treatment of hypertension in the individual; the treatment of the condition in the mass is beyond any man's power but by having before one the causes, it may be that in time a remedy for most of them may be found. I have given the causes as they have occurred to me. What remedies are there in the offing?

In the first place we must have a different standard, different ideals, more striving for contentment and a lessening of competition in the chase after riches. We must cultivate a spirit of leisure, making the lunch hour in public or in private a real rest hour, making sport not a passion conditioned on a desire to win but a recreation, pure and simple. As has recently been said by George Duhamel, a distinguished writer who has just received the Grand Prize of the French Academy, "What America needs is more loafers or, rather, dreamers if she wants to be saved from herself."

These ideals cannot be created in an adult population; the seeds of them must be sown in the child, in the home and in the school. If we once succeed in adopting from a by no means effete Europe that placidity, that tranquillity which is the aroma and the crown of life, then this country will have what it can and should have—the ideal civilization.

HYPERTENSION IN WOMEN[1]

The habitual use of the blood pressure instrument has brought me a number of surprises, none greater than the frequency with which hypertension occurs in women. The majority of the cases can be classified in a distinct and definite group having the following features in common:

1. The patients are usually stout, overweight and undersize.
2. They have borne many children.
3. They have neither a history nor any stigmata of syphilis.
4. They are over 45 years of age, the greater number falling between 50 and 60 years.
5. They are practically all constipated and some of them suffer from intestinal indigestion.
6. Up to a certain point they show an amazing tolerance to blood pressure of high degree.
7. In most instances the heart is enlarged, chiefly to the left.
8. The arteries are soft and even the retinal vessels rarely show any involvement.
9. The kidneys, as far as it is possible to determine, are competent.

The absence of gross renal and arterial changes has led writers to speak of such hypertension as essential, a word of little meaning though quite adequate for concealing our ignorance of the cause of the trouble. A similar hypertension is met with in men; but in them it is less frequent and in general less innocent.

When we come to search for causes, the points that stand out prominently are:

1. Multiple gestation. In nearly every case there have been not only two or three, but often five and six children. I have gotten the impression that the worries incident to raising a large family may count for no less than the repeated pregnancies. Inquiry has not elicited a history pointing toward any noteworthy abnormalities either in the pregnancies or in the lying-in periods.

2. Worry. Serious worry is rarely absent: on the one hand, heavy household cares; on the other, special trials and tribulations of the soul.

[1] Read before the Section on Practice of Medicine at the Seventieth Annual Session of the American Medical Association, Atlantic City, N. J., June, 1919.

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3. Constipation and intestinal indigestion, especially of the flatulent variety. Just what share to assign to these it is difficult to say. They may play a very important role as possible sources of autointoxication. I have, however, seen hypertension of this type in women in whom there was perfect function of the alimentary canal.

4. The menopause. The hypertension begins in such a high percentage of cases during the menopause that this constitutes an unquestionable etiologic factor. The relationship suggests the thought that this form of hypertension in women is based on some endocrine disturbance, not improbably arising in the ovary. Nearly 50 per cent. of the patients were widows.

Whatever the cause may be, whether it is of endocrine origin or some toxic substance made in the intestines or the slow poisoning from a focus of focal infection, the effect is an increased vascular tonicity which gradually leads to an actual thickening of the muscular coat of the vessels.

It is interesting to note the symptoms presented by the patients in the early stages of the disease, the inaugural symptoms, to employ a useful phrase of Moynihan's. They are dizziness, ringing in the ears, dyspnea on effort, anginoid pains, palpitation, gaseous distention, and vasomotor disturbances. Though several of these symptoms may be found in the same patient, the disease is often monosymptomatic in the beginning. In a very large proportion of cases the complaints, such as brachial neuritis, sciatica, migraine, have no apparent connection with the hypertension.

The chief physical findings are as follows:

The complexion is usually florid; obesity is very frequent; the area of cardiac and of aortic dulness is increased; a systolic murmur at the aortic area, transmitted upward and into the clavicles, and a ringing second aortic sound are common findings. In the later stages a soft systolic murmur can often be heard at the apex. The temporal arteries may be tortuous, but as a rule they are not conspicuous in women. The peripheral arteries are soft, in striking contrast to the blood pressure. An almost constant finding in patients of this type coming to the office is a slight elevation of temperature, between 99 and 100 F.

The average age of the patients was 54 years. The youngest patient was 43, the oldest, 71. The average systolic pressure was 211; the average diastolic pressure, 105; the average pulse pressure, 106; the highest systolic pressure, 310; the highest diastolic pressure, 160, and the highest pulse pressure, 120.

The highest tension, that of 310, was found in a woman, aged

46. Her sole complaint was dizziness. The year previous she had had a uterine hemorrhage. The physician who brought her to me and I myself were completely taken aback when we found the tension so high. From the woman's complaints we had not been led to expect it.

Another patient had a systolic pressure of 290, normal urine, normal eye grounds, and was well and active. She was able to play golf and had practically no complaint save ringing in the ears.

Of course, the type of hypertension I have described is not the only one met with in women. Chronic nephritis with high pressure is fairly common. It may be set down as a general rule that hypertension in women under 35 is practically always nephritic; it gives a bad prognosis, much worse than any other form of hypertension. In some of the nephritic cases the arteries are soft and impalpable; in others, they are hard, tense and rigid. Strange to say, the latter condition is more frequent in the younger patients.

There is, furthermore, the arteriosclerotic group in which the etiology, symptoms and course do not differ from those of the same disease in men.

I shall merely mention, without further comment, hypertension in acromegaly and in exophthalmic goiter. I want, however, to say a few words about a closely allied type which I would call nongoitrous thyrotoxic hypertension. This form is of considerable clinical interest; like the one of which I spoke first, it occurs with preponderating frequency in women. The patients are near or past the menopause, are not overfat, sometimes spare, often single. They complain chiefly of palpitation and headache; are emotional, and have a tendency to sweating. The heart is rapid, even to the point of tachycardia; the hands are tremulous. There is often a von Graefe sign, but no exophthalmus and no goiter or other tangible abnormality of the thyroid gland. The systolic pressure ranges from 150 to 210, with a diastolic pressure of from 90 to 120. While there is no positive proof of a thyroid cause, and while the patients are nearly all beyond the age at which hyperthryoidism usually appears, the symptoms nevertheless closely resemble those of a thyrotoxicosis. To be sure, the condition may be pluriglandular in origin. It is apparently not renal or arteriosclerotic. A point of interest and in a sense contributory evidence of thyroid origin is the fact that the iodides do not benefit but rather harm these patients. The thyrotoxic form is more incapacitating than the first variety of which I have spoken.

With regard to prognosis, the first type, the so-called essential hypertension, is in a sense benign; even high pressures are well

tolerated for many years, as I have pointed out in earlier papers on this subject.[2] Hence, it is both unwise and unnecessary to alarm these patients. Many have been unduly frightened by being told that they had very high blood pressure. Though the physician, in dealing with them, may well be optimistic, nevertheless, for the patients' sake it is important that he keep them under surveillance on account of the possible catastrophes that lie in wait for them. Three major accidents may happen:

1. Angina pectoris, which is much more frequent in women than is believed, and is especially common in the so-called essential type of hypertension. It is probably due to an extension of aortitis to the coronary arteries.

2. Apoplexy with hemiplegia, which latter in the majority of my cases has been left-sided.

3. Decomposition, a late stage of the disease resuling from myocardial exhaustion.

Treatment

In this, as in all chronic diseases not definitely infectious in character, our powers of cure are very limited. That being so, the great desideratum is to find means of prevention. To this end we must learn to recognize hypertension in the making and then to remove such removable factors as are concerned in its production. As there may be nothing in the symptomatology in the early stages to attract attention to the circulatory system, there is but one way to discover incipient stages—by routine blood pressure examination and careful determination of the size of the heart. A comparison of records made at intervals would then show us in which patients the pressure was on the upgrade.

In the treatment of the established condition, harm may readily be done by too much interference. Just as we have gotten away from using digitalis on the mere discovery of a murmur when the valvular defect is compensated, so we should not try to lower the bloodpressure to any great extent in patients in whom the hypertension is well borne—in whom it is adequately compensated. If the patients know that they have high blood pressure, one may honestly assure them that the dangers of this symptom have been overemphasized.

Regulation of the diet is necessary, more often in the direction of quantity than of quality. I have found this class of patients as a rule to be heavy eaters, and have come to feel that they do better on a restricted diet, especially on one that is largely lactovegetarian.

[2] Riesman, David: Penn. M. J. **18**; 193-202 (Dec.) 1914; Am. J. Obst. **71**: 428-133 (March) 1915; Am. J. M. Sc. **165**: 487-494 (April) 1913.

A lamp chop, a little chicken and fresh fish are permissible. Rest, at times a semirest-cure, is desirable in many instances. In some persons, however, graduated exercise, walking and moderate golf playing, may safely be advised.

With regard to drugs, I am not in the habit of using them as a matter of routine. The nitrites are not indicated in patients who do not suffer from their hypertension. Though high-geared, the circulation may be well maintained and vasodilators only serve to upset the equilibrium. The iodides may be used in the essential type of hypertension in small doses over a long period. Lately, I have secured apparently striking results from the use of corpus luteum extracts. The pressures were lowered without any untoward effects, and the subjective symptoms were markedly improved.

Baths and electricity may at times be employed with benefit. When the cases approach the danger line, nothing is so valuable as venesection; when this cannot be done, then leeching from the mastoid process is a very good substitute.

In the thyrotoxic cases, rest is of the greatest importance. Patients of this type should take their breakfast in bed and lie down for an hour or an hour and a half after the noon meal. Tea and coffee should be forbidden. Medicinally, the bromides, at times with small doses of tincture of veratrum, seem to do good. I may add that in the dizziness of hypertension, tincture of veratrum has often given me very satisfactory results.

The patients of all types of hypertension should be urged not to worry, but the mere injunction "not to worry" carries small weight. It is necessary for the physician to analyze with judgment and with great patience the worry-breeding conditions of the person's life and to convert his patient, if possible, to a more philosophic attitude. By considering all the details of the patient's daily life, one may often point out definite ways of easing the strain.

HIGH ARTERIAL PRESSURE: HIGH PRESSURE HYPERTROPHY OF THE HEART [1]

For a long time clinicians and pathologists in studying diseases of the circulation centered their attention almost exclusively on the heart. And even today we speak of heart failure, although we know that taken by itself such a thing is of extreme rarity. In the maintenance and control of the circulation the heart does not stand alone; it shares the responsibility with the blood vessels, which participate actively in propelling the blood and in maintaining the blood pressure. The specific subject I wish to take out of this extensive and important field and discuss is high arterial pressure. I use this term instead of arteriosclerosis partly because the two are not synonymous, though often so used, and partly because the latter, arteriosclerosis, conveys the idea of an anatomic lesion, a terminal event best studied after death; while the former indicates at once a vital functional alteration with a direct bearing upon symptoms.

What do we mean by high arterial pressure? High arterial pressure is a relative term. Sex, age, and other factors must be taken into consideration. Up to a few years ago clinicians trusted to their fingers and eyes, but now we have fairly accurate and convenient devices by which we can determine quantitatively the amount of arterial pressure. The signal advantages of instrumental determination must be at once apparent. They are greater accuracy, standards of comparison, and ability to control treatment by recorded observations. The sphygmomanometer is to blood pressure what the hemocytometer and hemoglobinometer are to blood. Before we had them we knew of anemia, but had no definite standards and no basis for records. It is beyond the province of this paper to discuss the various instruments on the market. None is perfect; all are subject to the inevitable influence of the personal equation; but variations due to error are slight.

To know whether the blood pressure is high or not it is necessary to know the normal standards. These vary somewhat with different observers. The best records are probably those that have

[1] An address delivered by invitation before the Wayne County Medical Society, Detroit, Michigan, May 20, 1912.
Reprinted from American Journal of the Medical Sciences, April, 1913.

been obtained by careful insurance examiners, as such examiners deal more frequently than we do with healthy persons. Dr. Woley, of Chicago, in a study of 1000 healthy individuals, found the average to be as follows:

15 to 30 years	Blood pressure, 115 mm.
30 to 40 years	Blood pressure, 127 mm.
40 to 50 years	Blood pressure, 130 mm.

For women of the same ages the blood pressure is from 8 to 10 mm. lower. Not only age and sex, but also mental state, posture, and many other factors have an influence. Under excitement the blood pressure may rise 20 to 30 or even more millimeters. Due allowance must always be made for these variable factors.

Clinicians differ as to the exact dividing line between normal and abnormal pressure. My own feeling is that, other things being equal, a pressure over 145 is abnormal. At the age of fifty a pressure of over 150 is pathologic. This does not mean that the patient is gravely ill, but it does mean that such a patient should be kept under observation and that the cause of the rise in blood pressure should be ascertained, for when it comes to arterial disease—particularly hypertension—prevention is better and easier than cure.

As guardians of the health of our patients we are not doing our full duty. We are still too much concerned in treating the sick; a laudable purpose in itself, but one not exhausting our possibilities for good. I need not discuss the utility of preventive medicine in general. We are all agreed on that. What I have particularly in mind is personal preventive medicine. By that I mean that we should make it our duty toward our individual patients and families to guard them against such ill health as timely examinations can anticipate. To this end we should urge the men and women of over forty years of age to send urine for examination two or three times a year and to have their blood pressure taken twice a year. If we can once induce those whom we should be called upon to treat if they were ill to see the value of such examinations to themselves, our usefulness to the community and our prestige, which many new creeds and fancies have somewhat impaired, would be greatly enhanced. I see no reason why medical officers of health should not add to their preachments about communal prophylaxis, appeals for personal prophylaxis against insidious diseases of non-infectious nature which when once detected are often beyond cure.

To return to our subject: When I stated above what I considered the limits between normal and abnormal blood pressure I was giving the results of personal experience and belief. I am in

the habit of looking on a pressure of from 140 to 150 in a man aged between thirty and forty years as not altogether normal if it is found on several examinations, especially if the diastolic pressure is raised 20 or 30 mm. Here I must emphasize one point to which I have already alluded: under excitement or fear, or after a heavy meal, or after exercise, the pressure rises temporarily, at times as much as 50 mm. Due allowance must be made for such transitory variations. Only when the pressure is sustained at the same level under proper conditions of testing is it significant.

When we consider the causes of high arterial pressure we enter a field with few well-defined paths. Bright's disease, particularly the chronic interstitial variety, bears an unquestionable relationship to hypertension. But in what way the lesion of the kidney acts to bring this about is far from settled. Permanently high blood pressure is produced not only by the chronic interstitial form, the parenchymatous type also raises the blood pressure. I believe in such cases that estimation of the blood pressure is often of great diagnostic and prognostic import. If we could explain the hypertension in nephritis we should also know the causes of the hypertrophy of the heart that is an almost constant feature of this affection. It may be remembered that the early view was that the restriction of the vascular area in the diseased and contracted kidney was responsible for the rise in blood pressure. This can scarcely be the case in view of the great adaptability of the circulation to slowly developing conditions; moreover the kidney circulation bears but a small ratio to the general vascular territory, and the local pressure restriction seems hardly capable of influencing general pressure to any marked degree.

Another view is that the disease of the kidney increases the viscosity of the blood, and hence the internal friction, and as a corollary the pressure against the vessel walls. It is quite possible that such heightened viscosity may be a factor, but the pressure is also raised under conditions in which the viscosity is presumably lessened: in chronic parenchymatous nephritis with dropsy and hydremia.

The theory that hypertension in nephritis is due to a contracted state of the vessels, the result of a generalized exaggeration of the vasomotor tonus, has had strong attractions for recent writers. It may be expressed by saying that in chronic nephritis some pressor substance circulates in the blood; either a new one or a previously existing one in increased quantity, which causes a spasm of the vessels. I see no flaw in this hypothesis except that the pressor substance is not unequivocally demonstrated. Many believe that it is adrenalin or epinephrin. While a number of investigators have

found the adrenalin increased in nephritis, others have not. If there is an excessive amount in the blood, a hyperadrenalinemia, it remains yet to be explained why the adrenalin content is increased. Inasmuch as some recent investigators have found a pressor substance in the kidney itself, it is possible that through the melting down of renal tissue in Bright's disease such a substance may be liberated and taken up by the blood. Quite recently attention has been turned upon the liver in Bright's disease, as the belief is growing that the relation between that organ and the kidney is far closer than physiologists have held. It is to me not inconceivable that some of the symptoms of nephritis are connected with disturbed hepatic function. An attractive hypothesis could be erected on the theory that the kidney is an organ of internal secretion, but the paucity of facts does not warrant it. It can be seen then how far we are from a real knowledge of the cause of hypertension in Bright's disease.

Another cause of persistent hypertension is arteriosclerosis. So much has been said and written on this subject that I shall not discuss the clinical causes or the pathology. Let me state only that arteriosclerosis is both a general and a local process. Local arteriosclerosis, which may often be intense, is not necessarily accompanied by a rise in blood pressure. Thus we may have marked calcification and beading of the accessible arteries without hypertension, and, on the other hand, I have seen a considerable number of patients with impalpable arteries whose pressure was 200 mm. or more. These are the cases that are difficult to interpret. Sometimes careful and repeated examination of the urine will show evidence of chronic interstitial nephritis: abundant urine of subnormal specific gravity with a trace of albumin and a few hyaline casts. In others the urine is entirely normal. At times the quantity is slightly increased and a few hyaline casts are found in the centrifuged specimen. I lay no stress on a sparse number of casts, especially if the urine contains crystals of uric acid and oxalate of lime.

Now it is this particular group of hypertension cases to which I have just referred that is of interest and importance; the group without notable thickening of the superficial arteries and no renal changes of importance. It is common in men and comprises, in my own experience at least, a rather large proportion of women of middle age. Not until I began to look for it did I realize how common this non-sclerotic type of hypertension is in the female sex. Both the men and women with this affection are usually robust, stout to obese, and past fifty years of age. In none of my cases in women was syphilis or alcohol a factor. In men syphilis at

times plays a part, but I do not think that alcohol is to be blamed. I do not mean to say that these patients do not drink, but I wish to convey the idea that I do not consider alcohol itself an important feature in the production of high arterial tension. In the majority of cases there had been mental strain and heavy responsibility. Some of the women had reared large families under difficulties. One curious circumstance may not be without significance. Nearly all the women had come, after years of privation, to live in comparative comfort because their sons, several of them physicians and lawyers, had been successful, and had dutifully made life easy for their mothers.

The symptoms complained of were usually respiratory or gastric in nature; rarely such as to direct attention to the heart and vessels. I have no statistical tables, but I have gained the impression that one-half to two-thirds came complaining of indigestion and bloating after meals. A majority of the remainder noticed shortness of breath on exertion, which they were inclined to ascribe to distention with gas. A few were first troubled with vertigo, with numbness and tingling of the extremities, or with ringing in the ears. The women in this group have interested me particularly because in few of them had the real nature of the affection been suspected. They had usually been treated for stomach trouble—flatulent dyspepsia or nervous indigestion.

Now what do we find on examination? The men are usually overweight, with large and solid-looking chests. They have an air of youthfulness and often much vitality. The women are large and have heavy, pendulous breasts. The heart is found enlarged, often far beyond what one would expect from either the symptoms or the physical appearance and capacity of the patient. The radials are either soft as in youth or a trifle thickened, like a thin-walled rubber tube. The temporals, which are rarely conspicuous in women, may not be abnormal. An arcus senilis is often present. The urine may not show anything of importance except a slight increase in quantity. The specific gravity will not vary much from the normal, but there is one factor of importance that I have noticed quite recently since my attention was called to it by Dr. Pratt, of Boston—namely, that these patients pass much larger amounts of urine during the night than in the daytime. I have a patient under observation at present who voids sometimes twice as much at night as in the daytime, the urine being measured separately from 8 A. M. to 8 P. M., and from 8 P. M. to 8 A. M. The blood pressure will be found high—from 190 to 260 or even more—far beyond what would be expected from an examination of the arteries.

The hypertrophy of the heart, which is always present, is not due to valvular disease. There are no endocardial murmurs except perhaps late in the course, when through loss of compensation the heart dilates and a mitral systolic murmur appears. Usually, indeed, almost without exception, the second aortic sound is much accentuated, and the first sound at the apex dull and heavy. The heart is generally regular. This type of hyperthrophy is frequently overlooked, as I have had occasion to notice both in undergraduate and in postgraduate teaching. It is overlooked because many of us fail to palpate and to percuss the heart. I am inclined to believe that percussion and palpation of the heart are more important than auscultation.

Not rarely there is a systolic murmur at the aortic area without concomitant signs of aortic stenosis. The murmur indicates, I take it, sclerosis in the arch of the aorta. It is customary to make light of this murmur; justly so in the case of arteriosclerosis; but in the group with which I am dealing, in which there is no sclerosis in the peripheral vessels, the murmur, to my mind, has an important meaning. I believe the patients that have it are more liable to angina pectoris. This brings me to another important point of interest: these high-pressure cases that do not have visible or palpable arteriosclerosis during life are particularly prone to anginal attacks, to coronary sclerosis and thrombosis. A systolic murmur at the aortic area in such a patient is ominous of an early extension of the sclerotic process from the arch into the coronary artery; its presence therefore influences the prognosis.

The blood pressure, as I have said, is high, often startlingly so, in patients whose complaints are seemingly trivial. Thus I have under my care at present a widow, aged forty-seven years, with a systolic pressure of 265, soft arteries, a perfectly regular but enlarged heart, whose chief complaint is ringing in one ear. Not a few cases have been referred to me by ophthalmological friends who detected retinal hemorrhages. Such hemorrhages, or rather the visual disturbances dependent upon them, are often the earliest symptoms of which the patient is cognizant. Ophthalmologists have learned to recognize these high-pressure cases by means of the ophthalmoscope. Many patients, however, have normal eyegrounds.

The course of this affection, which I have been bold enough to designate *high-pressure hypertrophy*, is largely governed by the state of the heart. As long as the latter is competent the circulation is maintained at its high level, often with a minimum degree of functional disturbance. Eventually, however, the *vis a fronte*

becomes too great for the *vis a tergo,* and the heart yields and dilates. The subsequent events are practically identical with those of decompensation from any other cause, and need not detain us. No doubt the lessening of the resilience of the vessels and their failure to help in the proper movement of the blood are important contributing factors in the downward course of events.

I have been impressed with the infrequency with which high-pressure cases suffer from apoplexy. It occurs, but more often in the younger than in the older patients. Death results either from total failure of compensation or from angina pectoris, unless some intercurrent malady anticipates these two.

What is the cause of this interesting syndrome—this high-pressure hypertrophy? At first sight it looks as if there must be some pressure-raising substance in the blood. I have been hoping that some method of detecting this could be adapted to clinical application so that the theory might be tested. At present the methods are too complicated. In many cases there is, I believe, arteriosclerosis of certain important vascular territories—namely, the aortic arch and the splanchnic vessels. How sclerosis of the former raises pressure, if it does so, is a mystery. I am not sure that the ingenious hypothesis of Bittorf solves it.[2]

Sclerosis of the splanchnic vessels, on account of the great area of this system, is undoubtedly capable of raising the pressure. It is likewise possible that with sclerosis of this territory some changes take place in the suprarenal glands by which the blood pressure is affected. At any rate, sclerosis of the splanchnic vessels is not uncommon, and perhaps some of the gastric distress and abdominal pains of which the patients complain may find their explanation on that basis.

I shall not dwell on the hypertension accompanying the more obvious types of arteriosclerosis. The clinical differences are not great and the diagnosis is much easier. Angina pectoris is not so common with pipe-stem peripheral arteries; apoplexy is more frequent.

Treatment. The treatment of hypertension is a subject of great practical importance upon which there is as little unanimity as upon most other subjects of medical practice. I have already discussed means of prevention, an object possible of accomplishment when the taking of blood pressure becomes a habit and when

[2] Bittorf believes that a possible cause of high arterial pressure is degeneration of the depressor nerve or its terminations in the arch of the aorta. The depressor nerve is an afferent nerve carrying impulses to the brain, in response to which the peripheral arterial pressure is lowered through vasodilatation. When the nerve is diseased the system naturally loses this important "factor of safety."

the laity learn to realize the importance of paying for medical advice before it is imperative to have it.

It should be borne in mind that the high pressure, like much of Nature's work in the body, is compensatory and reparative. Hence any attempt to depress the blood pressure to its normal for the individual is both irrational and harmful. All that we may safely attempt to do is to lower the blood pressure when it is excessively high to a point where symptoms cease and to keep it there. Serious consequences have followed when a pressure of 240, for example, was knocked down medicinally and precipitately to 150. Let us see what we can do to lower hypertension to a reasonable level. If we knew the direct cause we might combat it. As we do not know it we must work indirectly. First and foremost in my mind is rest, mental rest being more important than physical rest, although the latter has its place. It is astonishing what relief from the "weariness, the fever and the fret" will accomplish. Sometimes driving a patient to make a decision in a critical matter, so as to have it over with, accomplishes more than any medicine.

The diet is of importance, but more from the point of view of quantity than of quality. Many patients with hypertension have a habit of overeating, and suffer from what Sir Clifford Allbutt calls "hyperpiesis." And it may be wise to restrict somewhat the nitrogenous, more particularly the purin-containing foods. A valuable admonition is that the patient should eat a small evening meal—he will rest much better. In regard to stimulants, I am more afraid of tobacco than of alcohol, but usually restrict both, as the case may require. I do not think tea or coffee is good for these patients, a fact they often discover for themselves. The bowels must be kept open. No one remedy or measure can be employed for all cases. The salines are useful. Many persons get comfort from a pill of phenolphthalein and rhubarb, or from the well-known compound liquorice powder. An occasional dose of calomel or blue mass serves a useful purpose. Special baths are of doubtful value, and I question particularly whether the Turkish bath so frequently employed does any good. A simple hot bath or a short electric cabinet bath may at times be of benefit, but the latter ought not to be left to the uncontrolled discretion of the patient.

Electricity in the form of the high-frequency current (auto-condensation) has a growing number of advocates. My use of this is of such recent date that I have no personal opinion.

As for drugs, even the laity are familiar with the value of the nitrites, and are no longer frightened when nitroglycerin is pre-

scribed. There are cases in which nitroglycerin fails. In these cases sodium nitrite in doses of from ⅛ to 2 or even 3 grains may prove useful. Erythrol tetranitrate is a powerful vasodilator in doses of one-half grain, but often produces a painful fulness in the head, to which patients object seriously. The nitrite group of remedies is to be used only to relieve symptoms, which they often do—especially nocturnal dyspnea—in a remarkable manner. The continued use of the nitrites is of doubtful utility unless the pressure is rising, or there is angina pectoris, or marked dyspnea. In such cases they may be given over a long period in large doses.

The iodides are much in use. I give them routinely, though their method of action is unknown. Perhaps they reduce the viscosity of the blood. I prefer the sodium salt given two hours after meals, in water or milk. I find the newer iodine-containing tablets convenient, especially for persons who travel.

Digitalis might appear to be contraindicated in the cases of hypertension with which I am dealing, but strange as it may seem, many patients who are suffering from dyspnea and even from vertigo do well on small doses of digitalis. I prefer either the tincture in from 5 to 10 mm. doses three times a day, or the powdered leaves (¼ to 1 grain).

There is one more measure in the value of which I have an abiding faith—namely, venesection. At the Philadelphia General Hospital venesection never went entirely out of use, and in the last score of years it has again become popular and is winning its way into general practice. It is safe to abstract in such cases up to a pint of blood, and if the pressure instrument is kept on the arm and the pressure controlled, we may take off 20 or 24 ounces. The relief from symptoms is often magical.

A number of European health resorts enjoy a great popularity in the treatment of hypertension and other cardiovascular conditions. Personally I doubt whether there is anything specific in their waters or in their baths; but freedom from care, regular hours, and greater frugality of living are probably the factors that achieve the good results.

THE LIMITS OF SAFETY IN BLOOD PRESSURE CHANGES[1]

In raising blood pressure to the dignity of a main theme, we are in danger of forgetting that abnormal blood pressure, either high or low, is not a disease but a symptom, a mere phrase in a sentence that cannot be understood without its context. And there exists the further danger that we may exaggerate the importance of it as a symptom. This, I think, has indeed been done and the profession as well as the laity has become imbued with an unwarranted awe of abnormalities in blood pressure. Because some cases of high tension are short-lived, the conviction has arisen and has been promptly espoused by the laity that high pressure is a serious omen and needs active treatment.

The blood pressure reading takes rank with urine analysis and blood tests in importance as an aid to diagnosis and prognosis, hence it should become a feature of routine examination. I am inclined to think that a goodly number, perhaps the majority, of surgeons, are not deeply interested in it. If their hospital internes take the pressure well and good. They themselves care little about it. A recent English text-book on Surgery (Choyce and Beattie, London, 1912) has not a word upon the subject.

A single reading of the blood pressure is not sufficient. To be of value pressure studies must be made regularly, and I need only cite the observations of Briggs and Crile (Blood Pressure in Surgery, Philadelphia, 1903, p. 400) with regard to typhoid fever. They found that the earliest symptom of perforation is a rise in blood pressure. This of course can be discovered only if regular studies are made. Assuming that the pressure is systematically taken what use can be made of it? As I have said it is only a symptom and may therefore, like other symptoms, be misleading. Thus a normal pressure reading may be obtained in a case with a bad circulation—one in which operation might be fatal. We cannot therefore depend on blood pressure alone in deciding whether a given

[1] Read by invitation before the Obstretical Society of Philadelphia, November 5, 1914. Reprinted from the American Journal of Obstretics and Diseases of Women and Children, Vol. LXXI, No. 3, 1915.

patient is a good surgical risk. When the pressure is abnormal, the case is in some respects simpler. If the pressure is very high, that of itself will act as a "temporary stay of execution" until the case can be more fully studied. What shall our attitude be in the high pressure cases? First of all, we must find the cause of the high tension, for some causes are grave obstacles to successful operations while others, as I hope to show, are not. From the operative standpoint, the most serious cause is chronic nephritis. As this is practically never monosymptomatic, a careful search will show in addition to the hypertension other characteristic signs—polyuria, low content of solids in the urine, hypertrophy of the heart, etc. I need scarcely say to you that an operation should not be undertaken in such patients unless it be to save life. There are, however, cases of nephritis in which the urinary changes are very slight. In them the discovery of high tension, let us say 200 mm. or over, is of very great importance. The factors of safety in such cases are apt to be overestimated, because the ordinary urine examination reveals but little departure from the normal. In such cases the phenolsulphonephthalein test ("the red test") is of great value. It will give information as to the functional capacity of the kidneys and will afford a better idea of the margin of safety than the blood pressure and the urine analysis combined. This is another of the many illustrations of the need in modern times for the co-operation of physician, surgeon and laboratory worker.

Another cause of high pressure that plays an important role in surgery is arteriosclerosis. Rigid arteries and high tension are a serious handicap for the patient needing an operation. Nevertheless, many operations have to be done or at least are done on arteriosclerotic subjects, not only those of necessity but many more or less elective in nature. Owing to the frequency with which renal changes accompany the arteriosclerotic process, it is well, if the urine arouses suspicion, to proceed as I have advised in the case of nephritic hypertension, that is to make the functional test of renal sufficiency. Taking arteriosclerosis cases by and large I may say that syphilis is the most frequent cause of the uncomplicated type of the disease. This in certain circumstances is of decided importance; for example, in cases of obliterative endarteritis with threatened gangrene. The discovery of syphilitic infection through the history or the Wassermann test may deter the surgeon from amputation until a trial of therapeutic measures has been made. Operations are fairly well borne in arteriosclerotic subjects provided the heart is competent, and that point a medical man with experience can determine in the majority of cases. I have seen men with

arteriosclerosis pass through prostatectomy, radical cure of hernia, gall-stone and other operations with remarkable ease and freedom from complications. But even in the case of heart lesions, particularly valvular defects, the factors of safety are often considerable and unless there is evidence of myocarditis with dilatation and perhaps fatty change, operations are reasonably safe.

When arteriosclerosis is associated with diabetes, and this is the rule in elderly diabetics, then the problem of deciding upon an elective operation is more difficult. My opinion is that even in such cases operation is fairly well borne, provided, of course, that the kidneys are sound, and that the proper precautions are taken to fortify the patient by diet and by alkalies against coma.

There is another form of hypertension which is clinically more or less mysterious. The urinary findings indicate intact kidneys or at least kidneys but little diseased and the superficial arteries as well as the retinal vessels show no change. This form is rather common in middle-aged, stout women, and may give very high pressure readings (190-270 mm.). Some writers see the cause in disease of the kidneys but I am not sure that this is the true cause. Be that as it may, the important fact is that these patients bear operations better than one would expect from the height of the blood pressure, granted that the heart is fully competent. It is among this group of cases that the greatest harm is done by telling the patients of their blood pressure and by subjecting them to more or less violent treatment calculated to upset a circulation that is of necessity geared high and should not be thrown out of balance. These patients are frequently gall-stone subjects and are thus brought to the notice of the surgeon.

It is in pregnancy that the blood pressure, taken as a single symptom, acquires its greatest significance. Dr. Hirst has, both tonight and on other occasions, contributed much to this phase of the subject and I need only say that a rising pressure is one of the early signs of toxemia—a pressure of 130 or 140 is deserving of more attention than at other times. The factors of safety in pregnant women cannot be large, else we should not have the sudden explosions, the eclamptic attacks; but it would be a mistake to hold the high pressure itself, even if it reaches 200, responsible for eclampsia. It is merely a sign of something much more subtle that has not yet been fathomed. But there is an exception to every rule and eclampsia has been noted when the pressure was not raised. Nevertheless, high tension is such a valuable sign in pregnancy that blood-pressure taking ought to become a habit among obstetricians.

Can we do nothing to reduce pressure and thereby increase the factors of safety in operations? Yes, we can, but pressure-lowering drugs of all measures are the least helpful. History repeats itself, and the experience with the use of antipyretic drugs in fevers is being duplicated in the drug treatment of hypertension cases. Our predecessors thought that in reducing the temperature by means of drugs they cured the disease, and many men have fallen into a similar error in thinking that to reduce high pressure by means of vasodilators means a permanent advantage to the patient. If by altering the metabolism of the patient we can lower the temperature or lower the pressure we have made a greater gain. I would not, however, decry the judicious use of vasodilators—just as hyperpyrexia is dangerous *per se*, so great hypertension may be dangerous, and then the *nitrites* are both indicated and valuable.

In cases intended for operation, much may be accomplished by a preliminary period of rest and low protein diet. For example, in exophthalmic goiter, in which high pressure is the rule, rest and milk diet are useful in direct proportion to the severity of the case. Not only does such a regimen affect the pressure favorably, but it lessens, and this is of great importance in goiter patients, the thyroid toxemia. In nephritic cases these same measures accomplish a good deal. In all circumstances free bowel action tends to lower pressure. An interesting observation on prostatic cases comes from the Mayo clinic (D. C. Balfour, Mayo Clinics, 1913, p. 73). It has been found that the preliminary drainage of the bladder either by a retained catheter or by a suprapubic stab of the bladder lowers the pressure (in fifty cases on an average from 166 to 145) and cuts down the mortality to a considerable degree. Chilling must be avoided. In ether cases it causes a rise of pressure and congestion of the internal organs thereby predisposing of pneumonia.

The relation of *low blood pressure* to surgical conditions, like the whole subject of hypotension, is still very obscure. Only in connection with shock has much scientific work been done upon it. When in an adult a low blood pressure exists (a systolic pressure under 100) the margin of safety possessed by the circulation is small and a grave operation, unless extra precautions are taken, must end disastrously. I am sure a large number of this class of patients would not die if blood pressures were regularly taken. Under the head of low tension, we may consider shock, the salient feature of which is a great fall of blood pressure. Crile showed in 1903 (Blood Pressure in Surgery, Philadelphia, 1903) that this fall was due to exhaustion of the vasomotor center and not to any large extent to cardiac failure. It is of medical interest here to note

that the work of the Leipsic school has shown that a similar pathogenesis underlies the circulatory failure in typhoid fever and other grave infectious disease. In his more recent publications Crile (*Lancet,* 1913, II, p. 7) states that shock is accompanied by certain degenerative changes in the brain, the supposed result of so-called "noci impulses." The noci impulses are in a large measure preventable. They are for the most part psychic in nature, and while as a medical man it is not in my place to speak of the value of nerve blocking, I will say that from observation I am fully convinced of the inestimable benefits obtained by surrounding the patient before operation with an environment conducive to mental tranquility. I have seen a conscious patient brought into an etherizing room in which an assistant surgeon, with hands and gown covered with blood, was sewing up a gaping incision in the abdomen. The effect upon the patient can be imagined. Such things should not be.

I shall not enter here into a discussion of the relative merits of the theories advanced to explain surgical shock—those who are interested will find a lucid discussion of Henderson's acapnia theory and of Crile's views in the proceedings of the last (1913) International Medical Congress (*Lancet,* 1913, II).

Hemorrhage during operation, rough handling of the viscera, sudden changes of posture, prolonged operation and improper administration of the anesthetic, as every surgeon knows, make for fall in blood pressure, which will often pass unnoticed because the pressure is not taken. Ether itself, unless inordinate amounts are given, has a tendency to raise pressure (Guy, Goodall, and Reid, *Edinburgh Medical Journal,* August, 1911,) and would therefore be in all cases of hypotension the anesthetic of choice.

I have been much impressed with the recent suggestion of an English surgeon, who instead of waiting until the operation is nearly over before administering saline solution to combat a possible fall of pressure, starts the flow into the loose axillary folds with a Y-shaped tube at the beginning of the operation. He calls this the "axillary sup."

I have tried to point out as briefly as possible the bearing of blood pressure studies upon surgical operations and to show the factors of safety possessed by patients under varying conditions. If these factors of safety are not known, the surgeon may on the one hand undertake an operation from which he should keep aloof, and on the other hand, he may deprive a patient of the benefit of an operation which it might be safe to do.

THOUGHTS ON HYPERTENSION *

An article contributed to an Anniversary Volume in honor of Doctor Joseph Hersey Pratt

Whether hypertension is a disease or a symptom is a much debated question. It can, I believe, be answered rather easily, for the present at least, in the following way. When we know the cause or the apparent cause we emphasize it and consider the hypertension as part of the symptom complex. When we do not know the cause we look upon the hypertension as the disease itself. On this basis the hypertension of chronic nephritis or aortic insufficiency is a symptom, while that of unknown cause is a disease entity. Such a disease entity is represented by essential hypertension.

Although my main object is to deal with essential hypertension, I shall for purposes of clarity give a tentative classification of hypertension. As long as our knowledge of the etiology is limited, such a classification has to be mainly clinical.

Classification of Hypertension

1. Primary, essential or arteriolospastic.
2. Arteriolitic or malignant.
3. Nephritic.
4. Secondary or accidental.
   - (a) Aortic insufficiency
   - (b) Coarctation of the aorta
   - (c) Adrenal tumors
   - (d) Pituitary basophilism
   - (e) Hyperthyroidism
   - (f) Pregnancy
   - (g) Enlarged prostate
   - (h) Arteriovenous aneurysm

Subclasses:

1. Juvenile.
2. Superhypertension.

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I need say little about this classification—it is largely self-explanatory. With regard to malignant hypertension, I might say that I do not believe it is a late stage of essential hypertension. It is a different disease and has all the earmarks of a distinct clinical entity. In my experience it has occurred earlier in life than essential hypertension. The diastolic pressure is much higher than in the majority of cases of the latter. Renal changes are pronounced. The peripheral vessels are thickened, tortuous, tense and hard. Retinal changes are present. The patient looks pale and sallow; his color has been compared to that of a cold buckwheat cake. Cerebral accidents are common.

On account of the necrotic inflammatory changes in the arterioles, the term arteriolitic hypertension is applicable.

The secondary types of hypertension need not detain us, except to say that the hypertension in some of the conditions is compensatory; in others, the connection between cause and effect is obscure.

Juvenile hypertension and superhypertension are entirely arbitrary classes. By juvenile hypertension I mean a premature hypertension occurring usually from just before puberty to about 35 years. My associate, Dr. Stanley E. Harris, has found many instances among students at the University of Pennsylvania, and I have seen a number of examples in my office. We admit to this class only those cases in which the blood pressure has been repeatedly tested and found elevated—150 and upwards.

Superhypertension is applied to those cases in which the blood pressure is 260 and higher. I have put them as a separate class so that I can better watch them and note their progress. Such a procedure will eventually be helpful in arriving at a more securely based prognosis. I have had under observation a considerable number of women with systolic pressures of 270 who lived for many years. One, a relative, had a systolic blood pressure of from 200 to 274 and lived to be nearly a hundred.

Essential or primary hypertension is the most important type, being responsible for 15 per cent. of all deaths after the age of 50 years.* It is the principal factor in what I have called the *failing heart of middle life*. The most striking objective result of essential hypertension is enlargement of the heart. At times one finds the heart enlarged in the absence of valvular disease and of concomitant hypertension. In the majority of such cases we may infer that a hypertension existed previously but had disappeared.

I shall not discuss in any detail the theories advanced in

*Cardiovascular disease, and in this hypertension is the chief factor, causes four times as many deaths as cancer.

explanation of essential hypertension, because I should have to say after each one "not proved." A few points of interest may, however, be mentioned.

Hypertension is uncommon among the Chinese. Even foreigners living in China tend to have lower blood pressures (Foster [1]). Gunewardene [2] examined 200 Buddhist priests ranging in age from 30 to 80 years and found only one instance of real arterial hypertension. This striking difference between the oriental and the occidental has been attributed to differences in stature, muscular development, climate, habits of diet. But none of these nor all of them combined are sufficient to explain the difference. The greatest difference lies in their respective attitudes toward life. To the Buddhist priest the restlessness, the consuming ambition of the western business man is unknown and incomprehensible. He is never in a hurry, never runs, not even as Gunewardene says, if his robes caught on fire. His only concern is life after death or some metaphysical problem. The placidity of the Chinaman is proverbial.

Foster thinks that in the Chinese the widespread use of watermelon seeds which apparently contain a substance that depresses blood pressure may be another factor in the lower vascular tension of the Chinese.

Of etiologic factors often not sufficiently appreciated I want to refer to two.

1. The possible influence of psychologic disturbances both in causing permanent hypertension and in producing temporary rises above the patient's habitual level. Disturbances in the sexual sphere, frustrations, etc., mental strain from business or domestic worries, unsatisfied ambition—seem to be capable of raising the vascular tonus.

2. Heredity. That heredity is an influential factor in hypertension is easily demonstrated, but that is merely a statistical fact which offers no fundamental explanation. We do not know what genes transmit the tendency or where the point of attack is on the blood vessels—on the vasomotor mechanism or on the musculature of the vessels, or back of both, on one or more of the hormone-secreting glands. The problems are endless.

It seems logical to place the immediate cause of hypertension in the arterioles, in the precapillaries. What is the nature of the process in the vessels? The variability, the labileness of the blood pressure in essential hypertension, the absence of structural, that is inflammatory or degenerative, changes in the arterioles in hypertensive persons dying in the early stages of their hypertension, suggest that spastic constriction of the arterioles in a large vascular

bed such as the splanchnic area is the likely cause. For that reason I would make arteriolospastic and essential synonymous words.

Having carried essential hypertension back to the arterioles, to arteriolospasm, still leaves unanswered the question what is the cause of the spasm. It is most probably chemical or hormonal. It would, however, be an incomplete view of essential hypertension if we considered merely the angiospastic phase. The human system is an integration of innumerable quasi-independent mechanisms in harmonious relation, in homeostasis, to use Cannon's word, achieved by the self-steering of all the organs and tissues of body. If the neurovascular system shows evidence of disturbance as in hypertension, many fine adjustments are necessary to keep the body functioning. At any point in these interdigitating mechanisms a breakdown may occur. We are often unable to recognize the early signs of such a breakdown, one reason being that our thinking has hitherto been too anatomic and not enough physiologic. It is necessary to study many things. At one time the nervous control of the heart was considered the main element in cardiac contraction, until the myogenic theory gained preëminence. Perhaps we are at present giving too much prominence to the vasomotor mechanism and not enough to the intrinsic myogenic capacity for contraction and dilatation of the blood vessels.

Symptomatology. Essential hypertension may be symptomless for many years. It is often accidentally discovered during insurance or health examinations. As long as the heart is competent and able to counteract the resistance in front symptoms are minimal or absent.

The inaugural symptoms are mainly subjective—dizziness, headache, ringing in the ears, palpitation, slight dyspnea on effort, a sense of weight in the chest, nose bleed and irritability. Naturally these need not all be present. There may be only a single one in the beginning. The patient may ignore these symptoms or the unobservant doctor may overlook their cause, contenting himself with purely symptomatic treatment. Such patients eventually come under observation for more pronounced symptoms. These are most variable but are principally cardiac, cerebral, or gastric.

The cardiac manifestations are those of early congestive failure—subjectively, dyspnea, objectively, peripheral edema, basal pulmonary congestion or unilateral hydrothorax. These, especially the latter two, must be looked for, otherwise they will be overlooked.

A rarer symptom which might be called cardiopulmonary, is acute pulmonary edema, which has a tendency to recur at intervals and usually comes on at night. Air hunger, a sense of suffocation and fear of impending death, together with intense cyanosis, the

physical signs of pulmonary edema, and at times but not constantly the expectoration of blood-tinged frothy fluid are the characteristic symptoms.

An attack of angina pectoris or of coronary occlusion may be either an early or a late symptom.

If the patient presenting one or more of these symptoms is carefully examined the following conditions will often be found:

1. A high systolic and a relatively low diastolic pressure.
2. Cardiac enlargement.
3. Accentuated second aortic sound.
4. Often a systolic murmur at the aortic area.
5. In late stages a systolic murmur at the apex.
6. The radial vessels are usually soft but the temporal arteries are often tortuous.
7. Arcus senilis or annulus senilis.
8. There may be basal rales.
9. Hydrothorax, generally unilateral.
10. Edema of the shins and ankles.
11. Changes in the retinal vessels.

The electrocardiograph may show left axis deviation; in cases of long standing hypertension the degree of axis deviation may be marked, with prolongation of the QRS interval beyond the accepted top normal figure (0.1 second), due to increased conduction time through an hypertrophied ventricle. T_3 may be inverted and, according to Master, T_1 may also be inverted.

Many clinicians in speaking of the enlarged heart of hypertention use the term myocarditis. Strictly speaking this is not correct, for only rarely is there any evidence of inflammatory changes. Nevertheless, the heart muscle gives out. In order to get rid of the inappropriate myocarditis, I have proposed the word myocardosis as a generic term to imply a functional rather than a structural change.

Cerebral Symptoms. These are extremely interesting and important for the understanding of the morbid physiology of hypertension. As a rule the disturbances are transient—hemiplegia, aphasia, monoplegia—and are usually ascribed to local angiospastic states. In severe cases generalized convulsions may occur. They are often wrongly called uremic or epileptic. There may be no evidence of kidney damage and, setting in late in life, after fifty, they are not true epilepsy. Some speak of the condition as hypertensive encephalopathy; it is also called epilepsia tarda.[3]

During the convulsive seizure and in other types of encephalopathy, before the onset of the particular symptom there is usually

a sudden and abrupt rise in the systolic blood pressure, at times to 280 or even 300.

The focal symptoms mentioned above may last from a few minutes to 24 or 36 hours and may then subside without any residue. However, I have observed in numerous instances the persistence of one particular symptom, namely conjunctival anesthesia on the side that had been affected. I found this even in cases in which there had been no anesthesia of the general body surface.

Besides angiospastic complications hypertension may lead to thrombosis and to rupture of cerebral vessels, i.e., to apoplexy, which is a frequent but by no means the most frequent mode of death in essential hypertension.

The gastric symptoms of hypertension are the gastric symptoms of the myocardial weakness, the myocardosis, associated with it. In the majority of such instances the chief complaint is fullness and gaseous distension. Such a complaint by a person past 50 years who previously was free of digestive disturbances, is never to be treated lightly—it may mean the beginning of malignant disease or the failing heart of longstanding high blood pressure.

Diagnosis. It is important to make the diagnosis of essential hypertension in the early stages for the treatment will then be of most avail. A systolic blood pressure of 140 to 150 in an individual under 40 years is not to be ignored. Naturally it must be checked by several readings on different days so as to eliminate the factor of fear or excitement. A labile blood pressure showing wide swings from high to low is common in persons who later show a permanently elevated blood pressure.

The family history may be of significance. A history of hypertension, apoplexy, chronic heart or renal disease constitutes a background for hypertension in the descendants.

What shall be our criteria for the diagnosis of essential hypertension? As I view the subject these criteria are:

1. A persistently high systolic pressure.
2. A relatively low diastolic pressure.
3. Absence of disturbance of renal function.
4. Normal blood chemistry, that is as regards urea nitrogen and chlorides.
5. Absent or minimal eye changes.
6. A symptomatology trivial compared with the height of the systolic pressure.

At this point I might say something about prognosis, since due attention to that rather neglected phase of medical practice may

help us in dealing with our patients. I shall be somewhat dogmatic as unconditional statements are more useful, provided they are favorable, in quieting the patient's mind.

1. An individual can live to be 80 or even 100 years with high systolic blood pressure.
2. Women bear high blood pressure better than men.
3. The diastolic blood pressure is more important as a prognostic index than the systolic blood pressure. A low diastolic blood pressure favors relative longevity.
4. Good renal function—traces only of albumin or no albumin, a few hyaline casts, good concentration—is a favorable prognostic finding.
5. Moderate cardiac hypertrophy is not unfavorable.
6. Cerebral accidents even of apparently trivial nature as well as anginal pain and retinal hemorrhages are all ominous signs.

Treatment. The treatment of essential hypertension is psychologic. By that I mean that it must be addressed to the intelligence rather than to the stomach of the patient. Such treatment ought to be part of our general scheme of preventive medicine in the sense that we should know the vascular characteristics of our patients and of their children—the tubing as Osler called it. It certainly would give us valuable information if we were to examine the children of a man or woman in whom we had discovered high blood pressure—we might be able so to shape the lives of these persons as to guard them against hypertension in later life. To do all this means addressing ourselves to the minds of our patients and making them understand our aims.

We must assure our patients with essential hypertension of the comparative harmlessness of high blood pressure. To some extent we physicians have been responsible for making the laity blood-pressure-minded. A goodly number of patients have come to me all in a tremble saying, "Doctor, I've got blood pressure." When we can conscientiously do so we must relieve such persons of their anxiety.

Is it wise to tell the patient who has hypertension what his blood pressure is? Here the psychologic insight of the doctor and the general circumstances of the case must be the guide. My rule is this: If the patient is cooperative, then there is no need of his knowing his top figures. If he is uncooperative, then it may do good to tell him so as to scare him into good behavior.

Many hypertensive patients overwork, overeat, undersleep, and oversmoke. All these departures from the norm must be corrected. The man who takes to bed with him "the cares that infest the day"

must be educated in a better habit. Attention must be given to the sexual life in both sexes—not that we can often help, but we can better understand. In some cases we can actually help—by advising infrequency of coitus when dealing with patients having super-hypertension or with those approaching it.

Diet. Dietetics is the weakest subject in medicine. One can find authority for almost any conceivable diet for any human ailment. At one time it was customary in hypertension to give a salt-free, low-protein diet. Excepting in those who indulge in meat and salt to excess, such extreme restriction was of no particular value in reducing blood pressure. All it did was to make the patient's life miserable. Moreover, Vilhjalmur Stefansson has shown that one can subsist on an exclusive meat diet for a year without any elevation of the blood pressure. Yet that might not apply to one who by heredity was destined to have high blood pressure; for such a one a low protein diet may be wise.

I think physicians are generally agreed that quantity is more important than quality, especially if the patient is overweight as is so commonly the case. We serve our patients best by teaching them moderation.

Alcohol has been under suspicion but in my opinion unjustly. It is true many free drinkers are hypertensive but such men as a rule are also free livers. A little whiskey or a social glass of wine does no harm to the blood pressure.

With respect to tobacco, my opinion is quite different. I usually advise a minimal amount of smoking and if the patient has had cardiac pain, I as a rule forbid tobacco altogether.

The bowels need attention. The patient should have a regular, easy, daily movement or two movements without straining. If need be, he should take a laxative, such as mineral oil or compound licorice powder. Toxic symptoms—occipital headache and mental depression—are sometimes quickly relieved by a colonic irrigation but this is not needed with any great frequency.

I have found in particularly constipated people that a weekly dose of castor oil is helpful.

Exposure to the hot sun should be avoided.

Exercise within reasonable limits is permissible. The trouble is to find the "reasonable limit." Wading in a swift stream to catch trout or salmon involves not only a severe physical but also an intense emotional strain—more than is good for a hypertensive fisherman. A prolonged golf game in the hot sun is likewise fraught with risk. Then there are persons, usually bankers or captains of industry, who are given to violent home gymnastics—their

habits must be studied and modified to suit their cardiovascular condition.

Medicinal Treatment. There is no specific drug in our pharmacopeia that will permanently lower arterial blood pressure. Many have been recommended, all have been found wanting. Their very number is proof of what I have said. I have used bismuth subnitrate, potassium sulphocyanate, and various organic extracts. They have all proved unreliable. Does that mean we are powerless in dealing with hypertension? By no means. The best results are obtained with sedatives, particularly those of the barbituric acid group. Phenobarbital in one form or another is very useful. The bromides are also helpful. One can combine them with advantage with elixir phenobarbital. I also like chloral hydrate which in reasonable doses is perfectly safe.

When the pressure is high and the heart begins to labor or convulsions occur or acute pulmonary edema, venesection often brings about immediate and dramatic relief.

In women at the menopause it is perhaps rational to try some of the endocrine products. If one takes the words of detail men or of the pharmaceutic literature as gospel, then these are sovereign remedies. We need to know a great deal more about them before any such statements can be made.

When the pressure is abnormally high, in other words, in cases of superhypertension, one may give the nitrites. Of those I prefer for regular use erythrol tetranitrate in doses of 0.015-0.03 (¼ to ½ grain). In any emergency and when the patient has cardiac pain nitroglycerin under the tongue is the best remedy.

Roentgen-ray therapy has been used on the adrenals and on the pituitary gland, the latter on the theory that pituitary basophilism might be the cause of essential hypertension. The data are as yet insufficient for a definitive conclusion.

Physiotherapy, including diathermy, has been tried—personally, I have not seen much benefit from these measures.

Surgical Treatment. The general futility of medical treatment in established hypertension made the search for a surgical method altogether natural. A number of our bolder surgeons have devised procedures consisting in the main of cutting off the vasomotor supply to the abdominal arteries and arterioles. Theoretically this seems rational and can be attempted in various ways. It is not my present purpose to go into the history of this subject. Suffice is to say that the principal contributions are from the Mayo Clinic, from Adson and his coworkers, from the Crile Clinic, from Ann Arbor by Peet and his associates, and from the New York Hospital by

Heuer and Page. One of the first attempts made to treat essential hypertension surgically was that of George Crile, who about 1910 performed a unilateral adrenalectomy. The operation was followed by a temporary fall in the blood pressure which later rose again to the preoperative level. This temporary success led Dr. Crile to add to the unilateral adrenalectomy partial resection of the other gland. The blood pressure was affected somewhat more than by the unilateral adrenalectomy alone but it rose again to the disease level.

Crile next attempted to attack the function of the adrenal glands which he held responsible for the hypertension by denervating the glands in two stages. This had a better effect, the improvement or cure lasting in some cases as long as five years. But recurrences were still common. He therefore extended the operation to include resection of the larger, minor and least splanchnic nerves; but even then results were not what had been expected, so that another approach was chosen, namely resection of the celiac ganglion and denervation of the aorta. The results in twenty-five instances, chiefly cases of malignant hypertension, have been most encouraging. The operation can be performed under nitrous-oxide-oxygen anesthesia.

Adson and his colleagues at the Mayo Clinic have employed two operative procedures:

1. Extensive bilateral section of the ventral roots of the lower thoracic and upper lumbar nerves.

2. Extensive subdiaphragmatic sympathectomy, which includes the splanchnic nerves on each side as well as the two upper lumbar ganglia and biopsy or partial resection of the suprarenal gland. It is still too soon to draw definitive conclusions as to the value of these operations but from observations to date Adson, Craig and Brown [4] prefer the subdiaphragmatic splanchnic resection with removal of the upper two lumbar ganglia and resection of the suprarenal gland.

Page and Heuer [5] in 17 patients performed section of the anterior nerve roots. They conclude that although the operation has markedly improved the clinical condition of many of the patients studied for periods up to 2½ years, its ultimate value in the treatment of hypertension has not been established. In their most recent article [6] they offer no encouragement.

From reading reports about surgical operations for the cure of hypertension and from my own very limited experience and from reports given to me by my surgical colleagues at the University Hospital, I would conclude that surgery as at present practiced has

a long way to go before it justifies itself. But this does not preclude the possibility that some surgical method may be found that can be looked upon as curative. Perhaps we shall go through a stage similar to what occurred in the surgical treatment of hyperthyroidism. There was much criticism of the early operations. But that criticism has vanished before improved technic at operation and better pre- and postoperative care.

The pharmacologist, the biochemist, the clinician, must continue their intensive studies in the hope of finding the chemical agent that causes vascular spasm. Perhaps the Banting of hypertension has been born.

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HEMORRHAGES IN THE COURSE OF BRIGHT'S DISEASE, WITH ESPECIAL REFERENCE TO THE OCCURRENCE OF A HEMORRHAGIC DIATHESIS OF NEPHRITIC ORIGIN[1]

The occurrence of hemorrhage as a complication of Bright's disease has been familiar to clinicians since the days of Richard Bright (1827). But even before Bright, Latour,[2] in 1815, called attention to the coincidence of *epistaxis* and other forms of bleeding with dropsy, while the all-observing Morgagni, at a still earlier date, reported the case of a woman in whom, though she already had the odor of urine on her breath, vomiting of blood and bleeding from the nose proved beneficial. Rayer[3] was among the first to appreciate fully the significance of epistaxis as a symptom of Bright's disease. Naumann[4] cites the case of a young man who died in convulsions after having had repeated attacks of violent nose bleed, in one of which he lost as much as six pounds of blood. The autopsy showed enlarged and inflamed kidneys. While admitting that the hemorrhage in such cases might be purely accidental, Rayer was, nevertheless, of the opinion that it was more probably the result of an alteration of the blood consequent upon the derangement of the urinary secretion.

The close connection between Bright's disease and *cerebral hemorrhage* was strikingly shown in the classical paper of W. Senhouse Kirk,[5] while ophthalmologists have made us familiar with the frequency of hemorrhage into the eye in the course of nephritis.

These various forms of hemorrhage have been attributed, particularly by Huchard,[6] to vascular degeneration and hypertension; but the interesting studies of Schoenemann[7] seem to demonstrate that, as far as nose bleed is concerned, these are not necessary factors. He found after death numerous superficial hemorrhages into the mucous membrane of the nose. The number of peripheral capillaries, that

[1] Read at a meeting of the Association of American Physicians, Washington, D. C., May 7, 8 and 9, 1907.
Reprinted from the American Journal of the Medical Sciences, November, 1907.
[2] Quoted by Launois, Thèse de Paris.
[3] Traité des maladies des reins, I, 605.
[4] Quoted by Rayer.
[5] Medical Times and Gazette, XI, 515.
[6] Bull. et mem. Soc. méd. de hôp. de Paris, 1888, 3 s., V, 287-290.
[7] Arch. f. Laryng. und Rhin., 1901-2, XII, 437.

is, those near the epithelial surface, was increased; in many cases these capillaries had broken through the basal membrane, the capillary loops having forced their way through the basal epithelial cells. During life the capillary walls, as well as the epithelial covering, rupture, and the blood escapes upon the surface. Schoenemann did not observe these conditions in diseases other than nephritis. They cannot be regarded as the result of ordinary circulatory obstruction; the capillary walls themselves seemed normal in appearance, and the deeper vessels showed no degenerative changes, such as have been described in other parts of the body. Perhaps the changes are due to a circulating substance which penetrates by osmosis into the surrounding structures and weakens them and the capillary walls in such a way that they cannot resist the blood pressure.

That *metrorrhagia* may be a symptom of nephritis is not so well known, although several writers have called attention to it. Among the older authorities who mention it are Grainger Stewart,[8] and Lecorché.[9] Braun [10] reports two cases of metrorrhagia. Delbet [11] has recorded the case of a girl who died as the result of a profuse vaginal hemorrhage, in his opinion, dependent upon renal disease. Banifas,[12] in an intractable case of uterine hemorrhage in a woman, aged fifty-five years, saw an arrest of the hemorrhage under antinephritic treatment. Quite recently, Violet [13] reported three cases of profuse metrorrhagia, apparently caused by interstitial nephritis. He points out, as does Cumston,[14] the importance of recognizing the connection between metrorrhagia and nephritis, as otherwise improper treatment may be instituted. Ergot, in the opinion of both writers, is contra-indicated in such cases.

Hemorrhage from the lungs, as a manifestation of renal disease, is rare. Cases are recorded by Hawkins,[15] Fisher,[16] and Duclos,[17] and the subject is mentioned by Dickinson, Fuerbringer,[18] and Senator.[19] In Hawkins' case the hemoptysis continued for a year and two months, the autopsy showing cirrhosis of the kidneys. According to Duclos the hemoptysis, which is most frequent in old persons, is more often a precursor than an accompaniment or interstitial nephritis, and is due to sclerosis of the pulmonary vessels. The same cause

[8] Bright's Diseases, New York, 1871, 238.
[9] Traité de maladies des reins, 1875, 398.
[10] Quoted by Wieger (Launois, loc. cit.).
[11] Bull. soc. anat. de Paris, 1885, LX, 183-186.
[12] La Normandie médicale, 1898, XIV, 102.
[13] Lyon médical, 1904, CIII, 428-438.
[14] Buffalo Medical Journal, 1904-1905, 718.
[15] Trans. Clin. Soc., London, 1891-2, XXV, 237-242.
[16] Bristol Med.-Chir., Jour., 1904, XXII, 234-247.
[17] Rev. gén. de clin. et de therap., 1890, IV, 329; 345.
[18] Die Krankheiten der Harn-und Geschlechts-Organe, Braunschweig, 1904, 132.
[19] Nothnagel's Encyclopedia of Practical Medicine, American edition, Diseases of the Kidneys, etc., 227.

that produces these changes in the vessels of the lungs also acts upon those of the kidneys, and thus brings about interstitial nephritis.

Fisher, in addition to one case of hemoptysis, reports four cases of *hematemesis* associated with small, white kidneys. In explanation of these hemorrhages, he propounds an ingenious hypothesis, to which I shall refer later. Another case of severe gastric hemorrhage, in a nephritic patient of thirty, is reported by Bonifas.[20]

Hematuria, a common symptom of acute nephritis, or of the acute exacerbation of chronic nephritis, may arise in the absence of acute manifestations, as in the cases reported by Askanazy [21] and Kusumoto,[22] in which the hemorrhage occurred apparently from the engorged veins of the renal pelvis.

An interesting form of nephritic hemorrhage is that into the *ear*, of which Schwartze [23] has reported a case. Haug,[24] in an exhaustive paper upon this subject, collects a number of instances from medical literature, all of them examples of hemorrhage into the structures of the ear in Bright's disease. Alibert, in 1880, devoted a thesis to the subject of otorrhagia in nephritis. Hemorrhage into the tympanic cavity may occur even before other symptoms of nephritis are manifest. It thus has the value of an early or prenephritic symptom.

I should not fail to mention the fact that Dieulafoy [25] believes that auditory disturbances, such as tinnitus, partial or complete deafness, and otitis media are more frequent in the course of Bright's disease than disturbances of the eye. Pissot [26] found among 66 cases of chronic nephritis, 34 suffering from auditory disorders.

In addition to the isolated hemorrhages I have so far described, we meet in Bright's disease, with a true *hemorrhagic diathesis*, two cases of which have come under my own observation. In a sense, the term hemorrhagic diathesis is also applicable to those cases of epistaxis, metrorrhagia, etc., in which the hemorrhage is uncontrollable, and in which there is no local lesion to explain the bleeding.

Medical literature contains but few references to the hemorrhagic type of bleeding in its relation to Bright's disease. Avrad [27] saw a well-marked example in a case of scarlatinal nephritis. An incomplete report of a case was made by Imbert-Gourbeyer,[28] in 1856. Levi [29] reports two cases—one of parenchymatous nephri-

[20] Loc. cit.
[21] Zeit. f. klin. Med., Band LVIII, 432.
[22] Deut. Archiv f. klin. Med., 1907, Band LXXXIX, Heft 5 und 6, 405.
[23] Arch. f. Ohrenheilk., IV, 13.
[24] Deutsche med. Wochenschrift, 1896, 723.
[25] La France méd., 1877.
[26] Thèse de Paris, 1878.
[27] Gazette médicale, 1853.
[28] Quoted by Launois.
[29] Quoted by Launois.

tis with epistaxis and hemoptysis, terminating in recovery; and one of contracted kidney, with dropsy, hemoptysis, and epistaxis, ending in death.

Among systematic writers, Senator,[30] Fuerbringer,[31] Castaigne,[32] and Osler [33] mention hemorrhagic diathesis as a rare complication of nephritis. According to Wagner,[34] and to Senator,[35] the hemorrhagic diathesis sometimes precedes and is the cause of nephritis. More probably, however, the cause of the one is the cause of the other. A case of this nature is the one reported by George Johnson.[36] A man, aged thirty-seven years, was seized with epileptiform attacks, rigors, and pains in the limbs, followed by a purpuric eruption and general dropsy; the urine was albuminous, and contained epithelial casts and blood. Johnson believed that in this case, which terminated in recovery, the cutaneous eruption and the desquamative disease in the kidneys were primarily consequences of the poisoned state of the blood, and that the dropsy was a secondary result of the renal disease. A case analogous to Johnson's is reported by Girode.[37] Purpura hemorrhagica came on in the course of a chronic diffuse nephritis in an eight-year-old boy. The hemorrhages occurred very early in the disease, and suggested a common, infectious origin for both the purpura and the nephritis.

Samuel Gee [38] briefly mentions three interesting cases of purpura in children in association with nephritis. The onset was marked by diarrhea, with blood in the stools; in two cases there was also vomiting. The purpura occurred in repeated accesses, but finally ceased, although the albuminuria persisted. These cases remind one of the erythema group so exhaustively described by Osler; in all probability they belong to it, and it is a fair assumption that the purpura, the diarrhea, and the renal disturbances were all dependent upon one and the same infectious or toxic agent.

The history of the two cases that have come under my observation is as follows:

Case I.—J. S., male, aged thirty years, a Russian tailor, was admitted to the Polyclinic Hospital on March 21, 1904, in the service of my colleague, Dr. Schneidemann, with a severe inflammation of the eye. The patient, whose family history was negative, had had no other illness, aside from measles in infancy, except two previous attacks of nephritis: the first seven years before, characterized by swelling of the feet, and, the second, two

[30] Loc. cit.
[31] Loc. cit.
[32] Manuel des maladies des reins et des capsules surrénales, 1906, 268.
[33] Practice of Medicine, sixth edition, 669 and 743.
[34] Quoted by Senator.
[35] Loc. cit.
[36] Diseases of the Kidneys, London, 1852, 152.
[37] Arch. de physiol. norm. et path., 1887, 3 s., IX, 478-485.
[38] St. Bartholomew's Hospital Reports, 1880, XVI, 47.

years later, in which the face was chiefly swollen. The third had begun three weeks before, with swelling of the face; but he was able to work until a few days prior to his entrance into the hospital. When admitted he was found to be pale and poorly nourished; the face was swollen, more particularly around the chin, the left eye, and the left malar and temporal regions. The left eye was inflamed and reddened, and the conjunctiva chemotic. The right eye was painful on palpation, and its tension seemed increased. The heart was enlarged, the apex beat being in the sixth interspace in the nipple line; the first sound was muffled; the second much accentuated, with a tendency to reduplication; the radials and temporals were thickened. A blood examination showed: red blood corpuscles, 2,350,000; white blood corpuscles, 15,200; hemoglobin, 50 per cent., with a differential count as follows: polymorphonuclears, 78; small mononuclears, 13; large mononuclears, 4.5; eosinophiles, 3; transitionals, 1.5. There was no ascara; no ascites; no edema of the legs; no enlargement of the spleen.

Dr. Schneidemann made a careful examination of the eyes and reported as follows: "When the man came in he had redness and great edema of both eyelids. Conjunctiva highly congested and chemotic; not tense, but relaxed and folded on itself. The lower conjunctiva was everted, and the upper slightly from the swelling; the motility of the eyes was somewhat impaired, especially outward. The right pupil was moderately dilated, larger than the left, and immovable. Cornea was insensitive. Anterior chamber was extremely shallow. Iris nearly in contact with the cornea; tension + 2. A dull fundus reflex; but no details could be obtained. The edema, mentioned above, extended to the region over the malar bone. On account of the man's condition, the functional testing of the eye for vision was unsatisfactory. There seemed to be some, but rather uncertain, perception for large objects. The patient complained of headache around the orbital, temporal, and malar regions."

On March 24 the patient began to bleed from the mouth, and on examination a carious tooth was found, which was thought to have caused a wound in the cheek; but, although the ragged edges of the tooth were broken off and styptic applications were made to the cheek, the bleeding continued. On account of the eye trouble, a leech was applied to the right temple; when it dropped off, there was free bleeding from the wound, a collodion dressing being required to check it.

On the 26th the patient had a convulsion, following which he was bled to the amount of fifteen ounces. After the venesection, he received an intravenous injection of 1200 c.c. of salt solution. Despite this, he had another convulsion on the same day.

On the 29th, a hemorrhagic suffusion appeared on the right side from the third rib to the costal margin, and a few purpuric spots were seen on the right arm. No history of an injury could be obtained, except the hypodermoclysis, which he had had three days before.

On the same day he began to have hiccough, and gradually passed into a stuporous condition.

The ecchymosis on the right side became more extensive, and the spots on the right arm increased in number. Blood was running constantly from the mouth, and the breath was very fetid. The urine contained a large amount of albumin (1.5 parts in 1000), red blood corpuscles, and granular and hyaline casts.

On the 31st, a systolic murmur appeared, its area of maximum loudness

in the third left interspace. Despite active treatment in the way of hot packs and stimulants, the pulse gradually grew weaker, and on April 1, eleven days after admission, the patient died. No autopsy could be obtained.

Case II.—W. D., tavernkeeper, aged fifty-five years, born in Philadelphia, was admitted to the Jewish Hospital, September 2, 1904. He had never been ill, and denied drinking to excess. He attributed his trouble, namely, hemorrhages from the mouth and bowels, which had begun eight weeks before, to having neglected his own health in attending to his wife while she was suffering from an attack of pneumonia. When admitted to the hospital he was stuporous and delirious, and in evident uremia. The breath was urinous, and according to the history obtained, he had voided no urine for forty-eight hours. The mucous membranes were pale; the tongue and teeth covered with recent blood clots; the heart sounds clear; pulse slow and feeble; pupils widely dilated. There was no ascites; no enlargement of the abdominal veins. The urine, which had to be drawn, had a specific gravity of from 1010 to 1012; contained albumin, and red and white corpuscles. Blood examination showed: red corpuscles, 4,440,000; white corpuscles, 6680; hemoglobin, 55 per cent.; differential count: polymorphonuclears, 83 per cent.; lymphocytes, 9.6 per cent.; mononuclears, 4.7 per cent.; eosinophiles, 0.6 per cent.; transitionals, 2 per cent.

The man died in a convulsion on September 10, 1904; the bleeding having continued to the end. There were no purpuric spots upon the surface. The autopsy revealed marked anthracosis of the lungs; a moderately enlarged heart without valvular lesion, and a smooth liver of normal size. The kidneys were enlarged and covered with small cysts; the capsule stripped with difficulty. On section, the kidney showed an almost total absence of cortical substance and marked fibrosis; the cut surface bled freely. The pathologist thought that the condition was one of acute exacerbation of a chronic, diffuse nephritis. The gastrointestinal tract and urinary bladder were normal.

There are four ways in which one may interpret the relation of the hemorrhagic diathesis to renal disease:

1. The hemorrhagic diathesis may be an accident; that is, an independent affection not casually related to the nephritis. This would obtain in such cases in which a septic infection, as, for instance, ulcerative endocarditis, coexisted with the renal disease and caused the hemorrhagic state.

2. The hemorrhagic diathesis may be the cause of the nephritis. Cases of this type, as has been previously stated, have been observed by Wagner and Senator. It might be difficult, however, to prove in a given instance that the third explanation does not better apply.

3. The two may be due to the same cause. This relation of the two conditions is fairly clear in a number of cases in the literature, notably those of Johnson, Gee, and Girode, already cited.

4. The renal disease may be the cause of the hemorrhagic diathesis. This is the explanation I would give for my own cases, and is the group to which I especially desire to call attention.

The question arises, in what particular way does the nephritis

cause the hemorrhagic diathesis? Several possible etiological factors suggest themselves: (1) Hypertension; (2) arterial disease; and (3) toxemia.

The first and second are important factors in the ordinary types of nephritic hemorrhage. In all probability they are a sine qua non; but they are not of themselves sufficient to cause a true hemorrhagic diathesis, for the production of which another element, presumably a toxin, is necessary. Flexner's [39] studies on the effects of snake venom have shown the existence of substances, by him termed hemorrhagins, that are capable of causing hemorrhagic extravasations through a destructive action upon the capillary endothelium. Toxins with analogous properties may, as Fisher [40] has suggested, be present in the blood in nephritis. The hypothetic poison, whatever it may be, in addition to acting upon the vessel walls, may also impair the integrity of the blood—an impairment similar to that found in chronic jaundice.

Quite recently, Friedman [41] found in the pancreatic juice a powerful hemolysin possessing the property of dissolving homologous red corpuscles and causing hemorrhages. In health it is neutralized by a protective substance; but we may conceive conditions—among them Bright's disease—in which this substance fails to act. In its power to cause hemorrhage and paralysis, the poison of the pancreas resembles crotalus venom.

Prognostically, nephritic hemorrhages of every variety constitute a sinister omen; the hemorrhagic diathesis in particular seems to presage an early death. It is evident that in every obscure case of hemorrhagic diathesis, as well as in cases of apparently causeless bleeding from mucous surfaces, the possibility of a renal origin should be borne in mind.

Conclusions

1. Bright's disease may cause hemorrhage from the nose, uterus, lungs, and stomach; hemorrage into the brain, eye and ear; and also a more or less well-marked hemorrhagic diathesis.

2. The last-named condition is characterized by bleeding into the skin and from the mucous membranes.

3. The true cause of the hemorrhagic diathesis is unknown; but it is probably a toxin analogous to the hemorrhagins of snake venom.

4. In the other types of bleeding, arterial disease and hypertension are the chief factors.

5. The prognosis in all cases of nephritic hemorrhage is unfavorable, and generally hopeless when the hemorrhagic diathesis exists.

[39] Amer. Jour. Med. Sci., 1903, 202.
[40] Loc. cit.
[41] Deutsche med. Wochenschr., 1907, Nr. 15.

DISEASES OF THE LUNGS

ALBUMINOUS EXPECTORATION FOLLOWING THORACOCENTESIS [1]

Tapping of the chest for the removal of fluids is ordinarily such a simple and safe procedure that the possibility of serious accident scarcely ever enters the physician's mind. This feeling of security is of decided advantage, inasmuch as it insures a desirable confidence and makes resort to aspiration more prompt and more frequent than was the custom among our predecessors, by whom the gravity of the operation was greatly magnified—so much so, indeed, that many patients died for the want of timely tapping.

The knowledge that accidents may occur is not, however, a real handicap; it merely serves to make us more circumspect in performing the trifling operation, and renders us unsurprised and ready when untoward circumstances arise.

It is not my purpose to review all the complications that may accompany or follow tapping of the chest, such as syncope, pulmonary and other forms of embolism, convulsions, etc. These are adequately dealt with in the articles and works of Leichtenstern, Foucart, Dandridge, and Wilson Fox. I merely intend to give an account of one particular complication, which, although exceedingly rare, has in the past aroused remarkable interest, viz., albuminous expectoration. A survey of the literature shows that this was first described by Pinault in 1853. His patient was a man, aged thirty-four years, who had been suffering for three months with left-sided pleural effusion. Three liters of fluid were removed by tapping, with instant relief of the dyspnea. In the evening of the same day, however, the shortness of breath returned, mucous rales appeared over the chest, and the patient began to expectorate large quantities of an albuminous fluid, bringing up two cuspidorfuls (about a pint). Cases were subsequently reported by d'Espine, in 1869; by Woillez, in 1872; by Marrotte, in 1872; by Behier, in 1872; and by Lande, in 1873. The entire subject was thoroughly reviewed in 1873 by Terrillon, who collected twenty-one observations, including his personal cases, with two fatalities.

Very little attention was bestowed upon the condition outside

[1] Read before the College of Physicians of Philadelphia, Dec. 4, 1901.
Extracted from The American Journal of the Medical Sciences, April, 1902.

of France, yet it is of great interest to note that one of the first publications made elsewhere was that of Dr. William Pepper, in 1874. In a case of hydrothorax seen with Dr. T. J. Yarrow, of Philadelphia, Dr. Pepper withdrew by aspiration seventy-five ounces of serum. A troublesome cough followed, but was relieved by deodorized tincture of opium. The expectoration set in eighteen hours after the tapping, and continued for twenty-four hours, the patient bringing up three gills of fluid altogether. This fluid closely resembled that removed from the chest. A dangerous syncopal attack, from which the patient was aroused by stimulants, occurred six or seven hours after the operation.

In 1873 the subject of albuminous expectoration formed the theme of a heated discussion in the Société Médicale des Hôpitaux in the Académie de Médecine. This was at the time when, through the efforts of Dieulafoy and Potain, in France, and Bowditch, in this country, aspiration was coming into use, and, as a novel method of procedure, had its advocates and opponents. This discussion stimulated the publication of numerous cases and of opinions on the etiology of the condition, and the French literature of the period contains a large number of reports, among others those of Prévost, Dujardin-Beaumetz, Moutard-Martin, Féréol, Hérard, Desnos and Drivon, and that of Laboulbène, who was one of the first to give a careful analysis of the expectorated fluid. Cases were also reported by Dieulafoy, and later by Hayem and Tissier, and others.

In the German literature I was able to find but three cases—those of Kredel, Schütz, and Scriba, although Leichtenstern, in the article already referred to, makes comprehensive reference to the condition. Strümpell also mentions it.

In England a full report of the French discussion was published by Labbée in the *British Medical Journal* in 1873, and some observations were recorded by Johnson and by Duffin. A clear account of the subject was given by Wilson Fox in his monumental work on *Diseases of the Lungs and Pleura.* The first case reported in detail seems to have been that of Gee, in 1886. A brief and interesting report of a case had been made, however, by Fraser, in 1876. West, Haviland Hall, and Hale White published cases in 1896.

In American literature, aside from the case of Dr. Pepper, I have found scarcely any reference to the subject; Bowditch was aware of the condition, but I was unable to find his original publication. Systematic writers, such as Donaldson, Osler, and Whitney, refer to the subject.

The history of the case which I have had the opportunity of observing is as follows:

Miss J. R., aged forty-eight years, born in Philadelphia; was always healthy, except for sick headaches, from which she suffered all her life, until a year ago, when, at about the time of the menopause, they disappeared. Her mother died of dropsy at the age of sixty-two; her father is living and healthy; two sisters died at the ages of twenty-two and twenty-four years, respectively, of unknown causes, but not, it is stated, of lung trouble; an aunt died of consumption.

A year ago, at the climacteric, she began to suffer with shortness of breath and puffiness of the face and neck. She has had occasional slight cough for the past six months. From time to time she would have intense attacks of dyspnea and orthopnea, particularly upon slight exertion. At no time did she have any fever or any severe pain in the chest. Her appetite has always been poor, and for some time she has had slight difficulty in swallowing. Her bowels were at first constipated, but now are regular. She has been under medical treatment throughout the year of her illness. The diagnosis at first was nervousness dependent upon the change of life; more recently she has been treated for emphysema of the lungs.

Upon examination, in November, 1901, I found her to be a large, fairly well-nourished woman, with cyanosis and puffiness of the face. She was sitting up in bed and breathing rapidly and with great difficulty. The openings of the sebaceous ducts all over the face were unusually large, the lips blue, the sclera dark and cyanotic. The neck was greatly enlarged, and all the natural depressions, particularly those above the clavicles, were obliterated. Above the inner end of the right clavicle a large and hard gland could be felt. The chest was crossed by large veins, especially on the right side, above and below the breast. Resonance was impaired on the right side from the clavicle down to the liver, dulness and resistance being more marked above than below, and extending over, behind the manubrium, to the left border of the sternum. There was some tenderness on percussion near the right apex. Posteriorly there was dulness, but not flatness, at the right base, and some tenderness on percussion. Tactile fremitus was almost absent at that point. Auscultation revealed inspiration and expiration to be equal in length, and harsher over the right side in front than over the left. Posteriorly breathing was quite distinct over both lungs, inspiration being a little harsher on the right side than on the left, and expiration just below the right scapula having a distinct bronchial quality. Vocal resonance was well marked over the right side, and had a slightly twangy character. The heart did not seem to be enlarged; the apex-beat was not palpable; there was no murmur, and the sounds were not abnormal. The temperature was 97.8° F.; the pulse 108. There was a small amount of clear, tenacious sputum, which did not contain any tubercle bacilli.

The existence of the impaired resonance, diminished tactile fremitus, distant bronchial breathing, and twangy vocal resonance led me to suspect the presence of fluid; and on my second visit I made an exploratory puncture and withdrew a syringeful of clear serum. On the following day, November 11th, at noon, I tapped in the seventh interspace, postaxillary line, and by means of the aspirator drew off three pints of a somewhat turbid, yellowish fluid, frothing readily. After a little less than a quart had been removed the patient began to cough. At first the cough was dry, but toward the end of the tapping a little frothy fluid was brought up. The patient seemed to be dyspneic and became blue in the face; and, as the cough grew more intense, I suspended the tapping and administered a

small dose of morphine. As she did not seem to grow any worse under observation I left her at 12.30 P. M. and saw her again at 6 P. M. During this interval she had expectorated about five ounces (160 c.c.) of a turbid, amber-colored fluid, covered with a layer of froth half as thick as the fluid itself, containing a few streaks of blood and some flocculi. The cough had not diminished to any great degree, but the expectoration had gradually lessened. The patient was very much more comfortable than she had been for a long time. The difficulty in swallowing had disappeared, and there was good resonance over the right lung.

Unfortunately, the chest filled up again, and I had to aspirate a second time, on November 24th, this time drawing off about a quart of fluid. There was again intense cough, but no true albuminous expectoration, only a little tenacious sputum. At the last examination, made today, I found the chest again full to the top. The dulness behind the sternum has increased in intensity and in extent, reaching now about two inches beyond the left sternal border, and fusing on the right side with the dulness of the fluid. A large, hard gland has also appeared above the left clavicle. The signs are sufficient to warrant a diagnosis of tumor to the anterior mediastinum, probably sarcoma, which is encroaching upon the right lung and compressing the veins that return the blood from the right pleural cavity.[2]

The *aspirated fluid* was of a turbid amber color and frothy. It coagulated upon standing, the clot floating at some distance from the bottom. The circumambient fluid was clear, straw-colored, and not gelatinous. It coagulated into a moist, solid mass upon boiling, had a specific gravity of 1021, was faintly alkaline in reaction, gave the biuret test, was free from sugar, and did not form a precipitate with acetic acid. The amount of albumin present with Esbach's albuminometer was 4.5 per cent. The total solids obtained by evaporating, thoroughly drying in the water oven, and standing for twenty-four hours in a desiccator, were 6.8 per cent.

The *expectorated fluid* was of a turbid amber color, was covered with a layer of froth to the amount of about half the thickness of the fluid itself, and had a thin sediment of blood. It was gelatinous, like white of egg, and coagulated upon boiling into a solid mass. The specific gravity was 1018, the reaction neutral, the biuret test positive. There was no sugar. Chlorides were present, and acetic acid produced a distinct precipitate. The albumin amounted to 3.5 grammes with Esbach's albuminometer; the total solids were 5.84 per cent.

As the terms albuminous, albuminoid, and seroalbuminous imply, the expectoration consists of a richly albuminous or serous fluid. It is viscid, frothy, neutral or faintly alkaline, and of a yellowish or amber color, contains a little blood, and is coagulated upon boiling and by nitric acid. As a rule, it closely resembles in appearance the chest fluid. Acetic acid, as in my own case, usually gives a precipitate, suggesting the presence of mucin. Urea, hemoglobin, and the salts characteristic of serum are present. Urobilin has also been found.

The expectoration seldom sets in during the paracentesis, but

[2] The chest was aspirated for the third time on December 6, 1901, and more than three pints of fluid were withdrawn. A severe, spasmodic cough ensued, but no albuminous expectoration.

Addendum. The patient died on December 19, 1901, and at the autopsy a sarcoma of the anterior mediastinum was found.

generally after an interval of from a few minutes to half an hour. In rare instances the interval has been prolonged to two hours, and in the case reported by Pepper it was apparently eighteen hours. During the interval the patient generally enjoys a marked feeling of comfort, which is suddenly terminated by dyspnea and cough. Sometimes the latter begins before the tapping is finished. The cough rapidly becomes more intense, and expectoration increases, the patient at the same time experiencing a terrible sense of oppression, which compels him to sit up in bed. The breathing is intensely labored, the face deeply cyanosed and very anxious, the skin clammy, the pulse rapid and weak. Auscultation reveals the characteristic coarse and fine moist rales of pulmonary œdema.

In mild cases these symptoms subside gradually, the expectoration ceasing after several hours; sometimes, however, not until a day has elapsed. In extreme cases the fluid gushes from the mouth and nose in a constant stream, the patient suffering the most agonizing dyspnea, and not infrequently dying of asphyxia—drowned, as it were, in his own juices. The amount expectorated varies with the duration and the intensity of the attack; not rarely as much as a pint or even a quart is brought up in the course of one or two hours. Gee's patient expectorated a liter in two hours; Schütz's a total quantity of 1500 c.c.

The duration of an attack is, as a rule, from one to two hours, but in some cases it has been six, twelve, twenty-four, and even forty-eight hours.

On standing, the fluid generally separates into three layers; the upper, whitish and frothy; the middle, opalescent and yellowish; the lower, denser and more viscid and containing a few whitish flocculi. In my own case there were but two layers on standing; an upper, frothy layer, and a lower stratum, twice the thickness of the upper, of opalescent fluid.

Analysis of the Fluid. I have already detailed the analysis in my own case. For purposes of comparison I give below the few analyses of the pleural and expectorated fluids that I was able to find in the literature. Many are incomplete.

1. Terrillon's case: The pleural fluid contained 1.61 per cent. of albumin; the expectoration, 1.42 per cent.

2. Foucart states that the total solids in the pleural fluids were 7.5 grams per liter; in the expectoration they were 100.3, the albumin being 93.6 and the mineral salts 6.7.

3. Daremberg and Dujardin-Beaumetz: a. *Pleural Fluid.* Specific gravity, 1020; albumin, 66.88 grams per liter; urea, 0.58 grams per liter; hematoidin crystals, biliverdin, and a notable quantity of

mucosin. b. *Expectoration.* Specific gravity, 1010; albumin, 1 gram per liter; urea, 2.36 grams per liter; cholesterin and fat.

4. Drivon: a. *Pleural Fluid.* 945.28 parts water, 54.72 parts solids. Of the solids there were albuminoids 48.28, divided as follows: Albumin, 25.69; hydropsin, 22.59; mucosin, a trace; salts, 6.44 per cent. b. *Expectoration.* 976.86 parts water, 23.14 parts solids. Of the solids there were 15.87 parts organic and 7.27 parts salts.

5. Laboulbène: a. *Pleural Fluid.* Specific gravity, 1020; total solids, 65 grams per kilogram. Of this 0.678 were fibrin; 7.5 mineral matter. b. *Expectoration.* The dry residue varied from 16.47 to 24.60 on different days; the mineral matter from 3.53 to 7.8. The albumin was not estimated in the expectoration.

6. Besnier merely states that the quantity of albumin in the expectoration was double that in the effusion.

The analyses, it is seen, show enormous variations among themselves. In some cases the two fluids differed widely; in others they resembled each other very closely in composition. Regarding hydropsin, which, according to Drivon, is a substance characteristic of serous membrane exudates, I was unable to find any reliable data. Its existence is not recognized by physiological chemists of the present day.

Albuminous expectoration occurs especially after tapping in cases of acute effusion, although in my own case the effusion was unquestionably chronic. It has taken place with both left-sided and right-sided exudates and transudates. Of thirty-two cases the effusion was left-sided in eighteen, bilateral in four.

An important point, to which reference will again be made, is that in the majority of instances, the amount of fluid withdrawn was inordinately large; and usually, but not invariably, the withdrawal was rapid. In some instances the simple trocar was used; in others, the aspirator. Thus there were withdrawn in the case of Woillez, 5500 c.c.; in that of Marrotte, 5000 c.c.; in Lande's two cases, 3000 c.c. and 1800 c.c., respectively; in Pinault's, 3000 c.c.; in one of Besnier's, 2600 c.c.; in Pepper's, 2400 c.c. Prévost tapped several times in the same case. At the first tapping he withdrew 1000 c.c., and there was no albuminous expectoration; at the second, 3000 c.c. were withdrawn, and the expectoration followed. Subsequent punctures were not attended by any complication. In Schütz's case 2000 c.c. were removed.

In the majority of cases complicating conditions of various kinds existed and probably played a part in the production of the phenomenon. Lande believes that the danger of albuminous expectoration is particularly to be feared when the conditions on the

opposite side are such as to lessen the play of the other lung. At *autopsy* the principal change is an edema of the lung on the affected side; sometimes of both lungs. In cases in which the pleural effusion was of the nature of hydrothorax, heart disease was found. Scriba's case is of interest because at the autopsy a fibrinous coagulum was discovered plugging the bronchi. In the case of Hayem and Tissier there was adherent pericardium.

Various theories have been advanced in explanation of the curious phenomenon of albuminous expectoration. Terrillon classifies them as follows:

1. Perforation of the lung by the trocar.
2. Spontaneous rupture of the lung.
3. Absorption by the lung of fluid remaining after the tapping.
4. Pulmonary congestion, with intense edema.

The first three assume that the fluid expectorated is a portion of the pleural exudate; the last, that it is a transudate from the blood vessels of the lung.

I. **Perforation of the Lung.** The identity in appearance of the two fluids and the analogy in composition, which latter, however, is not constant, suggest this view, which was first propounded by Woillez and Marrotte, and was held by Scriba and others. I may also say that when I examined and compared the two fluids in my own case I was at first inclined to this theory; but against such an interpretation are the following weighty arguments:

1. The absence of pneumothorax, which should be present if the lung has been punctured by the trocar.
2. The late onset of the expectoration. If connected with perforation of the lung it ought to set in at once, and not after an interval of half an hour or more from the time of tapping.
3. The absence of hemoptysis.
4. The fact that albuminous expectoration has occurred especially in cases in which the effusion was very large, and the lung, of necessity, far away from the chest wall.
5. The large amount of expectoration. It is hardly conceivable that a pint or a quart of fluid could, in a short space of time, pass through such a small opening as would be made by the point of a trocar.
6. In some instances the expectoration occurred several times in the same case. Thus the patient whom Behier tapped four times had albuminous expectoration each time; and in the patient of Gee every one of three tappings was followed by albuminous expectoration. It is unlikely that the lung in these cases was punctured so many times. Moreover, both writers state that, warned by their

first experience, they afterward tapped with the greatest care, so as to avoid wounding the lung.

7. In none of the fatal cases was any perforation of the lung found post-mortem. This, to be sure, is not an argument of great force, for it is proverbially difficult to discover perforations in cases of pneumothorax and of empyema rupturing into the lung; but, on the other hand, the argument is not to be held too lightly, since, death being so much more prompt in albuminous expectoration than in pneumothorax or empyema, the chances of finding a perforation should be better.

II. **Spontaneous Perforation of the Lung** is the view defended particularly by Féréol. The excessive rarity of serous effusions perforating into the lung is against this. Furthermore, there is no reason why it should occur just at the end of tapping; and this, together with the non-development of pneumothorax, the failure to find the perforation at autopsy, and the absence of the auscultatory signs of pleurobronchial fistula is sufficient to dispose of this theory.

III. **Absorption of the Fluid in the Lung.** This is an illogical view, for it must at once be apparent that the absorption or sucking up of the fluid through the stomata of the lung would cause it to enter the lymphatic system and not the bronchi.

IV. **Pulmonary Edema.** This theory was first advanced by Pinault and was strongly advocated by Behier. It is the one adopted by Pepper, West, and most recent writers. In support of it we have the following arguments:

1. The onset of the expectoration a little while after the tapping is completed.

2. The physical signs of edema—crepitant and subcrepitant rales—are present.

3. Edema of the lungs is the chief lesion found in those organs at autopsy.

4. The occasional development of albuminous expectoration in the absence of pleural effusion. Thus Foucart reports a case in which it occurred in a patient with heart disease without pleurisy, and Woillez observed it twice in emphysematous asthma and once in aneurysm of the aorta. In his cases the expectoration did not contain any mucin.

5. The occurrence of the phenomenon after tapping in empyema, as in the case of Fraser. The rarity of albuminous expectoration after the evacuation of a pyothorax has been well explained by Curtin, who ascribes it to the fact that, owing to the thickness of the fluid, the abstraction is necessarily slow.

6. The chemical composition of the two fluids tells both for and against the edema theory, inasmuch as the fluids sometimes differ and sometimes appear to be almost identical; but, as it is not possible to discover any clinical difference between the two groups of cases, it is fair to assume that, even when the expectorated fluid most closely resembles that from the pleura, its origin is the same as when it differs the most widely.

7. In the majority of cases in which albuminous expectoration occurred the amount withdrawn was excessively large; in many instances, but not in all, the withdrawal was also rapid.

8. As stated by West, theoretical grounds are in favor of this view. The compressed lung is suddenly released from pressure, and there is naturally a great afflux of blood. A congestion follows, for which I should like to propose the name of *congestion by recoil.* It is true that it has been shown that an increase of pressure in the pulmonary circulation is not alone sufficient to produce edema; but we have in the condition here considered more than mere pressure—we have vessels that, by reason of their prolonged compression and the altered circulatory conditions, suffered a change in their walls, on account of which they are rendered more permeable. A transudation occurs into the air vesicles, which finds its way into the bronchi, and is expectorated. It is possible that the negative pressure exerted upon the heart by the expanding lung, intensifying the diastolic relaxation of the organ, and thus embarrassing its action, is a factor in the production of the phenomenon. This negative pressure effect was first adduced by Dr. Mary Putnam-Jacobi in explanation of the sudden syncope sometimes following thoracocentesis. Lande was of the opinion that the edema was due to the irritation of the air rushing into the expanding lung, while Johnson believed that it was favored by the existence of thrombosis in the vessels, the result of the long-continued compression and stagnation of the blood. This, however, is not tenable, because such a thrombosis would produce infarction, and of the existence of this there is no evidence in cases of albuminous expectoration. Duffin's view of a vasomotor paralysis of the vessels, in consequence of the prolonged compression, is not unreasonable, and helps to account for the congestion; but whether it be through a paralysis or through a nutritional change in the vessel walls, there is, in either case, a relaxation and a sudden afflux of blood to the expanding lung. The subsequent event—the transudation of serum—is best explained on the assumption of an alteration in the walls of the capillaries and small veins, such as Cohnheim has assumed follows prolonged compression.

Treatment. The cough is usually so intense that, despite the apparent contraindication of the drug, morphine cannot be dispensed with, at least in the severer cases. It is advantageously combined with atropine. Counter-irritation, in the form of mustard or dry cups, should also prove of value. Artificial respiration and venesection suggest themselves as theoretically beneficial. The former has had a practical trial in one case, without avail; the latter, so far as I have been able to determine, has not been employed.

Conclusions. 1. Albuminous expectoration is a very rare complication of thoracocentesis. It is usually serious and sometimes fatal.

2. It consists in the expectoration of a viscid albuminous fluid closely resembling the fluid of serous effusion.

3. The condition is best explained on the basis of an intense congestion and edema of the lungs (congestion by recoil).

4. The principal cause seems to be either too rapid or too great a withdrawal of fluid.

5. Serious cardiac disease and morbid conditions of the opposite lung, hindering expansion, are predisposing causes.

6. Under all circumstances, but particularly when these complications exist, aspiration should be performed slowly. If the effusion is large the amount withdrawn at any one time should be moderate.

7. In some cases it may be wise to perform several tappings, drawing off a small quantity each time.

8. The treatment consists in counter-irritation, venesection, and artificial respiration, together with the use of morphine if the cough is severe.

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ACUTE PULMONARY EDEMA, WITH SPECIAL REFERENCE TO A RECURRENT FORM [1]

The edema of the lungs to which I desire to call attention is not that so commonly seen in the period of lost compensation of valvular or muscular heart disease, in cachectic states, in grave infectious diseases, or in acute and chronic nephritis in the terminal phase. It bears no relation to subcutaneous dropsy, and in typical cases is not associated with it. In the suddenness of its onset, in the alarming character of its symptoms, and in the mortal peril in which it places the patient, acute pulmonary edema resembles angina pectoris, and deserves, with equal propriety, a separate place in our text-books. Those who, interested in the subject, look through the text-books and encyclopedias of medicine will be astonished to find how little mention is made of acute edema of the lungs or, for that matter, of pulmonary edema in general.

History. Laennec,[2] in 1819, alluded in his chapter on edema of the lungs to a suffocative orthopnea that sometimes carries off children after an attack of measles, and considered it an idiopathic anasarca of the lungs.

Andral,[3] in his commentary to the fourth edition of Laennec's *Traité de l'Auscultation médiate*, clearly describes acute pulmonary edema, and compares it with edema of the glottis; but neither in this commentary nor in his own *Cours de Pathologie interne*[4] does he speak of the causes. He recognizes three forms of edema: (1) A fulminant form (forme suraigue), in which the patient is suddenly seized with an intense dyspnea that in a short time causes death; (2) a subacute form, in which the dyspnea, though sudden in onset, lasts somewhat longer before death ensues; and (3) chronic edema, which does not concern us at the present time.

Legendre,[5] in 1846, speaks of an acute pulmonary edema occurring during the course of scarlet fever.

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[1] Read in abstract at the meeting of the Association of American Physicians, Washington, D. C., May 15 and 16, 1906.

Extracted from the American Journal of the Medical Sciences, January, 1907.

[2] Treatise on Diseases of the Chest and on Mediate Auscultation, 1830, p. 179.

[3] Laennec's Traité de l'Auscultation médiate, 4ième édition, par Andral, t. xi, p. 424.

[4] Cours de Pathologie interne; 4ième édition, 1842, p. 123.

[5] Œdeme aigue du tissue cellulaire de poumon à la suite de la scarlatine, quoted by Fouineau.

Rokitansky,[6] like Andral, compares acute pulmonary edema with edema of the glottis; it is, he states, a frequent cause of suffocation in adults and newborn children, and is often combined with hyperemia and serous effusion within the cavity of the cranium.

Bernheim,[7] in his clinical lectures, refers to a fulminant pulmonary edema during the course of acute articular rheumatism; and Lebreton,[8] among the pulmonary complications of rheumatism, mentions an acute edema of the type under consideration.

Landouzy [9] observed two rheumatic patients with pulmonary edema, one having four and the other five recurrent attacks; neither had albuminuria.

Jaccoud [10] reports a case of typhoid fever terminating fatally within fifteen minutes from acute pulmonary edema, which he designates as "un veritable coup de sang pulmonaire." The autopsy revealed nothing to explain the tragic event.

Debove [11] speaks of repeated accesses of acute pulmonary edema, and cites the case of a physician having aortic disease who died in half an hour in an attack, after having had several before. Debove thinks that aortic affections, and cardiac diseases in general, predispose to acute pulmonary edema.

P. de La Harpe,[12] in 1881, reported three cases that illustrate the condition of acute pulmonary edema very well: Case I—A woman, aged forty-three years, healthy, exposed herself to inclement weather after a slight attack of influenza; edema of the lungs developed and caused her death within a short time. Case II—A woman, aged sixty years, also healthy, after one or two nocturnal attacks, died of edema in a few minutes. Case III—A man had from fifteen to twenty attacks, all terminating by repeated eructations of gas and the voiding of large amounts of almost colorless urine. Similar cases are reported by Lund.[13]

One of the most important communications is that of Dr. Lindlay Steven,[14] of Glasgow, who, under the name of acute suffocative pulmonary edema, reports two cases, in both of which there were evidences of renal disease; and in one of them there was also an affection of the aortic valve. Steven's paper stimulated the report of a number of other cases, one of the most interesting being that of Lissaman,[15] whose patient, a woman, aged forty-five

[6] Manual of Pathological Anatomy, Sydenham Society's translation, IV, p. 71.
[7] Leçons de Clinique médicale, 1877, p. 494, quoted by Fouineau, q. v.
[8] Thèse de Paris, 1884, quoted by Fouineau.
[9] Bulletin médical, 1897, p. 445.
[10] Clinique de la Pitié, I, 1883, 1884, p. 567.
[11] Bulletin médical, 1897, XI, p. 400.
[12] Rev. méd. de la Suisse Rom., 1881, p. 322.
[13] Lund. Norsk. Mag. for Lägevid, quoted by Huchard and by Fouineau.
[14] Lancet, January 11, 1902.
[15] Ibid., February 8, 1902.

years, had within two and a half years seventy-two attacks, all characterized by sudden onset, pain in the chest, frightful dyspnea, lividity of the face, profuse cold sweats, labored action of the heart with small and rapid pulse, and the ejection, without cough, of enormous quantities of thin, pink, seromucous fluid. All the attacks were nocturnal.

Four well-studied cases have been reported by Hewlett,[16] who adopts Steven's designation of acute suffocative pulmonary edema: Case I—A woman, aged forty-nine years, had six attacks—two in the afternoon, the others at night. Albuminuria, myocarditis, arteriosclerosis, and hypertension. Case II—A woman, aged fifty-two years, had repeated attacks, after each of which albumin and casts were present in the urine. In the intervals only casts were found. Heart hypertrophied; blood-pressure high. Case III—A woman, aged sixty-nine years, had ten attacks, all but one at night. Urine contained a trace of albumin; no casts. Case IV—An alcoholic woman, aged fifty-two years, who died in an attack of edema.

A fairly typical case of the recurrent variety is reported in this country by Crummer.[17]

Among the most important systematic contributions to the subject from the clinical and pathological standpoint should be mentioned those of Huchard,[18] Dieulafoy,[19] Renaut,[20] Fuoineau,[21] Bouveret,[22] and Coplin.[23]

Its pathogenesis has been studied by Welch,[24] whose researches are of fundamental importance; by Sahli,[25] Grossman,[26] Lowit,[27] and others.

Etiology. Acute pulmonary edema is associated with a variety of affections that, in a clinical sense, may be considered in the light of causes. I would classify them as follows: (1) Arteriosclerosis; (2) Bright's disease; (3) heart disease—angina pectoris; myocarditis; valvular affections; (4) asthma; (5) acute infectious diseases—typhoid fever, measles, rheumatic fever, influenza, pneumonia, etc.; (6) pregnancy; (7) paracentesis of thorax and of abdomen; (8) angioneurotic edema; and (9) obscure conditions of questionable causal relationship (hysteria, etc.).

[16] Intercolonial Medical Journal, 1903, p. 611.
[17] Northwestern Lancet, 1902, p. 203.
[18] Bulletin médicale, 1897, XI, p. 393.
[19] Bulletin médicale, 1897, XI, p. 400.
[20] Bull. de l'Acad. de Méd., 1897, XXXVII, p. 557.
[21] L'Oedème du Poumon, Thèse de Paris, 1898.
[22] Rev. de méd., March, 1890.
[23] Therapeutic Gazette, April, 1906.
[24] Arch. f. path. Anat. und Phys., 1878, LXXII, p. 375.
[25] Arch. f. exper. Path. und Pharm., 1885, XIX, p. 435.
[26] Zeit. f. klin. Med. XII, XV, XVI, 1887-1890.
[27] Ziegler's Beiträge, XIV, p. 401; Centralblatt f. allgem. Path. und pathol Anat., 1895.

1. *Arteriosclerosis.* A large number of the reported cases of acute pulmonary edema showed arterial disease. Case II of my series belongs to this group. Huchard[28] contends that vascular disease, especially aortitis and periaortitis, is the only cause of acute pulmonary edema. No doubt it is an important factor in many cases, but not the essential one in all. Clifford Allbutt[29] admits the importance of aortitis; but very properly lays stress on the coexistence of general arteriosclerosis. The edema results, according to Huchard, from disturbance in the innervation of the pulmonary vessels brought about by extension of the aortitic or periaortitic process to the cardiopulmonary plexus.

2. *Bright's Disease.* The important relationship that Bright's disease bears to acute pulmonary edema was first clearly pointed out in 1890 by Bouveret, and afterward emphasized by Dieulafoy, Brouardel,[30] and others. Case I of my series is an illustration.

Dieulafoy, like Andral and Rokitansky, compares edema of the lungs to edema of the glottis, which is known to be one of the occasional complications of Bright's disease. How the nephritis acts has been much discussed by French writers: whether directly by toxemia (uremic poisoning) or indirectly through disease of the heart and aorta. For myself, I believe that nephritis can produce acute pulmonary edema without the intervention of arterial or cardiac disease, through the mediation of poisons the true nature of which remains unknown.

3. *Heart Disease.* I have separated this from arteriosclerosis, with which it is generally associated, because there are cases of œdema in the literature in which the last condition is not mentioned, and may be presumed not to have existed, but in which there was valvular disease of the heart. It must be remembered that the edema here considered is to be distinguished, as I stated in the beginning of the paper, from the ordinary edema of valvular disease, which is a part of a general edematous process.

With regard to angina pectoris, the coincident occurrence of edema is noted but by few authors. It is presented by Case V of my series. Angina pectoris is, no doubt, often associated with aortitis, but not necessarily so; and certainly not always with evident peripheral arterial disease. In my own case there was no general arteriosclerosis. I have for that reason separated the pulmonary edema of angina pectoris from that of arteriosclerosis.

4. *Asthma.* The occurrence of acute suffocative edema during the course of asthma is illustrated by two of my cases—III and IV.

[28] Loc. cit.
[29] Lancet, July 8, 1903, p. 141.
[30] Bull. de l'Acad. de Méd., 1897, XXXVII, p. 509; Bulletin médicale, 1897, XI, p. 400.

Differentiation of the condition from a violent asthmatic paroxysm can be made by attention to the physical signs, the character of the expectoration, and the profound collapse. Moreover, the patients themselves are aware that something very different from an asthmatic attack is taking place. It is quite probable that many of the so-called asthmatic attacks coming on in middle or advanced life, without any previous history of asthma, are in reality attacks of pulmonary edema.

5. *Acute Infectious Diseases.* In the section on history I have already cited a number of authors who have observed acute pulmonary edema during (a) typhoid fever (Jaccoud and Merklen[31]); (b) rheumatic fever (Lebreton and Landouzy); (c) scarlet fever (Legendre); (d) influenza (Glasgow[32] and Lemoine[33]); (e) pneumonia (Souin de la Savinière[34]).

6. *Pregnancy.* The first to report a case of acute pulmonary edema during pregnancy was Charles Wilson[35] (1856), whose patient was a woman, aged thirty-four years, eight months pregnant. There was anasarca and scanty, high-colored urine (no analysis); sudden pulmonary edema at night; recovery after abstraction of twenty ounces of blood. Premature, spontaneous labor, followed by puerperal mania, with recovery under opium.

Vinay,[36] in 1896, reported three cases of acute pulmonary edema during pregnancy, two of which were speedily fatal; in all three there was mitral-valve disease, and in one of them also nephritis. One of my cases, VI, belongs to this group.

7. *Paracentetis of the Thorax and of the Abdomen.* In rare instances tapping of the chest, and more rarely still of the abdomen, is followed by the signs of acute pulmonary edema, with the expectoration of large amounts of frothy albuminous material (albuminous expectoration). Originally it was believed that the albuminous expectoration was due to a wound of the lung, with a sucking up and the expectoration of the pleural fluid. This is not the case. The edema results from an afflux of blood to the expanding lung, and a leakage of serum through the walls of the vessels, which by reason of long compression have become changed and rendered more permeable. In a paper upon this subject,[37] in which a bibliography will be found, I speak of this afflux as "congestion by recoil."

[31] La Méd. moderne, 1903, XIV, p. 145.
[32] Amer. Jour. Med. Sci., April, 1895, p. 425.
[33] Press méd., 1905, p. 151.
[34] Contribution à l'étude de l'œdème aigue du poumon, Thèse de Paris, 1873, quoted by Fouineau.
[35] Edinburgh Med. Jour., 1856, II, Part I, p. 481.
[36] Lyon méd., 1896, LXXXII, p. 289.
[37] Amer. Jour. Med. Sci., April, 1902.

8. *Angioneurotic Edema.* A case of sudden pulmonary edema with coincident fugitive swelling of the face is reported by Hermann Müller,[38] who looks upon the pulmonary edema as of the same origin, namely, angioneurotic, as of that of the face.

9. *Obscure Conditions of Questionable Causal Relationship.* Lavallèe[39] reports of a case of tabes dorsalis with two attacks of localized pulmonary edema. There was arteriosclerosis, but no albuminuria and no valvular disease. In a case reported by Lèopold-Lèvy,[40] there was no other morbid condition than hysteria. Poppert [41] observed acute edema of the lungs after ether anesthesia and collected seven similar cases from the literature.

Pathogenesis. Pulmonary edema, whether acute or chronic, is brought about by leakage of serum through the capillary walls into the air vesicles and intervesicular tissues. In order that such leakage may take place, the pressure within the capillaries must be raised, or the permeability of the walls must be increased, or both factors must co-exist.

Many are the theories that have been advanced to explain the acute form of edema. For purposes of clearness they may be classified as follows: (1) The periaortitic theory; (2) the cardiac theory; (3) the toxic vasomotor theory; (4) the infectious theory; and (5) the increased permeability theory.

1. *The Periaortitic Theory.* Huchard believes that the principal cause of acute pulmonary edema is aortitis or periaortitis with extension of the inflammatory process to the cardiopulmonary plexus. The pathogenetic sequence, to quote his words, is as follows: "Disturbances of the innervation of the cardiopulmonary plexus by periaortitis; considerable augmentation of the vascular tension in the small circulation; acute or rapid insufficiency of the right ventricle." This is a satisfactory theory for those cases in which angina pectoris, Hodgson's disease, or other affections of the aorta exist; but it does not give an adequate explanation of those cases in which evidence of aortitis and general arterial disease is absent.

2. *The Cardiac Theory.* The cardiac origin of pulmonary edema has its ablest defender in Welch, whose classical essay from the laboratory of Cohnheim has been misunderstood by more than one later investigator. As restated by Welch [42] in a recent communication, the theory is as follows: "Pulmonary edema is due to a disproportion between the working power of the left ventricle of such character that, the resistance remaining the same, the left

[38] Corresp. f. Schweizer Aerzte, 1891, p. 432.
[39] Journ. des Praticiens, May 14, 1897.
[40] Arch. de méd., 1895, CLXXVI, p. 473.
[41] Deut. med. Woch., 1894, p. 719.
[42] Meltzer, Amer. Med., 1904, VIII, p. 19, 59, 151, 191.

heart is unable to expel in a unit of time the same quantity of blood as the right heart. Such disproportion may be brought about by paralysis or by spasm of the left ventricle." The salient feature of this theory then is a difference in the amount of blood thrown out by the two ventricles; the left expelling a little less in a given time than the right. As a result some blood remains behind in the left auricle; this reacts upon the pulmonary veins, so that they cannot empty themselves completely; consequently, there is a rise of pressure in the pulmonary circulation to a degree sufficient to bring about a transudation of fluid through the capillary walls.

The attacks upon this theory by Grossmann, who has produced pulmonary edema with muscarin, by Sahli, and by Löwit are answered by Welch in the communication referred to, and need not be taken up here. Meltzer [43] has ingeniously applied Welch's theory to an explanation of the pulmonary edema following adrenalin injection. He holds that in consequence of the great obstacle caused by the considerable constriction of all the smaller blood-vessels of the body, the left ventricle is incapable of throwing out all the blood that it receives from the pulmonary veins, while, on the other hand, the right ventricle, stimulated by adrenalin, unloads with increased energy upon the lungs all the blood which the contracting vessels drive into it.

3. *The Toxic Vasomotor Theory.* According to this theory, which is advanced by Bouveret,[44] acute pulmonary edema is due to the action of toxic substances on the pulmonary vasomotor mechanism. There is doubt among physiologists whether the pulmonary arteries possess a vasomotor nerve supply, although Francois-Franck [45] seems to have shown that such a supply exists, and Hoffman [46] considers it practically demonstrated that the pulmonary vessels have vasomotor nerves, though their influence is not great.

The toxic theory is useful in explaining the acute pulmonary edema of some cases of Bright's disease, that of angioneurotic edema, and, perhaps, that of pregnancy when there is no valvular or vascular disease.

4. *The Infectious Theory.* Caussade, Milhit, and Israel de Jong [47] have recently described a subacute edema accompanying diverse pulmonary affections and possessing a more or less epidemic character. The expectoration is albuminous, frothy, not sanguinolent, and is easily differentiated from that peculiar to the disease,

[43] Lot. cit.
[44] Lot. cit.
[45] Arch. de Physiol., 1895, p. 816, quoted by Hofmann in Handbuch der Physiol. des Menschen, Nagel, p. 298.
[46] Handbuch der Physiol. des Menschen, Nagel, p. 300.
[47] Bull. et mém. de la Soc. méd. des Hôp. de Paris, February, 1906, p. 160.

e, g., bronchitis or pneumonia, with which the edema happens to be associated. In the sputum the pneumococcus, usually of a virulent type, is present; whence the authors conclude that it is the cause of the edema. Chloride retention and the neuroarthritic diathesis are predisposing factors.

The mere presence of the pneumococcus hardly possesses the importance the authors give to it, for such presence is to be expected when the edema is an accompaniment of inflammations of the lungs that are known to be associated with this organism. The possibility of an infectious pulmonary edema is, however, undeniable. It is probably present at some stage of all acute inflammations of the lung; but the type of edema under consideration here does not bear the stamp of an infectious origin. The sudden onset of the attacks—their brevity, their subfebrile or afebrile character—militate against such a view.

5. *The Increased Permeability Theory.* Increased permeability as the sole cause of acute pulmonary edema, as advocated, among others, by Martin,[48] is not adequate; but in conjunction with increased blood pressure it becomes an important factor, especially in the form of pulmonary edema following paracentesis of the thorax.

Pathology. Renaut [49]— who is of opinion that both anatomically and clinically acute pulmonary edema possesses an individuality that indicates a special pathogenesis—finds that the principal lesion is a serous inundation of the pulmonary alveoli. The alveolar fluid may be slightly fibrinous. White cells are abundant, sometimes to such an extent as to resemble a pneumonic exudate. That the entrance of the liquid into the alveoli has occurred violently under pressure is shown by the many points of rupture in the alveolar walls. The epithelium disappears within the limits of the edema, having been forced off by the sudden eruption of fluid. The capillaries of the alveolar walls are flattened and rendered impermeable by compression, and hence are devoid of red cells. The large pulmonary and bronchial veins are, however, engorged with blood. The lymphatic spaces under the pleura are also distended.

Coplin,[50] whose study is the most recent, finds a finely granular deposit in the distended air vesicles and interstitial tissue, representing an albuminous fluid coagulated by the fixative. The capillaries usually show no conspicuous overdistention, and are frequently empty. The septal walls are often loosened and their tissues dissociated and infiltrated with mononuclear cells. The cell content of the air vesicles and interstitial tissue is subject to considerable

[48] See Hewlett, Intercolonial Medical Journal, 1903, p. 611.
[49] Loc. cit.
[50] Loc. cit.

variation; in some cases the erythrocytes are plentiful, and in others, not; polymorphonuclear leukocytes are at times abundant, and then bacteria are also present. In other cases again the cells are of the mononuclear type. Unlike Renaut, Coplin holds that detached vesicular epithelium can always be demonstrated. In some cases there is a marked swelling of the submucosa of the smaller bronchi and bronchioles, with a consequent narrowing of the lumen. The elastica is often stretched and the subserous and interstitial lymph vessels are distended.

Symptomatology. One of the most striking features of acute pulmonary edema is the suddenness of its onset, often in what appears to be a state of good health. The patient is seized, usually at night, with a sensation of oppression and suffocation accompanied by a fear of dissolution. The breathing is labored and of a rattling character; the dyspnea, or orthopnea, intense; the countenance either livid or pale and bedewed with sweat; cough may be harassing, or it may be entirely absent. In typical cases there is a copious, frothy, albuminous expectoration which may be expelled in gushes from the mouth and nose, and may reach the amount of one or two liters during an attack. Often it is blood-tinged, and in one of my cases (II) it had the appearance of raspberry vinegar; sometimes it is whitish like bronchial secretion. The action of the heart and the pulse are feeble in some cases, as in the two with asthma here reported; the pulse, however, may be full and bounding. Over the lungs the characteristic subcrepitant and bubbling rales of edema are heard; not rarely, they are most abundant over the upper parts, while in the ordinary edema they are most numerous over the lower lobes posteriorly.

The first attack of edema may be fatal, like the first attack of angina pectoris. More frequently the first attack is not fatal, and is followed by numerous others, all presenting a striking uniformity and each placing the patient in imminent danger of death. For some reason the paroxysms are generally nocturnal, and not rarely they set in during sleep. The average duration varies from three to six hours; some cases last twelve to twenty-four hours; in the extremely fulminant types, as in Case I of my series, death may take place within ten or fifteen minutes, the patient literally drowning in his own juices.

Brouardel [51] has pointed out the medicolegal importance of these hyperacute cases in which sometimes there is no expectoration, death taking place by suffocation before the patient has a chance to rid himself of any fluid. As to the number of attacks, the case

[51] Loc. cit.

of Lissaman [52] with seventy-two seems to hold the record. It is important to bear this tendency to recurrence in mind, so as to give a reasonable prognosis, and to be prepared to treat the attacks on a definite, well-considered plan.

Cerebral symptoms may be present, as in Case II, in which aphasia and hemiplegia complicated the attack and outlasted it for some time. Delirium, convulsions, and coma have also been noted.

Diagnosis. Acute pulmonary edema must be distinguished from (a) asthma; (b) pulmonary embolism; (c) acute dilatation of the heart; and (d) uremic asthma.

Asthma. From asthma, acute pulmonary edema may be distinguished by the fact that in the former there is very little expectoration during the attack, and is established only when the seizure has passed off, and is limited to a small amount of glairy material or a few mucous pellets. The piping rales of asthma are different from the mucous, bubbling rales of edema.

Pulmonary Embolism. In pulmonary embolism there is an embolic source; expectoration is developed later than in acute pulmonary edema, in which it usually coincides with the onset of dyspnea; when once established in embolism it is less abundant and more definitely bloody than in pulmonary edema.

Acute Dilatation of the Heart. The dyspnea and cyanosis in acute cardiac dilatation are rarely as intense as in acute pulmonary edema. There may be edema of the lungs; the difference here is perhaps only one of degree. In typical cases of acute pulmonary edema the dominant feature is the inundation of the lung with fluid, and the dyspnea is more directly mechanical than in dilatation of the heart.

Uremic Asthma. The dyspnea in uremic asthma is seldom as severe as in acute pulmonary edema, nor is it accompanied by profuse frothy expectoration, and, hence, not by the characteristic physical signs of edema of the lungs.

Treatment. Treatment must be prompt to be effective. The best results are obtained by venesection. Merklen,[53] with great enthusiasm, says, "c'est l'unique salut." The abstraction of a small amount of blood usually suffices, though in rare instances as much as from 400 to 600 c.c. has to be taken. When bleeding cannot be done, or in addition thereto, dry cups may be used. Half a dozen wine-glasses, in which air has been rarefied by burning alcohol, should be placed over the back; and if the patient is turned on his side several can be put on the front of the chest at the same time. If there is much nervous excitement, and a terrifying feeling of

[52] Loc. cit.
[53] Loc. cit.

impending death, a small dose of morphine should be administered hypodermically. Authors, it must be admitted, differ as to the value of morphine. Hewlett recommends it; Stevens condemns it. Lissaman found chloroform eminently successful in his remarkable case. When the pulse is feeble and asystole is threatened, diffusible stimulants, such as whiskey, ammonia, and hypodermic injections of camphor, are useful. Crummer ascribes the favorable outcome in his case to adrenalin chloride; but as far as this drug is concerned, the experimental observations of Bouchard and Claude,[54] of Meltzer, and of Coplin, who found that it could produce edema in the lower animals, ought to make us cautious. Nitroglycerin suggests itself as a remedy in those cases in which there is every evidence of arterial hypertension, namely, in the arteriosclerotic and renal types. Oxygen is an agent of value when there is much cyanosis.

As I have said before, the likelihood of recurrence should be borne in mind, and should be made clear to the relatives of the patient. Where possible an intelligent member should be instructed in the method of applying dry cups, and, perhaps, in the use of the hypodermic syringe. Such precautions commend themselves more especially because the attacks generally occur at night, when it may be difficult to obtain medical aid at once.

Report of Cases

Case I.—Mrs. L., aged forty-six years; numerous attacks of acute edema coming on without apparent cause. First attack in 1902, two days after death of mother; lasted one and one-half hours. No albuminuria in the beginning, later small amount of albumin, urine pale, low specific gravity, casts from time to time. Attacks characterized by dyspnea, rattling breathing, mucous rales, sense of fear and terror, high tension pulse. Patient neurotic and subject to laughing and crying spells. Death occurred, December, 1905, in an attack lasting ten minutes, during which frothy, bloody fluid gushed from mouth and nose. Autopsy: Chronic interstitial nephritis, hypertrophy of the heart; intense pulmonary edema, fresh petechial hemorrhages in the pleura and pericardium.

Case II.—Mr. W., aged seventy-two years; always healthy. Seized suddenly one night with intense edema of the lungs; chest filled with moist rales; reddish, frothy fluid gushing from mouth; dyspnea, collapse, unconsciousness, paralysis of right arm and leg, pulse irregular, reduplication of first sound at apex. Marked arteriosclerosis, urine (catheter) albuminous. Disappearance of pulmonary signs in two or three days, palsy lasting a little longer; eventual recovery. Another attack a month later, January 23, 1904, not so severe; recovery. Numerous others, usually with stupor or coma and variable degrees of fleeting palsy and aphasia. Last attack, March 19, 1904, at 3 A. M.; intense dyspnea, unconsciousness, fluid gushing from mouth and nose, paralysis of right arm; partial restoration of consciousness following venesection. Death, no autopsy.

[54] Comp. rend. de l'Acad. des Sciences, Dec., 1902, p. 928.

CASE III.—Mrs. McC., aged forty years; asthma of several years' standing. During the past winter and spring repeated attacks of intense dyspnea with rattling breathing, frothy expectoration, bubbling rales, alarming collapse, with pallor, feeble pulse, clammy skin. Attacks entirely different from asthmatic paroxysms, but occurring during asthmatic periods. A number of attacks within two or three months. None since going south.

CASE IV.—Miss I. C., aged twenty-five years; asthmatic. Without apparent cause seized at midnight with intense dyspnea and fear of impending death; lips cyanotic, face ashen pale, skin clammy, no pulse at wrist, respiration rattling, chest filled with bubbling rales, frothy fluid slightly tinged with blood gushing from mouth and nose. Urine normal. Attack subsided by morning; extreme prostration for several days; one slight recurrence while still in bed.

CASE V.—Mrs. N. S., widow, aged fifty-eight years. For three or four years attacks of anginoid pain in precordium with radiation into left arm. Attacks always associated with orthopnea and signs of pulmonary edema; the latter at times confined to left lung, generally bilateral. Best results during attacks from dry cupping and nitroglycerin. Death from cardiac dropsy, no autopsy.

CASE VI.—Mrs. S., aged thirty-eight years; pregnant seven months—eighth pregnancy. Seized without warning and without previous exposure with an attack of intense dyspnea and a feeling of oppression and anxiety. There was a great deal of wheezing and cyanosis, harassing cough, and alarming prostration. My first impression was that the patient had asthma; but antiasthmatic treatment had no result. The rales, which had been dry, soon became moist and bubbling, and a free, whitish, frothy expectoration developed. The patient had never had asthma nor any other illness; had passed through five labors and three miscarriages without a doctor, a midwife only attending. There was no history of previous kidney disease; nevertheless, the urine was loaded with albumin, but free from casts. The heart presented nothing abnormal; there was no arteriosclerosis. Her condition becoming worse, and as she seemed in danger of suffocation, Dr. E. E. Montgomery was called in consultation, and it was agreed between us that labor should be promptly induced. Under ethyl-chloride anesthesia an attempt was made to stretch the mouth of the womb, but it could not be done sufficiently, and it was thought best to introduce a piece of gauze and await developments. Free bleeding occurred during the stretching. To our surprise labor did not follow, but the patient rapidly improved, and within twenty-four hours had practically recovered from her dangerous condition. The urine cleared up entirely within a few days. Six weeks later, without any warning, the edema returned. I promptly bled her from the elbow, with the most happy result. Her confinement is expected at any day.[55]

Conclusions

1. There is an acute pulmonary edema that comes on without any apparent exciting cause and often kills in a short time.

2. Recovery from an attack is frequent; but there is a striking tendency to recurrence, subsequent attacks being similar to the

[55] Since writing this she was delivered without difficulty by Dr. V. A. Loeb, to whom I transferred her for this purpose; she has had no other attacks.

first. They set in suddenly, usually at night, and place the patient's life in jeopardy.

3. The clinical causes are various: arteriosclerosis and cardiac and renal disease are most important.

4. The pathogenesis is obscure; vasomotor disturbances and a disproportionate activity of the two ventricles (the right predominating) are the principal factors.

5. The chief symptoms are agonizing dyspnea, cyanosis, cough, expectoration of frothy albuminous fluid, and profound prostration. Over the lungs, often more over the upper than the lower portions, the characteristic moist rales of edema are heard.

6. The most valuable remedies are bleeding, dry cupping, and cardiac stimulants.

7. The condition is of sufficient importance to warrant its having a special chapter in the text-books of medicine.

EDEMA OF THE LUNGS [1]

This subject was suggested to me by your President, Dr. Watson, and in many ways it is one of the best choices of a general topic that could be made.

You will be surprised if you look up the standard text-books to find how little space is devoted to pulmonary edema. One of the most recent works on diseases of the heart and lungs contains hardly more than a page or two on this important subject. I have wondered why it is being treated in such a stepmotherly fashion. I do not know. Anyone who sees a good deal of clinical medicine cannot help but have a deep interest in edema of the lungs, and those of us who passed through the recent influenza epidemic have acquired a very profound respect, if not an actual awe, for it.

What do we mean by pulmonary edema? By pulmonary edema we mean the presence of serum in the air vesicles. In mild cases it is confined to the air vesicles, but in severe cases it may collect in the finer bronchial tubes and the air passages in general, and may transude into the interstices of the pulmonary tissue.

In order to understand the subject of pulmonary edema we ought, I think, to classify the types of edema, and when we begin to do that we realize that some forms of edema are unimportant and, from the standpoint of practice, negligible. Now it is to those that the majority of text-books give attention; they devote so little space to the subject because those varieties do not require much consideration. But there are other forms of pulmonary edema, the importance of which is hardly exceeded by any other condition that we have to deal with in the thorax. That is a strong statement, and yet I am going to prove to you that this is a fact.

I am in the habit of classifying pulmonary edema as follows:

1. Passive Edema.—That is the common edema of heart disease, of valvular and muscular disease of the heart with decompensation. When we say "decompensation" the average person thinks of the fully developed form; just as when we speak of cirrhosis of the liver or of tabes dorsalis, the beginner at least thinks of the classical types of these diseases. Now, the classical types of most diseases are so well known that he who runs may read; it is the imperfectly

[1] From Medical Clinics of North America, March, 1920.

developed, the incipient cases of any chronic affection that do not diagnose themselves and have to be diagnosed.

The meaning of that is this: We can often diagnose the oncoming of cardiac decompensation before decompensation is manifest, and the thing that usually tells us is pulmonary edema. In many cases, before any swelling of the feet, any shortness of breath, any enlargement of the liver, any effusion into serous cavities appears, a little crackling can be heard at the base of the lungs. This is pulmonary edema. It is the earliest stage of the passive variety. You might say, Is that not passive congestion? Many do not distinguish between passive congestion and edema, but there is a distinction. A patient with disease of the heart of any duration always has some congestion of the lungs, but he does not have pulmonary edema, the leaking of serum out of the vessels, until decompensation begins to ensue. Passive congestion, as such, may be considered to exist when in valvular or muscular heart disease there is a loud accentuated second pulmonic sound and enlargement of the heart's dullness to the right, indicating an overfilled auricle; an overfilled auricle means an overfilled lung, and that is a congested lung which does not become an edematous lung until some of the serum oozes out of the engorged vessels into the air cells.

Now I have often found in cardiac cases—coming for other reasons—a little edema, shown by rales at the bases. I tell the patient that he must go to bed for a few days, otherwise he is likely to have shortness of breath and swelling of the legs; perhaps even more serious symptoms. The edema being an early sign, enables us, if we detect it, to begin treatment of decompensation in its incipiency. The value of this is self-evident.

2. Then, again, we find passive pulmonary edema in elderly persons, or in any person who has been long lying on his back. This is sometimes spoken of as hypostatic edema. It is an advanced stage of hypostatic congestion—a *gravity edema*. It has a peculiar feature. Is is what the French call a *reversible edema,* changing from side to side as the patient is turned. I have just come from another hospital where I found such a shifting edema in an old man. The edema is a passive-congestion edema; it is chiefly significant in affording a good soil for bronchitis and pneumonia in the aged. A similar edema, explicable on the same grounds, is found in typhoid fever, in septicemia, in severe influenza, and in a protracted fever from any cause. In the senile edema, if there is no contravening circumstance, it is advisable to have the patient sit up as early as possible, as that helps to get rid of the edema.

3. Another form of pulmonary edema is that due to Bright's disease—*nephritic edema.* It is most common in acute and chronic glomerular and tubular nephritis.

The question may come to your mind, Is nephritic edema a passive edema, an edema of the same nature as that of heart disease? I should have to answer the question by saying: "It does not appear to be so; it is questionable." In some cases of chronic Bright's disease of the so-called interstitial variety there is often some edema due to cardiac failure; but I do not think that edema of the legs or of the abdomen, or of the face in the other, the so-called parenchymatous nephritis, can be explained on a cardiac basis alone. Some of the forms of nephritic edema are due to a toxic irritation of the blood-vessel walls, making them more permeable, or to changes in the blood, chiefly an increased sodium chloride content. In any event, the edema of Bright's disease is not a purely mechanical one.

4. The next form I wish to speak of is what might be called *localized inflammatory edema* of the lung. This is important from the diagnostic point of view on account of its presence in the earliest stages of lobar and influenzal pneumonia. It gives rise to those fine crepitant rales that are so characteristic of oncoming consolidation.

An acute edema of general distribution is seen in gas poisoning. It has long been known in the industries to be a consequence of the inhalation of irritant vapors. In the late war gas poisoning, as you know, was very common. The gases, mostly of an irritant character, distribute themselves in the lungs and cause an acute inflammatory edema, which is not confined to the air vesicles, but involves other portions of the lung as well. I shall not go into the details of this topic, but would refer you to a valuable paper published by Dr. G. W. Norris, of the University of Pennsylvania, in the Journal of the American Medical Association.

5. Acute Terminal Edema.—In pneumonia, influenza, septicemia, and a variety of other acute diseases one frequently finds a generalized edema as a serious complication. Indeed, death often seems to be the direct consequence of a rapid filling up of the lungs with edematous fluid. During the influenza epidemic pulmonary edema was a frequent and much dreaded occurrence, against which we were often powerless. When we come to speak of treatment I shall point out the measures that sometimes prove successful in combating the edema. An acute edema of a similar character has been described as occurring in acute rheumatic fever. Personally, I have never seen it.

An analogous edema plays a part in postoperative shock. The cause of such edema—which often deserves the name "agonal"—is to be found in toxic myocardial weakness and in vasomotor paralysis.

6. Postcritical Edema.—This is an edema that is found in the pneumonic lung after the crisis. The fever is gone; the patient seems perfectly well, and wants to get up; but if one listens over the lung one hears a little residual crackling which often persists for a long time. Many patients with such an edema do well if allowed to sit up, but they should not be allowed to walk about or to go out of doors.

In some cases of influenzal bronchopneumonia an edema of large and small rales, affecting apices as well as bases, persists for a long time after the temperature has reached normal. It is accompanied by marked prostration, a slight degree of cyanosis, and a tendency to sweating. Atropin, digitalis and dry cupping have seemed to influence it favorably. Regarding the etiology, it is difficult to make any definite statements; the association with profuse perspiration suggests a vasomotor factor.

7. I now come to speak of an edema which is perhaps more important than any other. For years it has greatly interested me. I have called it *acute apoplectic edema*, and because of the marked tendency to recur it has also been designated *acute recurrent edema*. I can best describe it by reading to you brief histories of a few cases that have come under my observation (Riesman, Amer. Jour. Med. Sci., January, 1907).

Case I.—Mrs. L., aged forty-six years; numerous attacks of acute edema coming on without apparent cause. First attack in 1902, two days after death of mother; lasted one and a half hours. No albuminuria in the beginning, later small amount of albumin, urine pale, low specific gravity, casts from time to time. Attacks characterized by dyspnea, rattling breathing, mucous rales, sense of fear and terror, high tension pulse. Patient neurotic and subject to laughing and crying spells. Death occurred December, 1905, in an attack lasting ten minutes, during which frothy, bloody fluid gushed from mouth and nose. Autopsy: Chronic interstitial nephritis, hypertrophy of the heart; intense pulmonary edema, fresh petechial hemorrhages in the pleura and pericardium.

Case II.—Mrs. McC., aged forty years; asthma of several years' standing. During the past winter and spring repeated attacks of intense dyspnea with rattling breathing, frothy expectoration, bubbling rales, alarming collapse, with pallor, feeble pulse, clammy skin. Attacks entirely different from asthmatic paroxysms, but occurring during asthmatic periods. A number of attacks within two or three months. None since going south.

Case III.—Mrs. N. S., widow, aged fifty-eight years. For three or four years attacks of anginoid pain in precordium, with radiation into left arm. Attacks always associated with orthopnea and signs of pulmonary edema;

the latter at times confined to left lung, generally bilateral. Best results during attacks from dry cupping and nitroglycerin. Death from cardiac dropsy; no autopsy.

CASE IV.—I have another case among my records that occurred during pregnancy. The patient, suffering from albuminuria, was in such an alarming state as the result of the edema that Dr. Montgomery, who saw her with me, thought that labor should be induced. Under ethyl chlorid an attempt was made to stretch the cervix, but it could not be done. A piece of gauze was introduced, free bleeding followed, but labor did not take place. The woman nevertheless improved and soon recovered and the urine cleared up. Six weeks later the edema recurred. I promptly bled her from the elbow, with good results. She was afterward delivered without difficulty and has had no other attacks since.

Permit me to recite one other case:

CASE V.—Mr. W., aged seventy-two years; always healthy. Seized suddenly one night with intense edema of the lungs; chest filled with moist rales; reddish, frothy fluid gushing from mouth; dyspnea, collapse, unconsciousness, paralysis of right arm and leg, pulse irregular, reduplication of first sound at apex. Marked arteriosclerosis, urine (catheter) albuminous. Disappearance of pulmonary signs in two or three days, palsy lasting a little longer; eventual recovery. Another attack a month later, January 23, 1904, not so severe; recovery. Numerous others, usually with stupor or coma and variable degrees of fleeting palsy and aphasia. Last attack March 19, 1904, at 3 A. M.; intense dyspnea, unconsciousness, fluid gushing from mouth and nose, paralysis of right arm; partial restoration of consciousness following venesection. Death; no autopsy.

This form of edema, about which very little has been written, is, as you see, very important. Three of the patients died and two nearly died. It may occur under a variety of conditions. One of my early cases occurred in a patient with mitral stenosis. When I came to the house the doctor in attendance said the man was practically dead. True, he seemed to be in articulo mortis; the breathing was rattling and pitifully laboring; the chest full of rales; bloody froth was gushing from nose and mouth; the pulse at the wrist was imperceptible. To our amazement the man reacted, was soon himself again, and lived for several years afterward.

In pregnant women having mitral stenosis this form of edema is quite common. It is, of course, true that many women with mitral stenosis pass through labor unscathed, but the possibility of an acute fatal edema of the lungs hangs constantly over them.

The same type of edema occurs in chronic myocarditis. Six days ago a physician brought to my office a man forty-eight years old, complaining of most distressing attacks coming on chiefly at night, in which he would get extremely short of breath and very anxious, and would expectorate large quantities of frothy fluid. I asked him what the color of this fluid was, and he answered, "I think it was

pinkish." I said, "You think? Do you not know?" He replied, "To tell the truth, doctor, I am totally color blind." Since he thought it was pinkish it must have had some color to suggest pink to him. Within a year he has had about ten attacks, each lasting from one to two hours. At the beginning of an attack he gets hot and perspires; afterward he feels cold and subsequently falls asleep. His blood-pressure in my office was 170 systolic, 80 diastolic, the pulse 148. Because of a prominence of the eyes and a rapid pulse my assistant got the impression that the man had exophthalmic goiter, but upon examination I found extreme irregularity and rapidity of the heart, there being 168 beats over the heart and 148 at the wrist. There was no goiter. The heart was enlarged and a loud blowing mitral systolic murmur was present. The case was one of myocarditis with auricular fibrillation.

A short time ago I saw a man fifty-seven years of age who stated he had heart trouble. He suffered from attacks in which he said he choked and choked until the lungs were empty. During such a seizure he expectorates from a half-gallon to a gallon of bloody fluid, getting relief only when all the fluid is up. He is an intelligent man, has been carefully observed by his physician, and has been seen by nearly every local consultant and by everyone of note within a considerable radius of Philadelphia. Altogether he has had from thirty to forty mild and about six severe attacks. He knows when they are coming on; he gets "heated up and very short of breath." "It is like a fright; I have a choking sensation and a pain in the right chest crossing over to the left. I have to sit up or choke to death." The attacks come on usually during the afternoon, but they may occur at night. The longest lasted an hour and a half. There is no provocative cause apparent, but he himself says that he has neurasthenia. I am quite sure we should all become neurasthenic in similar circumstances. His blood-pressure is not very high, but there is distinct evidence of myocarditis.

I have seen the same form of edema also in association with angina pectoris. One of the patients whose history I read to you had anginoid pains in the precordia.

Next to myocarditis, the most frequent associations of acute apoplectic edema are with hypertensive arteriosclerosis and with chronic nephritis. The most fulminant cases I have seen were in patients with arteriosclerosis and high blood-pressure.

Barring angina pectoris, nothing in the way of an acute attack is so alarming as this form of pulmonary edema. It puts life in peril just as much as angina pectoris, yet volumes have been written about the latter and scarcely anything about the former.

A striking feature is its *tendency to recurrence.* Thus one man of whom I spoke had had thirty or forty minor attacks and six or seven severe attacks, in every one of which he thought he would choke to death. On looking through the literature I found the record of a woman of forty-five years who had had seventy-two attacks within two years (Lissaman, Lancet, February 8, 1902).

The pathogenesis of recurrent pulmonary edema is not definitely known. Most of the experimental work of any value dates back some years, so that there is here a great field for research by the newer methods. Dr. Welch, of Baltimore, working in Cohnheim's Laboratory, found that pulmonary edema was dependent upon a disproportionate action of the two ventricles. If the left gets weak while the right is still strong, the latter continues to pump blood into the lungs which cannot get out. The lung, in consequence, becomes overfilled and the blood-serum transudes from the capillaries into the air vesicles. This theory, while one most widely accepted, is not entirely satisfactory. In the first place it does not explain the cause of the sudden difference in the behavior of the two ventricles, and does not explain the acute development within the course of a few minutes of an edema menacing life. There is probably another factor, perhaps a vasomotor disturbance. In saying this I am well aware of the fact that the question of a vasomotor supply to the pulmonary vessels is still under discussion. While Bradford and Dean (Jour. of Physiol., 16, 34, 1894) contend that the pulmonary arteries possess vasoconstrictor fibers, Brodie and Dixon (Ibid., 30, 476, 1904) have come to an opposite conclusion. The question is an open one, but certainly there is a good deal in clinical observation to strengthen belief in the existence of a pulmonary vasomotor mechanism.

In reading the histories of cases I have practically given you the symptoms of recurrent edema which, please remember, is as distinct a syndrome as angina pectoris. To make the picture clear I will, however, bring the symptoms once more before you. They are sudden, intense dyspnea or orthopnea, deep cyanosis, air-hunger, rattling breathing, rales all over the chest—often most abundant at the apices—and fear of impending death. There is usually a large amount of thin, frothy sputum; in bad cases it may reach enormous quantities, gushing from mouth and nose and drowning the patient in his own juices. The fluid is frequently blood tinged, looking like raspberry juice. The presence of such expectoration is, however, not necessary to enable a diagnosis of pulmonary edema to be made. There are cases in which nothing is brought up, but in which the diagnosis is easily made by the

other symptoms and the presence of moist rales all over the chest. Sometimes there is, in addition to the pulmonary edema (and this proves that the condition is not a purely local one), a temporary aphasia or a trivial palsy; stupor or unconsciousness may also occur, showing that the brain has suffered. In many cases an extreme vascular distention is present.

The prognosis of apoplectic pulmonary edema is like that of angina pectoris. Who can give a reliable prognosis in that disease? In pulmonary edema a man may be brought to the brink of the grave, as close as I have never seen happen in any other condition, and yet survive. The prognosis is very much governed by one's cast of mind, whether one is an optimist or a pessimist. An optimist believes that the patient will weather the attack; a pessimist, that he will not. Prognostically I am an optimist.

Perhaps I ought to say a word about the diagnosis—what can acute recurrent edema be mistaken for? In one of the cases of which I have spoken, my doctor friend had made a diagnosis of cardiac asthma, because he was unfamiliar with the true condition. Charcot once said: "An obscure disease is often diagnosed by merely thinking about it." Not only must we distinguish it from cardiac asthma but also from other forms of asthma and from angina pectoris, more particularly when there is no expectoration. As I have stated, angina pectoris and acute pulmonary edema may occur together.

A fulminant edema quite different from the one just described sometimes occurs in influenza, killing its victims in from twelve to twenty-four hours. The patients—those I have seen or know about were girls and young women—have a grayish, cyanotic, or slaty color, are profoundly toxic, stuporous, or comatose. The rectal temperature is high, the circulation in collapse, the extremities cold; the lungs show fine rales, but not always in great abundance. There may be frothy salmon-colored expectoration; not rarely death occurs before anything is brought up. Consolidation of the lungs cannot be demonstrated; the virus causes death before pneumonia has time to develop.

8. There is another form of edema analogous in its manifestation, which I would call *postaspirational.* I can best illustrate it by describing to you an experience I had when I was a beginner in medicine. I tapped a woman who as the result of a mediastinal tumor had had a one-sided hydrothorax for a long period of time. As I was cleaning up the apparatus in an adjoining room, preparatory to leaving the house, I was suddenly recalled to the bedside of the patient. I found her in a terrifying condition. Her face had an agonized expression; her color was purple; she was sitting up

gasping for breath; the death rattle seemed to be in her throat. She was practically pulseless at the wrist; was covered with a cold sweat—not so cold as mine, however; I thought she was dying, and with her one-third of my practice. While I was watching her she suddenly spat up a huge quantity of syrupy looking fluid, exactly like that in the aspirator bottle—I had gotten about a quart or more of fluid. My immediate conclusion was that I had punctured the lung. I did what I could for the patient, and either because of what I did or because—as Jerome Cardan might have said, "my familiar spirit intervened"—she got well of her attack. I began to wonder what had happened, never having seen or heard of such a condition before. I boiled the expectorated fluid and that which I had drawn off with the aspirator. They both coagulated solidly; they seemed to be the same fluid, confirming me in my first impression that the lung had been punctured. But when I began to think more calmly and looked up the subject—and I may say that I had a hard time finding anything about it—I found that similar cases had been reported; one by the late Dr. William Pepper. Dr. Pepper's patient died. After due consideration I came to the conclusion that I had not punctured the lung, but that the thing I had seen was an acute edema of the lung. The lung expanding in a vacuum after long compression became suddenly intensely congested and overfilled with blood. Because of the long compression the vessels in the lung were altered and abnormally permeable; the fluid therefore leaked out, and being blood-serum, just like that in the pleura, it was albuminous and coagulable; hence the term "albuminous expectoration" under which the case was reported. To distinguish the edema in such cases and to indicate its nature I have called it *edema by recoil.* Fortunately, it is as rare as it is terrifying. Why it happens in the exceptional case is difficult to say. It is more likely to occur in cases in which the pleural effusion with compression of the lung has existed for a long time; also if there is some cardiac embarrassment, such as myocardial weakness or pericarditis. When tapping [2] in such cases one should always be prepared for it. Otherwise, the patient is likely to die. I will discuss the measures later on. Similar edema has been observed in rare instances after tapping of the abdomen. The edema is probably due to the same cause, the lung having been crowded and compressed for a long time by a large peritoneal effusion.

An edema that is rather unimportant from a human standpoint perhaps, but which throws some light on edema in general, is that

[2] In a number of the American Journal of the Medical Sciences soon to appear I am reporting a recent case of acute pulmonary edema following tapping.

due to adrenalin. If you are familiar with the experiments of Meltzer, you may know that adrenalin in animals can produce an intense edema that may be fatal. Whether adrenalin has a similar effect in man is a mooted question, which was rather vehemently agitated in a discussion on pulmonary edema at one of the meetings of the American Association of Physicians (Transactions, 1906).

There is another form of edema that I would speak of under this head, and that is *angioneurotic edema.* While this edema is most common in the skin, there is no reason why it may not occur anywhere where there are blood-vessels. There is no anatomic difference between edema of the lungs and edema of the skin; in the skin the serum following the path of least resistance oozes into the interstices; the same thing happens in the lungs, where it passes into the vesicles or into the interstitial tissue outside of the capillaries.

An acute edema sometimes follows suddenly after *operation.* I do not mean the not infrequent postoperative crackling at the bases, but a real apoplectic edema. It may be angioneurotic in origin.

Treatment—The treatment of the passive form of edema of the lungs is not important. We do not treat the edema directly, but the underlying condition—the failure of the circulation. Sometimes, as I have said, the edema may be lessened or relieved by setting the patient upright with a bed-rest or by getting him out of bed.

The acute toxic edema so commonly found in influenza and in pneumonia is sometimes very hard to deal with, as those of us who passed through the recent influenza epidemic remember only too well. The remedy that seems to do most good is atropin in large doses—1/75 or 1/60 grain. Sometimes bleeding is helpful, but we have often bled in the Philadelphia General Hospital without results. Cardiac stimulation is also of value. I did not see much benefit from glucose solution, but as we usually have given it by bowel and not intravenously, as has latterly been recommended; perhaps the disappointing results are to be ascribed to a faulty method.

In the treatment of the apoplectic form and that following aspiration of the chest, the best remedial agent is a hypodermic injection of morphin and atropin. The effect is sometimes magical and is in part due to the fact that morphin relieves the intense psychic unrest and fear. The second thing of value is dry cupping—a half-dozen cups to the front and to the back. This is often productive of instantaneous relief and I have great faith in it. Cupping is a very simple procedure and no complicated apparatus is necessary. A number of applicators are made out of match sticks and the inside of a small whiskey or wine-glass is moistened with an applicator dipped in alcohol. The alcohol is then lighted, and

before the flame blazes down the glass is applied evenly to the chest. The cups are left on until the skin has a purple hue.

Another excellent measure, useful especially in hypertensive cases, is bleeding. I have employed this several times, particularly in cases in which cerebral symptoms were an accompaniment.

In the apoplectic cases it is not only necessary to treat the attacks but also to find measures for preventing their recurrence. That can only be done by treating the underlying condition, and as this in the majority of cases is hypertension or nephritis and hypertension, treatment for these conditions must be instituted. It is, however, not my purpose to go into the details of this subject, nor can I discuss the treatment of mitral stenosis and myocarditis, which are also capable of producing the edema.

To guard against postaspirational edema it is in the first place necessary in all cases where such edema is a possibility, as in long-standing large effusions with myocarditis or pericarditis, to draw the fluid off slowly and with the least possible shock to the patient. Secondly, one should always remain near the patient's bedside for at least half an hour after the tapping. Thirdly, on the first sign of edema the patient should receive a hypodermic injection of morphin and atropin. Dry cups should then be applied and digitalis given. If oxygen is at hand it may be used, but when the lung is so full of fluid and breathing so embarrassed, it is hard for the patient to get any benefit from oxygen.

I hope that I have in a small measure awakened your interest in the subject of edema of the lungs. It is one that will well repay clinical and experimental study.

PLEURAL EFFUSION WITH INVERSION OF THE DIAPHRAGM PRODUCING AN ABDOMINAL TUMOR[1]

Together With Remarks on Acute Pulmonary Edema Following Tapping

A number of years ago I made an autopsy at the Philadelphia General Hospital on a case of left-sided pleural effusion. On opening the abdomen I found in the left upper quadrant a large, smooth, tense tumor which upon further exploration proved to be a bag made by the inverted diaphragm and filled with pleural fluid. The incident made a deep impression upon me, but was not duplicated in my further experience as pathologist. I have, however, seen this tumor twice since then, clinically. Of the first case I cannot find any record; the second, here reported, I saw a few months ago. The patient is a widow, aged seventy-seven years, who came under my observation in April, 1918. The salient points in her case are as follows: For years she has suffered with diabetes mellitus and chronic nephritis with moderate hypertension. She has diabetic cataract and retinal hemorrhages. When I first saw her, the heart was slightly enlarged; there was a soft systolic mitral murmur; the legs were somewhat edematous. The urine contained sugar up to 3.2 per cent.; and albumin from traces to 2.8 grams per liter. Ketones were inconstantly present. The quantity of urine was usually about 1500 c.c.; specific gravity varied from 1007 to 1013. Unlike most cases in which nephritis and diabetes coexist, the sugar in this patient did not vary in inverse proportion to the albumin—the larger amounts of sugar were often found when the albumin content of the urine was high.

Under treatment the patient improved greatly and was able to spend the summer of 1918 very comfortably in Atlantic City. On July 25, 1919, I saw her at her home in Wilkes-Barre with Dr. Bullard. It appeared that after eating some cheese on June 5, she

[1] Read before the Section on Medicine of the College of Physicians of Philadelphia, October 27, 1919.

Extracted from the American Journal of the Medical Sciences, March, 1920, No. 3, Vol. CLIX.

had been seized with an attack of acute indigestion characterized by abdominal pain radiating to the back, nausea, vomiting, and slight diarrhea. Within a few days thereafter she began to suffer from shortness of breath and fluttering of the heart which kept her confined to her room. I found her sitting up, intensely short of breath; the lips somewhat cyanosed; pulse rapid; no fever. Making a cursory examination of the abdomen I detected on the left side a large, tense, rounded mass, slightly uneven, somewhat tender, and occupying nearly the entire upper left half of the abdominal cavity. It extended forward to the prolonged midclavicular line and downward to the level of the umbilicus. I was at first somewhat nonplussed by it, but found the explanation when I examined the chest. The left chest was visibly distended and enlarged. The percussion note was flat from above the left clavicle down to the bottom of the thorax, front and back. No heart sounds could be heard on the left side; the apex beat was distinct both on palpation and on auscultation in the fifth interspace just within the right nipple line. Over the left chest bronchial breathing and a twangy bronchophony could be heard. I concluded that the abdominal tumor was the inverted diaphragm containing pleural fluid, a view confirmed by the results of tapping the chest.

After drawing off the fluid, which was done slowly, five pints being obtained, the tumor could no longer be felt. Fearing the possibility of pulmonary edema on account of the presumably long duration of the effusion, I remained for a considerable time at the patient's bedside. In the first half hour nothing happened; the patient was comfortable and greatly relieved of her shortness of breath. Then suddenly the lungs filled up with fluid, loud bubbling rales could be heard everywhere throughout the chest; the breathing became rattling and terribly labored. A violent cough which brought up only a little fluid added to the distress of the patient whose air hunger was painful to see. Her face became purple; the skin cold and clammy; dissolution seemed imminent. I gave her a hypodermic injection of morphin and atropin, which in other cases of this type I had seen productive of good results, but it had no effect. I then applied a number of dry cups over the back, and as if by magic every rale disappeared. I have never seen anything quite so dramatic. The grandson who was present in the room and who had been a most anxious spectator was amazed beyond expression by the instantaneous improvement.

After a proper interval I removed the cups; there was an immediate return of edema, but it was slight and caused little distress. From that time on the patient's improvement was rapid, and she

was able to go to Atlantic City the latter part of July, where I had the pleasure of seeing her with Dr. William W. Fox. A considerable accumulation of fluid had again taken place and the abdominal tumor had reappeared, but was not as large as before. Sometime later Dr. Fox tapped the chest, the tumor vanished, and the patient was relieved of her distress. As I know from frequent reports she is in good condition to this day.

I have looked through many text-books on diseases of the lungs and through recent and old works on physical diagnosis without finding more than two references to the diaphragmatic inversion.

Wilson Fox in his monumental work,[2] mentions it in the following words: "When the effusion is large, the diaphragm may pass below the ribs and may there, in some cases, be felt as a tumor."

Collet[3] describes the condition clearly, although he does not bring out the fact that a real tumor-like mass may appear in the left upper abdomen. He says: "Dans les epanchements énormes qui écrasent le diaphragme au point de le faire bomber dans l'abdomen, la matité franchit les limites de l'aire de Traube et dépasse de plusieurs travers de doigt le rebord costal."

The condition is a mechanical result of great intrapleural pressure. As pointed out by Powell and Hartley[4] "the negative pressure within the pleura is maintained until the lung is completely retracted before the advancing fluid; thereafter any further accumulation compresses the lung and by its weight and pressure forces down the diaphragm." To invert the diaphragm, however, to turn it inside out, a much greater pressure than ordinarily exists in pleural effusions must be produced. If the patient is up and about, gravity probably acts as a favoring factor.

It is evident that a tumor formed by a bag of pleural fluid projecting into the abdomen must be considered in the differential diagnosis of abdominal masses. If the chest condition is overlooked, or when not overlooked, if the pleural effusion and the abdominal tumor are not correlated, the possible diagnostic errors are many. The tumor has a peculiar bulky feel, is tender to touch, does not move with respiration, has the shape neither of the spleen nor of the kidney, and appears to have a deep attachment. Its true nature is revealed after aspiration of the chest, when it will be found to disappear. In the absence of tapping a roentgenologic examination is probably the best means of diagnosing the true nature of the tumor. Such an examination will likewise show

[2] Diseases of the Lungs and Pleura, London, 1891, p. 983.
[3] Précis des mal. de l'appareil respir., Paris, 1914, p. 501.
[4] Diseases of the Lungs, London, 1911, p. 97.

whether after tapping the diaphragm has returned to its normal position and is functioning properly.

Several years ago in a paper on "Albuminous Expectoration Following Thoracocentesis," [5] I referred to acute pulmonary edema following tapping, ascribing it to "congestion by recoil." It is very alarming and sometimes terminates fatally. Usually a hypodermic injection of morphin and atropin brings speedy relief, but, as in the case just cited, it may fail. The remarkable results produced by dry cupping, which cannot be questioned, must be due to some reflex nervous influence. I believe dry cupping to be a good therapeutic measure in all forms of acute pulmonary edema whether due to tapping or to other causes.

[5] Am. Jour. Med. Sc., April, 1902.

SPONTANEOUS NON-TUBERCULOUS PNEUMOTHORAX *

By spontaneous non-tuberculous pneumothorax we understand a pneumothorax occurring suddenly in healthy individuals, without the cause being discoverable by physical examination or by the history of the case, and in which there is rarely formation of liquid.

Pneumothorax was, no doubt, known to the ancients; but no clear account has come down to us. It is true that Hippocrates mentions the succussion splash, but this was wrongly interpreted as meaning pus in the pleural cavity; while, in reality, it means the presence of both air and fluid. Apparently the first to appreciate the condition was Riolan, a contemporary of Harvey, although the first exact description of it was not given until a century ago, in 1803, by Itard,[1] a French physician, who coined the term pneumothorax. His studies were made in the post-mortem chamber, and neither he nor his immediate successors seem to have recognized the condition during life. This was reserved for Laennec,[2] whose investigations, particularly of the symptoms and diagnosis of the disease, were so thorough that posterity has been able to add but little to them.

Laennec gave the probable causes of pneumothorax as: (1) tuberculosis; (2) decomposition of pleural effusions; (3) gangrene of the lung; (4) emphysema of the lung; (5) idiopathic formation of air in the pleural cavity. By the last, Laennec understood a sort of gaseous secretion on the part of the pleura. The second and last of these causes were finally, in the light of many observations, put aside; although the second, decomposition of pleural effusions, has lately been revived on good evidence. Thus, Levy [3] reported a case in which it seemed beyond doubt that a pneumothorax had supervened on a pyothorax, as the result of decomposition by an anaërobic organism, apparently the bacillus aërogenes capsulatus.

May and Gebhardt [4] likewise reported a similar case of pneumothorax due, in this instance, to the bacillus coli communis, and they proposed the name zymotic pneumothorax for one having such an origin. The proteus vulgaris and other undetermined organisms have

* Reprinted from The American Journal of the Medical Sciences, August, 1902. Written in collaboration with M. H. Fussell, M.D.

also been found in cases of this kind, particularly by French writers, who employ the term *pneumothorax par fermentation gazeuse.*

The most common cause of pneumothorax is tuberculosis; this is not alone the experience of individual observers, but is shown to be the fact by several series of statistics. Thus Biach,[5] in 1880, collected all the cases of pneumothorax which had occurred in three hospitals in Vienna—918 cases had been observed, which were divided, according to their cause, as follows:

Tuberculosis	715 cases.	Bronchiectasis	10 cases.
Gangrene	65 "	Abscess of the lung	10 "
Empyema	45 "	Emphysema	7 "
Traumatism	32 "	Infarct	4 "
Echinococcus	1 "	Perforated esophagus	2 "
Thoracentesis	1 "	Abscess of the bronchial glands	2 "
Worms	1 "	Fractured ribs	1 "
Peritonitis	1 "	Fractured sternum	1 "
Ulcer of stomach	2 "	Uncertain	14 "

As regards the frequency with which pneumothorax occurs in pulmonary tuberculosis, the following statistics, quoted from Biach, are of interest: In 58,731 cases of tuberculosis which had been observed, 433—or less than 1 per cent.—developed pneumothorax. Galliard[6] found 36 instances of pneumothorax among 3415 cases of pulmonary tuberculosis, making a percentage of 1.054. These are smaller percentages than those found by Lebert and by West,[7] who give the frequency as 5 per cent. In 1000 cases of phthisis at the Brompton Hospital, there were (Fowler and Goodlee[8]) 65 cases of pneumothorax (6.5 per cent.).

It is seen from these statistics and from others which have been compiled that from 80 to 90 per cent. of the cases of pneumothorax are due to tuberculosis, while the proportion of tuberculous cases that develop pneumothorax is from 1 per cent. to 6.5 per cent. Among the uncertain cases, fourteen in the foregoing series, there are a few of the so-called spontaneous, idiopathic, or accidental pneumothorax.

When these spontaneous cases were first observed and reported, it was thought that they probably arose from a small tuberculous nodule which could not be recognized by physical examination or by the history. This view is apparently still held by some reporters —notably by West,[9] Delafield (Case 4, this series), Talayrack,[10] and Hamilton.[11] West[12] says: "Experience and experiments seem to show that when pneumothorax has taken place in the apparently healthy, a lesion which may even be of a tuberculous character has really been the cause of the accident." Delafield apparently takes it for granted that his case was tuberculous, although neither

physical examination nor the history of the case bears out this conclusion. Hamilton seems to have based his belief largely upon West's great experience. Cases have been observed, however, that have come to autopsy, which prove that in some instances at least tuberculosis is not present; as in the cases of Ranking and Devillier (No. 9, our series). Two other cases, those of Chauffard and Osler (Nos. 40 and 48, our series), were treated by tuberculin, and gave no reaction. The authors have observed the two following cases, which are certainly cases of spontaneous pneumothorax, and which, they believe, are not tuberculous. The notes are copies of those made at the bedside of the patients.

Case I.—Katherine G., aged twenty-one years; father and mother living; mother the subject of diabetes mellitus; father well. One sister dead of unknown cause. One sister and three brothers living and well. There is no known tuberculosis in the family. When the patient was fifteen years of age she had a severe attack of chlorosis, from which she entirely recovered. When nineteen years old she gave birth to a perfectly healthy infant. (This child is living and well at present.) In 1894 she had a rather severe attack of dysentery. Except for the above conditions, she was perfectly well until March 14, 1895. On that date I was called to see her for some ill-defined ailment. A careful physical examination made at the time showed all the organs to be normal. On the morning of March 21, 1895, she was awakened from her night's sleep by a severe stabbing pain in the region of her left nipple, accompanied by distressing dyspnea. On inspection the left chest was seen to be without respiratory movement. It was distinctly distended. There was no tactile fremitus. There were no voice sounds or breath sounds over the left side. The apex-beat of the heart was in the fifth intercostal space on the right side of the chest. There was marked dulness on percussion. She received morphine and was kept in bed. On the next day there were the same physical signs, except that the dull note on percussion noticed over the left chest was found to be replaced by a resonant note.

The next day, March 23d, the note over the left chest was hyperresonant, and there was amphoric breathing over the base. On this day the patient's temperature was normal. She still suffered considerably, and the chest was aspirated. Nothing but air was found. The heart at once resumed its normal position, and the patient speedily recovered. At the end of two weeks she was able to resume her usual duties. She has never been ill since. Today, seven years after the attack of pneumothorax, she is perfectly well.

Case II.—The patient, P. B., a teamster, aged twenty-seven years, born in Ireland, was admitted to the Philadelphia Hospital on December 16, 1901, in the service of Dr. S. Solis Cohen, through whose courtesy we are able to make this report. His sole complaints were cough and pain in the right side. The family history was exceptionally good. The parents, three brothers, and three sisters, were living and in good health. One sister had died in infancy. The man himself had had the diseases of childhood and typhoid pneumonia. As a teamster he always had been much exposed; he had also drunk considerably.

For a month prior to admission he had had, as the result of exposure, a cough, which did not trouble him greatly. The night before his entrance into the hospital he had a particularly violent fit of coughing, during which he was seized with severe pain in the right side. He had to go to bed, and the next day was brought to the hospital.

On admission he was found to be a tall, robust, well-nourished man, with a flushed and rather cyanotic face. The breath smelled strongly of alcohol. There was no dyspnea apparent. The chest was large and deep, the intercostal angle obtuse. The right side of the chest was larger than the left, and the intercostal spaces on the former side bulged slightly. Expansion was deficient over the entire chest, particularly upon the right side, on which the fremitus was also decidedly less than normal, especially toward the base. The right nipple was half an inch higher than the left, and on inspiration the intercostal spaces retracted less on the right than on the left side.

On percussion the note over the right side was more resonant than that over the left. At the right apex the note had a quality which could be designated as wooden tympany; it was not a clearly tympanitic note. Toward the base, however, the percussion sounds were decidedly and characteristically tympanitic. The liver dulness was entirely obliterated. There was tympany at front, side, and back, down to the edge of the ribs; and the note here in the right hypochondrium, as has been stated, was more tympanitic than over the upper part of the chest. The tympanitic sound extended beyond the left border of the sternum.

Auscultation. On the left side the breath sounds were feeble, the vesicular element being almost suppressed. Expiration could not be distinctly heard in all parts, but where detected was prolonged and low-pitched. On the right side the breath sounds were entirely inaudible over the back. In the axillary region a distant breathing could be heard, the expiration being somewhat harsh. At the extreme apex in front the breath sounds were audible, but faint; below they were absent. Upon expiration an occasional sibilant rale could be heard. The vocal resonance was diminished, but not entirely absent.

The apex-beat was found in the fifth interspace, half an inch outside of the nipple line. The boundaries of the organ were not easily determined. They were on the right side to the left of the left sternal border, above, the third interspace; the left border was a finger's breadth outside of the nipple line; the lower at the sixth rib. There was some epigastric pulsation. The first sound was feeble at the base; the second pulmonic was accentuated. The apex sounds were feeble and distant.

On the following day, December 17th, the patient's condition was about the same, except that the cyanosis had increased and the apex-beat and the left heart boundary were a little further to the left than they had been. We strapped the patient's side, and this at once relieved the pain.

On the next day, December 18th, the patient, the notes say, was more comfortable; the cyanosis was less, there was some enlargement of the veins in the right hypochondrium, and the tympany still persisted. The heart, however, had receded fully an inch, the apex being now just within the nipple line.

On December 19th, three days after admission, an attempt was made to obtain the succussion splash, but without any result. There was evidently no fluid in the pleural cavity. The respiration on deep breathing

was somewhat amphoric. The coin-test was tried, but did not yield a characteristic result. There was no bell tympany, although the sound on the diseased side was different from that on the healthy one, particularly just below the angle of the scapula.

Mensuration of the chest on this day showed an expansion of ⅝ inch at the level of the axilla, and 1½ inch at the nipple line. The circumference on the right side just below the axilla was 19¼ inches; that of the left, 17½ inches; at the level of the nipples, the right measured 19¼ inches; left, 17½ inches; at the level of the ensiform cartilage, right side, 18½ inches; left, 17½ inches.

The urine was acid in reaction and had a specific gravity of 1012. It was free from albumin and sugar, but the sediment contained a few hyaline casts, triple phosphates, and epithelial cells. The sputum was also examined; it contained no tubercle bacilli. Fever was absent throughout.

The patient rapidly improved, and on December 23d, a week after admission, requested his discharge. The signs of pneumothorax were still in part present, and the cyanosis had not entirely disappeared, but there was no cough and no distress. He was seen three months afterward, and was entirely well, the breath sounds being normal and equal over both lungs.

It will be observed that in these two cases a pneumothorax appeared suddenly; in one of them during sleep. In neither of the cases were there any physical signs, symptoms, or history which would warrant a diagnosis of tuberculosis. In both of them recovery was complete. In one of the cases aspiration was resorted to for relief of the symptoms.

In a rather careful search through the literature of pneumothorax we have been able to collect 56 cases which appear to belong to the class of spontaneous non-tuberculous pneumothorax.

An analysis of the tables shows the following facts:

Sex. The sex is mentioned in 55 cases. Of these, 45 were in males and 10 in females. The large preponderance of males has long been recognized. West[13] published a series of 24 cases; and Hall,[14] a series of 31 cases, including 21 cases of West's. In Hall's series there were only two females, about 1 per cent. In our series there were 2 per cent. of females. Hall believes, correctly no doubt, that the preponderance of males is due to the fact that men are apt to make greater muscular efforts than women.

Age. There was one case under the age of ten years; between ten and twenty years there were 13 cases; between twenty and forty years there were 30 cases; over forty years there were four cases.

In eight cases the exact age was not mentioned, but they were all young adults. The condition, therefore, is distinctly more frequent in young adults than in either the very young or the very old. No cases occurred between the ages of three and sixteen years.

Side Affected. This is mentioned in 50 cases. In one case the left side was the seat of the lesion in one attack, and the right side in the other. (Case 41, Goodhart.) Of the remaining 49 cases, 24 were on the right and 25 on the left side.

Duration. The actual pneumothorax may last but a few days, though its effects may persist from a few days to eight or ten weeks. One of our own cases was perfectly well at the end of two weeks; the second left the hospital at the end of a week, but was not entirely well then. When examined, about three months later, he was entirely well. Two cases remarkable for their duration have been reported; one is included in this series. The case reported by Whitney (Case 53, our series) appears to be a true case of spontaneous pneumothorax. It had lasted nine years, and was under observation at the time Whitney's article was written. Another case of protracted simple pneumothorax, the result of a pneumonia, is reported by Adams.[15] This case had occurred two years before it came under the care of Dr. Adams. There were typical signs of pneumothorax, with dyspnea on exertion. After the case had been under observation three years it gradually cleared up, and all the physical signs disappeared. Both of these cases, however, are marked exceptions. The duration averages, perhaps, six or eight weeks, although the symptoms may disappear in a few days.

Exciting Causes. The exciting causes are not definitely known. The condition may supervene during sleep, as in one of our cases. Usually some violent exertion has preceded the attack—lifting weights, spasmodic cough, playing foot-ball, etc. It is probable that some such act is the usual exciting cause in most cases.

Symptoms. The symptoms are often slight. The patient of Jochmans (Case 53, our series) worked all the time he was under observation; but pain of marked severity, localized in the affected side, coming on suddenly and occasionally causing syncope, was present in practically all the cases. The pain, however, appears to last but a short time; at the end of twenty-four hours the patient was generally free from distress.

Dyspnea was absent altogether in the majority of cases. In one of our own it was marked, in the other it was absent. It is of a rather peculiar character; severe and constant in the beginning, later when the patient is lying still he is comparatively comfortable, but any exertion whatever causes him much distress.

Cyanosis was noticed in a few instances. It was present in the beginning of both our cases.

Unconsciousness occurred but once, and then apparently from the great pain and dyspnea.

Cough usually occurred, but was spasmodic in character and without accompanying expectoration.

Fever was not a marked symptom. In Case I. of our own observation there was a temperature of 102° F. in the beginning, but it lasted for only a few hours. In our second case fever was absent.

Physical Signs. Occasionally, as in the cases of Abeille (No. 10) and Johnson (No. 27) of this series, the physical signs were not marked when the patient was first seen, but they appeared gradually within twelve to twenty-four hours.

Mensuration is helpful in the diagnosis, as by that means a distinct enlargement of the affected side is usually shown. Thus in our second case the right side, which was the seat of the pneumothorax, was 1¾ inches larger at the level of the axillæ and of the nipples, and 1 inch larger at the level of the ensiform cartilage. In young individuals a compensatory emphysema on the healthy side may cause that side to be larger than the one affected with pneumothorax. The nipple is likely to be higher on the affected side than on the healthy one.

Inspection revealed enlargement of the affected side and bulging of interspaces in all but one or two of the cases in which it is mentioned. There was also loss of motion on the affected side. The apex-beat of the heart was dislocated to the right or to the left, according to the side affected. In a few instances—Heitler (No. 22), Chauffard (No. 40), and Galliard (No. 33)—the apex was seen in the normal position. In two cases (Lundie and Bushby, No. 50) it was not visible. In these cases there may have been pericardial adhesions, retaining the heart in the normal position; or the pneumothorax may have been only partial. In our second case the veins over the affected side were enlarged.

Palpation revealed loss of tactile fremitus on the affected side in all but one case. This appears to be the most constant of all signs. The edge of the liver may also be felt low down in the abdomen, but occasionally the liver cannot be felt in the abdomen, despite the fact that the hepatic dulness is absent from its normal place.

The displacement of the heart is an interesting phenomenon. Most writers attribute it to the effect of pressure, the mediastinum being pushed to the opposite side by the air under pressure. No doubt this is a factor, but another of much importance is the elastic traction of the healthy lung. The heart, as Powell [16] has shown, is held in place by the balanced traction of the two lungs, which, to use Fowler and Goodlee's [17] simile, acts upon it like two rubber bands pulling in opposite directions. When one of these bands is divided,

as is the case when the lung becomes collapsed, the other band pulls the heart toward its own side. This theory explains the immediate displacement before the pneumothorax has attained a high degree.

Percussion. In all but three of our series of cases the percussion note is described as hyperresonant or tympanitic. In two there was a dull note on percussion. In Case I. of our own and in the case of Waller (No. 35, our series) there was distinct dulness over the affected side. So great was the dulness in our own case that the condition was at first taken for one of pleural effusion. The note changed within twenty-four hours, however, and at the time of tapping there was hyperresonance over the affected chest. The dulness on percussion, which may not be distinguishable from that caused by liquid, is due to the great tension under which the air is held. The note on the unaffected side is more resonant than normal. The heart dulness will be found in an abnormal position, the mediastinum being pushed or drawn toward the healthy side. The employment of percussion to locate the heart is not mentioned except in our two cases and in that of Lundie. Care must be taken in locating the heart dulness to recognize the compensatory emphysema on the unaffected side. In many cases absence of liver dulness was noticed when the right lung was affected. As the air gradually disappears from the chest the percussion note becomes normal at the apex, but remains for a time hyperresonant at the base, the bottom of the chest recovering its natural character more slowly.

Auscultation. There may be entire absence of breath sounds and voice sounds, as is shown by one of our own cases. When this is combined with dulness on percussion there is great danger of mistaking the condition for one of pleural effusion.

Usually there is absence of vesicular murmur, which is replaced by amphoric breathing. The voice sounds are as a rule amphoric in character. The coin sound was present in many of the cases, but was absent in some. Discussion has arisen as to whether the coin sound may occur in any other condition than pneumothorax. That it does is proven by a case reported by Osler, in which there was a marked coin sound over the apex of one lung, although at post-mortem only a large cavity in the lung and not a pneumothorax was found.

Metallic Tinkling. A musical sound of high pitch, resembling drops falling into liquid confined in a cavity, is of frequent occurrence. As West pointed out in 1884, this phenomenon is not necessarily due to the presence of liquid, the explanation usually given for it, inasmuch as it is frequently present when liquid is absent; in such cases it is probably due to the escape of bubbles of air from the ruptured lung into the distended pleural cavity. In

none of these latter cases was there a collection of fluid following the entrance of air, as proven both by physical signs and, in some cases, by exploration with an aspirator.

The opening into the pleural cavity is probably soon closed in many of the cases in such a way that very little air finds its way out after the first escape. This is probable, as is shown by the rapid disappearance of air in most of the cases; and in the patients who had been tapped there was no return of air into the cavity, as there assuredly would have been if the opening had continued patulous. It is, therefore, seen that amphoric breathing and amphoric voice sounds are not necessarily, as has been held, signs of a patulous opening, but may occur when the opening is closed or valvular. That the opening is occasionally valvular, allowing the air to enter but not to leave the pleural cavity, is shown by the decidedly positive pressure of the air in the pleural cavity in some cases, as in the experiments of Aron,[18] made on a case of spontaneous pneumothorax. Hamilton has recognized this fact in his article.

Recurrence of Symptoms. This took place in six of the tabulated cases. In all but one of the instances the recurrence was on the same side as the original trouble. In one (that of Goodhart, No. 41) the recurrence was on the opposite side. In one case there were three recurrences (the case of Gabb, No. 34, in which there were four attacks, with intervals of six, two, and six years). In one instance (that of Finny, No. 51) the recurrence took place eight weeks after the first attack, when the patient seemed entirely well. In Flint's case (No. 26) there was an interval of four weeks.

A pneumothorax which is simple, that is, not accompanied with the formation of liquid in the chest, occasionally occurs in tuberculosis, and the patient may remain in good health for a long time. West reports such a case. A man, aged twenty-four years, under treatment for tuberculosis of the lungs, was suddenly seized with severe pain in the chest accompanied by dyspnœa, and with the typical physical signs of pneumothorax. The patient recovered from this attack in six weeks without the formation of liquid in the chest.

Cayley [19] and Hale White [20] give examples of pneumothorax occurring in typhoid fever; others refer to the occurrence of the condition in lobar pneumonia. These cases have not been included in this series because they were due to some sort of inflammatory process in the lung. The cases which we have collected had no inflammatory condition.

One of us (Fussell) has observed a remarkable case of pneumothorax which occurred as the initial symptom of a case of primary sarcoma of the pleura. Though the case is not one which belongs

under the heading of this paper, it was thought to be such a case for over three months. It is such a marked example of the difficulty of making a diagnosis that we report it somewhat at length. It is not included in the list.

CASE III.—John A., aged three years, an only child of healthy parents. No hereditary disease in either branch of the family. I have been his medical attendant since birth. He has never been seriously ill.

Suddenly in the night of December 14, 1901, he awoke from a sound sleep, crying with pain. During the next day he had a slight cough. I first saw him on the evening of the 15th. I made a cursory examination, but observed nothing especially wrong. At my visit on the 16th I observed that there was much dyspnea. When not disturbed the child was comfortable, but breathed rapidly. On examination the heart was found in the normal position. There was hyperresonance all over the right side of the chest. There was exquisite amphoric breathing and metallic tinkling. There was no succussion splash. Pectoriloquy could be heard over the entire right chest. The right side was motionless during respiration. There was no fever.

December 18th. Physical examination revealed the heart to be 3 cm. to the left of the nipple line. There was no fever. The liver dulness had disappeared.

21st. The amphoric breathing had disappeared from the apex of the chest, although it could be heard at the base. There was still hyperresonance.

22d. Vesicular breathing was heard at the apex of the right lung, to the third rib anteriorly and to the angle of the scapula posteriorly. The amphoric breathing was heard only at the base posteriorly. The heart's action was fairly slow.

26th. The heart was almost in its normal position. Breath sounds fairly well heard over the right chest.

February 1st, 1902. Patient moving about the house. The temperature had never been above normal. The liver dulness had returned. Breath sounds could be heard over the entire right lung, but they were not as good as over the left lung. The apex-beat of the heart was exactly under the nipple. There was no dulness.

6th. During the night following a day of too severe exertion, extreme dyspnea returned. On examination there was marked hyperresonance over the right chest. The heart-beat was in the anterior axillary line. Amphoric breathing, pectoriloquy, and metallic tinkling, with a typical coin sound, had reappeared. The liver could be felt on a line with the umbilicus. The patient was rather cyanosed, and the heart's action was rapid. The temperature was 102° F.—the first fever during the illness. There was evidently a reopening of the old rupture of the lung, or a rupture in a new place. The patient's condition gradually grew worse, and on February 11th he was almost in extremis. The chest was aspirated under local anesthesia. Much air, with a small quantity of bloody froth, escaped. Immediately the heart returned to its normal position, dyspnea disappeared, and good breath sounds were heard over the right chest. The child fell into a quiet sleep, and when he awoke asked for nourishment.

13th. The patient still pale, but not cyanosed. Good resonance over the right side, to the liver dulness, which was in the normal position. Heart dulness was of normal size and in the normal position. Breathing was slow, regular, and full.

24th. There was good respiratory movement on both sides of the chest. Breath sounds not quite so loud on the right side as on the left. Heart and liver in normal position.

March 3d. The child appeared well. The breath sounds were still not quite so loud over the right chest as over the left.

Patient was sent to Florida March 1st. Was improving steadily until April 8, when suddenly, in the middle of the night, he was seized with pain and seemed to be trembling and cold. There was some shortness of breath. From that time on he became gradually more dyspneic; breathing rate about 60. Various diagnoses were made until Charleston was reached, and liquid was diagnosed in the chest.

April 16th. Physical Examination. The patient lies quietly on the right side; but when disturbed he cries. He is not cyanosed. Crying does not cause cyanosis at first. After crying has continued and a little exertion is made, cyanosis is present. Bulging of the right side posteriorly. There is but little motion on that side. The apex-beat of the heart is not plainly seen, but it can be felt half an inch outside of the nipple line. Right chest measures 10½ inches; left, 12 inches. No fremitus on the right side. Large rhonchi are heard over the right side, possibly transmitted from the left. No coin sound; no metallic tinkling; no amphoric breathing. On quiet breathing, fairly good breath sounds are heard over the entire right side, but nothing to compare with those on the left. Percussion shows flatness over the entire right side posteriorly, resistance below the ribs on the right side, and good resonance over the right and left flank on lying down.

17th. The dulness still persists on the right side; no fremitus; distinct breath sounds on the right side; blowing breathing at extreme apex of the right side; left border of the heart dulness at the anterior axillary line. The patient was tapped in the mid-axillary line. There was practically no fluid present; only a small amount of blood and water that was in the tube at the time of operation. A hypodermic needle was entered in two other positions, but no liquid was found. After the operation the patient's left chest was almost tympanitic in character. Breath sounds were present. The patient could lie in comfort on the back—a thing not possible before.

18th. Patient breathing rapidly; lying on the right side; pale, but not cyanosed; abdomen distended. On the right side of the abdomen there is very much more resistance than on the left. The interspaces on the right side are still bulged. There is epigastric retraction, the external jugular vein is filled. There is tympanitic resonance over the right side anterior to the margin of the ribs, and there is dulness posteriorly of the right side below the fourth rib. No tinkling, no amphoric breath sounds. The external jugular fills on crying. The heart dulness is almost in the anterior axillary line.

21st. Breathing is more labored than yesterday, there is resonance over the right chest as far as the sixth rib anteriorly and posteriorly. Dulness below that position. The dulness is not movable. The left border of the heart is one inch to the left of the nipple.

22d. The patient passed a restless night, is cyanosed, the heart action rapid and weak. Physical signs about as yesterday except the position of the liver, which seems to be on a decidedly lower line than it was yesterday. In the afternoon the patient was suffering so extremely, and apparently was in such imminent danger of death, that ether was administered, a portion of the sixth rib excised, and the following conditions found:

There was a cavity lined with pleura which extended above the point of opening as far as the finger could reach. It contained 60 c.c. of bloody liquid. The whole lower chest was filled with a semisolid substance.

The patient bore the operation badly, but revived under stimulation, and was in good condition two hours after the resection.

24th. A sudden cardiac dilatation after a good night's rest.

26th. Death occurred. At the autopsy the right chest was found filled with a primary new-growth of the pleura. Rupture of the lung had occurred as the first sign of the disease.

A study of our own cases and that of those we have collected from the literature shows that pneumothorax occasionally occurs in persons in apparent good health. This has been observed, as the cases we have collected testify, but the tendency of writers has been to ascribe such cases to an unsuspected tuberculous lesion that had remained and continued to remain unrecognized by physical and rational signs. We desire to emphasize the fact, however, that there is a spontaneous pneumothorax which is not due to tuberculosis of the lungs. What is its cause? The most reasonable view, it seems to us, is that the rupture of the lung occurs through an emphysematous vesicle. This presupposes the existence of an emphysema; hence, it might be said, a disease of the lungs. As we have tried to exclude from our tabulation all cases of pneumothorax occurring in advanced chronic emphysema, our list comprises only cases in which emphysema if it existed was moderate and not possible of diagnosis. Now a moderate degree of emphysema in adults cannot be considered a sign of disease. It is extremely rare to find an adult lung in which there are not a few enlarged vesicles along the anterior margins or at the apices. As this condition is not recognizable clinically, and as it is not considered a sign of disease post-mortem, it is not necessary to do so when explaining spontaneous pneumothorax. Our conclusion, therefore, is that pneumothorax can occur, with a practically healthy lung, from rupture of an emphysematous vesicle.

The possibility of its occurrence as the result of emphysema is undoubted. A number of cases of pneumothorax are on record in which the autopsy showed advanced emphysema and no tuberculosis.

In Ranking's case, quoted in our series (No. 9), there was a spontaneous pneumothorax, with recovery. Some time after the patient died of an unsuspected dissecting aneurysm. At the post-mortem a small superficial area of the lung that had been affected with pneumothorax was found to be the seat of emphysema. Ranking believed that the pneumothorax occurred because of the rupture of one of these vesicles. There was no tuberculosis. Devillier (the

first case of our table) was unable to find at the post-mortem any signs of tuberculosis, and believed the pneumothorax was due to rupture of an emphysematous vesicle which was found.

Cnopf [21] has observed several cases of diphtheritic croup in which pneumothorax developed before death; at autopsy an emphysema, local in character, was found, rupture having taken place through one of the vesicles.

Zahn [22] reports six cases of pneumothorax caused by exertion in individuals suffering from some grave pulmonary lesion. He found either a rupture through a local emphysema or a tear of the pleura due to old pleuritic adhesions.

That pneumothorax may occur with a practically healthy lung is clearly demonstrated by the cases in our table; the histories show that the individuals were perfectly well before the occurrence of the pneumothorax. The after-history is likewise one of perfect health. No severe inflammatory reaction followed the entrance of the air into the pleural cavity. In tuberculous cases the simple pneumothorax is soon followed by the formation of liquid in the chest. Tuberculous cases die in the great majority of instances or become chronic invalids.

In three of the cases in our list (Osler, Chauffard, and Jochmans) tuberculin was used without any reaction following. This would go to show that in these cases at least there was no tuberculosis.

Diagnosis. With the symptoms as described above, sudden severe pain in the chest, dyspnea, faintness, cough, and the physical signs of hyperresonance, amphoric breath and voice sounds, metallic tinkling, coin sound, dislocation of the viscera, all suddenly appearing, there can be no possible difficulty in making a diagnosis of pneumothorax. All these signs, however, are rarely present at the same time in the same case. In the very rare cases in which there is dulness on percussion, together with loss of tactile fremitus and voice sounds, the pneumothorax may readily be mistaken for a pleural effusion, as was done in our first case. The sudden appearance of the symptoms and signs in the course of a few minutes or hours will usually serve to mark the case as one of pneumothorax. Puncture of the chest with a long hypodermic needle should always be resorted to when the question is in doubt.

In the cases in which there is hyperresonance with absence of breath sounds, together with loss of tactile fremitus and voice sounds, the thought of emphysema will arise. In emphysema, however, the physical signs are generally bilateral, in pneumothorax one side alone is affected. In the very rare cases of unilateral emphysema there may be more difficulty in arriving at a conclusion. There will be displacement of the viscera in pneumothorax, none

in emphysema; the presence of vesicular murmur in emphysema, none in pneumothorax.

There may be great difficulty in the diagnosis from diaphragmatic hernia. In this condition the abnormal percussion note, as a rule, does not extend over so great an area as in pneumothorax; gurgling over the affected side will be present in hernia, absent in pneumothorax. Auscultatory percussion—percussion over the abdomen, auscultation over the chest, reveals distinct transmission of the percussion note; and when the patient swallows water there may be splashing and gurgling noises. If strangulation is present the symptoms of this condition will help in the diagnosis. Attention to the same physical signs will aid in the differentiation of pneumothorax from an abnormally high position of the diaphragm on one side, with the consequent apparent presence of the stomach and intestines in the chest cavity.

The non-tuberculous cases will have to be distinguished from the extremely rare tuberculous cases that recover without the development of effusion. The history of the case and the absence of tuberculosis in any portion of the body will help. The use of tuberculin will cause a reaction in the tuberculous cases, none in the non-tuberculous.

The great difficulty in distinguishing these benign cases from malignant disease of the pleura with pneumothorax is well illustrated by the case we have reported. The final outcome is the only distinguishing feature in such a rare case.

In certain rare instances of extremely large tuberculous cavities all the signs of pneumothorax may be present, except dislocation of the viscera, which will serve to point the way to a correct diagnosis.

Case 56, by Jochmans, is of especial interest, because the X-ray was used to confirm or make the diagnosis. The collapsed lung could be seen as a shadow above a clear zone below. As the lung expanded its shadow was seen further down.

Treatment. The great majority of patients were put to bed and received an opiate to control the pain. No other treatment was necessary, as they soon began to improve. In our second case (No. 55 of table) strapping of the chest with adhesive strips proved effective in controlling the pain. Nine of the cases were aspirated, with instant relief of all symptoms and without return of air into the chest cavity.

Aspiration is certainly a safe procedure; it is entirely under the control of the operator, so that it can be stopped if untoward symptoms occur. If the symptoms are urgent the chest should be aspirated, and aspiration should also be performed if the air is not spontaneously absorbed in a few days.

It is wise, however, to delay aspiration for a few days after the rupture, in order that the seat of the opening may be firmly closed with lymph, otherwise the opening will rupture and the air re-accumulate.

Result. All but one case recovered (Case I., 1826), but the true nature of this case was not realized until autopsy.

Conclusions

1. Spontaneous non-tuberculous pneumothorax occurs in healthy individuals. It is rare. It is most common in young men.
2. The pneumothorax is simple—*i. e.*, there is no formation of fluid.
3. There is rarely any febrile reaction, except, perhaps, in the very beginning.
4. There is probably a moderate amount of emphysema in the lung which is not recognized during life and is not incompatible with health.
5. Aspiration is a certain and safe means of relief and should be resorted to in severe or prolonged attacks.
6. This form of pneumothorax is benign. All but one of the reported cases recovered, and there was only once formation of fluid.

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14. Hall. Ibid., 1887, p. 153.
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19. Cayley. Clin. Society Trans., 1884, xvii, p. 52.
20. Hale White. Ibid., 1896, p. 905.
21. Cnopf. Münch med. Woch., 1893.
12. Zahn. Virchow's Arch., 1890, vol. cxxiii.

LIST OF CASES

Reporter.	Sex and age.	Side affect'd	Duration.	Cause.	Symptoms.	Treatment.	Result.
1. Devillier. Thèse, Paris, 1826.	M. 18	Right	Several days.	.....	Dyspnœa; pain.	None.	Death.
2. Ferrari. Gaz. Méd. de Paris, 1856, No. 11.	M. 16	Right	Few days.	Over-exertion.	Resonance over chest, pain, dyspnœa, fever, cyanosis, no respiratory sounds, distention of chest.	Aspiration.	Recovery.
3. Brunnicke. Dublin Hospital Gazette, 1856, p. 111.	M. 31	Right	Few weeks.	.....	Perfectly well three months after.	.....	Recovery.
4. Dowell. Ibid., September, 1856.	M. 23	Left	3 to 4 weeks.	Severe cough.	Pain; slight cough.	.....	Recovery.
5. Thorburn. British Medical Journal, 1860, vol. i. p. 413.	M. 32	Right	2 mos.	24 hours after hard rowing.	Few; only dyspnœa, resonance, metallic tinkling, amphoric breathing.	Rest; iodine externally.	Recovery.
6. Thorburn. Ibid.	M. 37	Right	2 mos.	After gardening.	Same as above.	Rest.	Recovery.
7. Wipham. Proc. London Med. Soc., vol. ix. p. 247.	M. 31	Right	1 mo.	No exertion, had been sitting in draught.	Pale, anxious; amphoric breathing; metallic voice sounds; resonance on percussion good; fremitus.	Rest.	Recovery.
8. Ricker. Wien. med. Woch., 1860, No. 28.	M. 18	Left	2 mos.	During coughing	Pain; dyspnœa.	Aspiration; patient relieved at once.	Recovery.
9. Ranking. Ranking's Digest, 1860, No. 11, p. 96.	M. 19	Left	2 mos.	.....	Pain, dyspnœa, distention of side, dislocation of heart, amphoric breathing; metallic tinkling.	No treatment.	Recovery.
10. Abeille. Gaz. Méd. de Paris, 1867, No. 1.	M. 29	Right	7 wks.	Hard work.	Pain, dyspnœa, no phys. signs at first, three days later amphoric breathing, tympany, metallic tinkling.	Morphia for pain; rest.	Complete recovery.
11. Vogel. Deutsch. Arch. f. klin. Med., 1867, vol. xi. p. 244.	F 29	Right	4 wks.	Over-exertion.	Pain, dyspnœa, dislocation of heart.	Opium; rest.	Recovery.
12. Rilliet and Barthez. Malades des Enfants, vol. i. p. 614. Quoted by Galliard.	 3	Right	30 dys.	Unknown.	Pain, dyspnœa, amphoric breathing; no metallic tinkling.	.....	Recovery.
13. Oppolzer. Allg. Wien. Med. Zeit., 1868, No. 52.	M. 17	.....	Few days.	.....	Sharp pain dyspnœa, dislocation of organs, resonance, bell tympany.	Opium; rest.	Recovery.
14. Forster. Archiv. f. klin. Med., 1869, vol. v. p. 545.	M. 28	Right	3½ mos.	During walking.	Pain, dyspnœa, tympanitic dulness, metallic tinkle, breath sounds weak, distention of side.	Morphia for pain; rest.	Recovery.
15. Mackenzie. Lancet, Aug. 19, 1871.	M. 50	Right	3 wks.	Exertion.	Pain, dyspnœa, lividity, amphoric breathing, metallic tinkling; well in a few days.	Aspiration.	Recovery.

Reporter.	Sex and age.	Side affect'd.	Duration.	Cause.	Symptoms.	Treatment.	Result.
16. Wilks. Brit. Med. Journ., 1874, p. 770.	M. y'ng	Left	Few days.	Exertion.	Sudden onset, gasping, pain, tympany over chest.	None.	Recovery.
17. Wilks. Ibid.	M. eld'ly	.....	Few days.	Exertion.	Intense dyspnœa.	None.	Recovery.
18. Wilks. Ibid.	F 30	Left	3 mos.	Walking.	Eight months pregn't, delivered at term; dyspnœa, cough; no breath sounds, no voice sounds.	Aspiration.	Recovery.
19. Church. Edinburg Med. Journ., June, 1875.	M 39	Right	3 wks.	Walking.	Pain, dyspnœa.	Aspiration.	Recovery.
20. Bozasinsky. Canst. Jahr., 1876, vol. xi. p. 168.	M 30	.....	26 dys.	.....	Attack occurred during sleep.	.....	Recovery.
21. Bull. Ibid., 1877. vol. xi., p. 171. Quoted by Blach.	F 29	Left	Short time.	Playing, inst. conversation.	Two attacks, one after playing piano, another after talking.	.....	Recovery from both attacks.
22. Heitler. Wien. med. Woch., 1879, No. 17.	M adult	Right	2 mos.	While dressing.	Dyspnœa, no fever; tympany, distention of side; heart in normal position?	.....	Recovery.
23. Delgrange. Journ. des. Sci. Méd. de Lille, in Brit. Med. Journ., 1881, p. 196.	M 18	Left	8 dys.	Inflating chest.	Pain, dyspnœa.	.....	Recovery.
24. Fraentzel. Ziemssen's Encycl., vol. iv. p. 746.	M 19	.....	6 wks.	Rolling barrel.	Tearing in chest; dyspnœa.	.....	Recovery.
25. Biermer. Würzburger Med. Zeit., vol. i. p. 385.	M 18	Left	7 wks.	Dancing.	Sensation of oppression, dizziness.	Some liquid formed.	Recovery.
26. Flint. Practice of Medicine, 1881.	M 29	Left	7 wks.	Carrying a pack.	Pain, tympany, dyspnœa, amphoric breathing, metallic tinkling.	Morphia.	Recovery.
27. Johnson. Clin. Soc. Trs., 1882, p. 159.	M 17	Left	2 mos.	Playing.	Pain, dislocation of viscera three days after onset of pain.	Rest.	Recovery.
28. Rix. Quoted by Hall.	M 39	Left	7 wks.	While sweeping.	Pain, faintness, hyperresonance, metallic tinkling, no cough.	None.	Recovery.
29. West. Clin. Soc. Trans., 1884, p. 56.	M 24	Right	5 wks.	?	Pain, dyspnœa, displaced heart and liver, bell tympany, amphoric breathing, metallic tinkling.	Aspiration.	Recovery.
30. Symonds. New York Med. Record, 1886, vol. i.	M adult	Left	8 wks.	Riveting.	Pain, dyspnœa, dislocation of organs, no respiratory murmur.	None.	Recovery.
31. Vinay. Lyon. Méd., Jan. 30, 1887.	M 19	Left	2 mos.	?	Pain, no movement on affected side, no fremitus; tympany, amphoric breathing, metallic tinkling, dislocation of heart.	Morphia for pain.	Recovery.
32. Hall. Clin. Soc. Trans., 1887, vol. xx.	M 24	Left	1 mo.	Unknown.	Tempo. 100°, resonance, metallic tinkling, a second attack with no apparent cause.	Quiet.	Recovery.
33. Galliard. La France Méd., 1887, vol. iii. p. 1617.	M 33	Right	Short time.	Exertion.	Pain, tympany, no fremitus, silence over chest.	Rest.	Recovery.

Reporter.	Sex and age.	Side affect'd.	Duration.	Cause.	Symptoms.	Treatment.	Result.
34. Gabb. British Med. Journ., 1888, vol. xi. p. 178.	F 56	Right	Each attack 2 or 3 months	Strain.	Pain, dyspnœa, amphoric breathing, at first low down, later above resonance; four attacks well recorded, 1874, 1880, 1882, 1888.	Morphia.	Recovery.
35. Waller. Lancet, 1890, vol. i.	M 16	Right	2 mos.	Jumping.	Pain, faint breath sounds, slight fever, slight dulness.	Tapped with instant relief.	Recovery.
36. Lundie. Edinburgh Med. Journ., 1891, p. 220.	M 20	Left	1 mo.	Thinks an old pleural adhesion torn.	Pain, dyspnœa, hyperresonance, no heart dulness, no breath sounds, heart was dislocated backward.	None.	Recovery.
37. Glaeser. Zeit. f. klin. Med., 1892, p. 394.	M 32	Left	1 mo.	Unknown.	Sudden onset, dyspnœa, pain, tympany.	Tapped, with instant relief.	Recovery.
38. Klemperer. Deutsche med. Woch., 1893, p. 602.	M 21	Left	2½ wks.	Screaming.	Pain, dyspnœa, unconsciousness, cyanosis, no breath sounds; dislocation of viscera.	Rest; opium.	Recovery.
39. Galliard and Barbe. Gaz. des hôp. de Paris, 1896.	F 63	Left	6 wks.	Cough.	Pain, dyspnœa, tympany, coin sound, dislocation of viscera.	Rest.	Recovery.
40. Chauffard. Semaine Méd., 1896, vol. xvi. p. 156.	F 20	Left	2 mos.	Exertion.	Pain, dyspnœa, tympany, amphoric breathing; no sign of tuberculosis, no dislocation of heart.	Tested with tuberculin, no reaction.	Recovery.
41. Goodhart. Clinical Society Transactions, 1896, p. 29.	M 24	Right and Left	Short time.	Jumping.	Pale, dyspnœa, metallic tinkle, displaced heart.	Rest.	Recovery.
42. Aron. Deutsche med. Woch., 1896, vol. iii. p. 257.	M 34	Right	6 wks.	.....	Cyanosis, hyperresonance, metallic tinkle, no respiratory sound, positive pressure in chest.	Tapped.	Recovery.
43. Gibson. Edinb. Hosp. Reports, 1896, vol. iv. p. 237.	M adult	Right	.....	Exercising.	Partial coin sound, no breath sounds, no vocal resonance.	Rest.	Recovery.
44. West. Lancet, 1897.	M 46	Left	.....	Unknown.	Pain, dyspnœa, metallic tinkle.	Rest.	Recovery.
45. West. Ibid.	M 24	Right	6 wks.	Cough.	Pain, dyspnœa, bell sound, amphoric breathing, no tuberculosis.	Rest.	Recovery.
46. West. Ibid.	M 24	Right	8 wks. 4 wks. 2 wks.	Foot-ball.	Three attacks; pain, dyspnœa.	Rest.	Recovery.
47. West. Ibid.	M 15	Right	2 mos.	Dancing.	Pain, usual sign.	Rest.	Recovery.
48. Osler. Maryland Med. Journ., 1897-98.	M adult	Right	5 wks.	Walking.	Pain, dyspnœa, cough, bell tympany, metallic tinkle.	Rest; tested with tuberculin, no reaction.	Recovery.
49. Atkinson. Ibid.	M adult	.....	Few weeks.	Lifting.	Pain, faintness, amphoric breathing.	.....	Recovery.
50. Bushby. Liverpool Med. Chir. Journal, 1898, p. 97.	M adult	Left	3 wks.	Cough.	Pain, heart not located, hyperresonance, no voice or breath sounds.	Rest and opium.	Recovery.
51. Finny. Dublin Journ. Med. Sci., Apr., 1898.	M 18	Left	8 wks. and 5 wks.	Exertion.	Two attacks two mos. apart, pain, dyspnœa, hyperresonance, metallic tinkle.	Rest.	Recovery.

Reporter.	Sex and age.	Side affect'd.	Duration.	Cause.	Symptoms.	Treatment.	Result.
52. Delafield. Interstate Med. Gaz., 1899, vol. vi. p. 14.	M adult	Right	3 mos.	3 months, when dismissed	Sudden pain, amphoric breathing; dislocation of heart, author thinks it is tuberculous, but gives no reason.	None.	Under observation.
53. Whitney. Philadelphia Med. Journ., June 1, 1899.	F 35	Left	9 yrs.	Brisk walk.	Dyspnœa, cough, resonance, dislocation of heart, no fluid.	None.	Under observation.
54. Fussell. This paper.	F 21	Left	2 wks.	During sleep.	Pain, dyspnœa, dulness on percussion, absence of breath and voice sounds and of fremitus.	Tapped.	Recovery.
55. Riesman. This paper.	M 27	Right	1 wk.	Cough.	Pain, no dyspnœa, resonance, dislocation of viscera, no breath sounds.	Rest; strapping of chest.	Recovery.
56. Jochmans. Deutsch. Arch. f. klin. Med., 1902, Band iv., Heft 1 and 2.	M 22	Right	4 wks. 6 wks.	———	Pain; patient always able to work. Tuberculin used with no effect.	X-ray showed collapsed lung.	Recovery.

A LOBAR FORM OF BRONCHOPNEUMONIA OF LONG DURATION, OCCURRING IN CHILDREN AND YOUNG ADULTS [1]

For some time, possibly four or five years, I have been interested in a disease of the lungs which cannot be readily classified nor easily named.

Case I.—The first case I saw was in a young girl who came to the dispensary of the Polyclinic Hospital and puzzled my colleagues and myself by a long-continued, low fever. Week after week on her visits to the clinic we noted a moderate elevation of temperature, and as she had a cough, was pale and of poor physique, tuberculosis was naturally suspected. But aside from failure to find any evidence in the sputum, the physical signs—an abundance of crackling rales—were strictly limited to one lower lobe, there being no involvement of the apices. The history did not suggest an unresolving lobar pneumonia, and the child, so far as I can recall—the record is now lost—was not confined to bed at any time. After a most protracted course, covering possibly two or three months, the girl recovered completely.

Case II.—On September 12, 1911, I saw in my office Pearl L., a girl, aged thirteen years, who had been coughing for two weeks. At the age of two years she had whooping cough, otherwise she had been well. Although she did not appear to be very ill, I found impairment of resonance over the entire left lower lobe and sharply limited to it. The breath sounds were harsh and of a bronchovesicular character. There were also numerous crackling rales. The right side as well as the upper lobe of the left lung was entirely normal. Temperature, 99.5°; pulse, 120. Four days later the signs were more marked, the involvement extending from the base of the left lobe to above the middle of the left scapula, and from the spinal column to the postaxillary line. The impairment was, however, very slight, and only discoverable by careful comparison of the two sides. The rales were of a coarse, moist type; temperature, 98.9°; pulse, 108. On her next two visits very few rales could be detected. On October 27, six weeks after I first saw her and eight weeks after the beginning of her illness, rather coarse rales confined entirely to the left lower lobe could still be heard. On November 22, no rales could be found, but as late as January 4, 1912, four months or more after the onset of the disease, the breath sounds over the left base were still a little harsh. I saw the girl again February 17, 1912, for some trifling condition, and at that time the lungs were clear.

[1] Read at the meeting of the Association of American Physicians, May 8, 1913. A preliminary report was made to the College of Physicians of Philadelphia on February 5, 1913. Reprinted from the American Journal of the Medical Sciences, September, 1913.

CASE III.—Bertha M., aged nineteen years, a Normal School girl, came to see me March 31, 1911, on account of a severe cough from which she had suffered on and off for three months. She is very robust and comes of healthy stock. The cough had "somewhat run her down," to use her own words. Temperature, 100.5°; pulse, 120. On examination I found impairment of resonance over the right chest from the angle of the scapula to the base. Over this area the vocal fremitus was a little increased. On auscultation over the entire lower right lobe posteriorly, laterally, and in front from the mammary region down, numerous crackling rales could be heard. The lung elsewhere was normal. The patient had no expectoration, the appetite was diminished, the bowels constipated. By April 8, only a few dry rales remained at the base of the right chest.

CASE IV.—Bernice B., aged six years, had whooping cough soon after birth, a mastoid operation and adenoidectomy at three, otherwise nothing except slight anemia and transient choreiform movements. I saw her first on May 28, 1912. She had been coughing for some time. On June 6, I noted in my records: Cough very hard; temperature, 99.4°; harsh breathing at left base. On June 10: Cough continues; temperature, 99.4°; slight impairment of the percussion note of the left lower lobe posteriorly and in the axillary region, with harsh breathing and a fair number of fine rales. On June 17 the notes state: Temperature normal; cough less severe; rales have nearly all disappeared.

CASE V.—Dora Y., aged thirteen years, was seen with Dr. Hofkin on June 27, 1912, the history being that she had been ill with a continued fever for some time; just how long I could not ascertain. Typhoid fever and tuberculosis had been suspected. There was no cough; no expectoration; the fever was moderate; at no time had the child seemed very ill. A few weeks before she was taken sick an uncle had died in the same house of lobar pneumonia. Examination of the patient, who was up and about, showed slight impairment of resonance over the entire lower right lobe posteriorly and in the axillary region. The vocal fremitus was not altered. On auscultation a tremendous shower of crackling rales, which became a little finer after coughing, could be heard. Inspiration was harsh and expiration somewhat prolonged, but not bronchial. I ventured the positive statement that the child did not have tuberculosis and would recover fully. In September Dr. Hofkin wrote to me that the girl had been taken to Atlantic City and that he had found the lungs clear five weeks after our consultation, but had noted the persistence of harsh breathing over the formerly affected lobe. When he reëxamined her in September not the slightest abnormality could be detected.

CASE VI.—Sarah R., a girl aged twelve years, was first seen October 20, 1912. For three or four weeks she had had a severe cough, with some expectoration. According to the mother the child had been subject to such attacks for several winters, and when once started they would last throughout the cold season. The cough was worse at night and often disturbed the child's sleep. There were no night-sweats. The family history was good, and as for the patient, aside from the winter cough, she had had nothing except chickenpox at the age of two years. Examination showed over the left lung posteriorly a slight impairment of resonance. On auscultation numerous dry and some moist rales could be heard over the lower lobe of the left lung, behind and as far forward as the midaxillary region. Nowhere else were any abnormal sounds detected. The heart was normal; the

spleen not enlarged; temperature, 98°; pulse, 80. A few days later the patient had a severe stitch in the left side with a catch in breathing. When I saw her on October 27, there was no friction sound. The resonance over the left lower lobe was still a trifle impaired; the rales had disappeared.

CASE VII.—W. N., a colored lad, aged fourteen years, was sent to me by Dr. Watson, at the Polyclinic Hospital, on March 1 of this year, because, just as he was about to undergo an operation for enlarged tonsils, it was discovered that he had a temperature of 100°. The boy had had diphtheria at the age of seven and frequent attacks of tonsilitis. He did not complain of anything, but after we had detected the physical signs about to be described he admitted that for a week past he had had a slight cough, without expectoration, and some headache. I wish I could picture to you the surprise of my group of postgraduate students—and my own—when upon examination we found over the lower lobe of the left lung many small moist rales, bronchovesicular breathing, and impairment of the percussion note. There was nothing in the history, in the symptoms, or in the general impression that the boy made upon us to suggest any trouble in the lung. Had it not been for our practice of making a routine examination of the posterior bases of the lung, the trouble would surely have been overlooked. It is not improbable that some of the ether pneumonias are preceded by just such a condition as we found in this boy. If that is true then it behooves us in every case before an operation to make a thorough examination of the back of the chest.

The blood count gave the following results:

Hemoglobin	88 per cent.
Red cells	5,320,000
Leukocytes	16,160
Differential count:	
Polymorphonuclear cells	57.4 per cent.
Mononuclear cells	7.0 "
Small lymphocytes	28.6 "
Transitional	5.4 "
Eosinophiles	1.6 "

At the end of three weeks from the time he was first seen the boy was entirely well.

I have cited the foregoing seven cases as typical of the disease. I have seen perhaps double that number.

PATHOLOGY. There has been no autopsies and no X-ray examinations, so that the actual pathological anatomy is an inference. The condition is not an ordinary bronchitis: (1) because it is strictly unilateral, while bronchitis is generally bilateral; and (2) because unlike bronchitis it is accompanied by an impairment of the percussion note and by breathing of a bronchovesicular character. Repeated examination in my cases has shown the physical signs to be quite stationary in the part first affected. Nor can the condition be a pleurisy: the signs remain unchanged, no fluid is demonstrable, the tactile fremitus is either not altered or increased, and the line of dullness follows the slant of the division

between the lobes and has not the characteristic curve of an effusion. There is also practically no pain.

It is not a lobar pneumonia of the ordinary type, for it has not the acute, sharp onset, nor does it at any time give the impression that there is complete consolidation of the lung.

The view that we are dealing with a lobular or catarrhal pneumonia becoming confluent and assuming a lobar distribution seems to me to accord best with the conditions present. While lobular pneumonia in the vast majority of cases is a bilateral process, there is no inherent reason why it may not be unilateral. As the modes of infection in the two forms of pneumonia are not unlike; and as the infecting organism is generally the same, it is well within the law of probability that lobular pneumonia may be confined to the same parts of the lung as lobar pneumonia. Since we possess no satisfactory explanation for the lobar distribution in the one, none can be demanded for a similar distribution in the other.

In some experiments with the pneumococcus, Dr. Kolmer and myself, using the Lamar-Meltzer method, produced in dogs a pneumonia confined to a single lobe that to our minds had the characteristics of a spreading lobular rather than of a true lobar pneumonia, thus bearing a close analogy to the disease under discussion. At best, however, the pathological differences between lobular pneumonia and lobar pneumonia are neither great nor important.

It has not been possible to obtain sputum in many of the cases. When it was obtained it showed chiefly pneumococci. That the pneumococcus is capable of causing not only acute but also chronic pulmonary infections is demonstrated by the painstaking researches of Leutscher.

There is no evidence that the condition is an interstitial pneumonia of the type so ably described by Dr. Jacobi,[2] for it heals without residue—without evidence of retraction.

The disease would not impress anyone as a manifestation of influenza. The cases I have seen were scattered over a considerable period of time. They had none of the catarrhal symptoms nor the prostration so characteristic of influenza. Moreover, no other members of the patients' families were affected.

The chief symptoms are cough and a moderate fever, rarely above 101°, extending over a long period—from several weeks to three or four months. The cough may be harassing, but at times is slight, scarcely of enough moment to attract attention. There may be considerable expectoration or none; it may contain a little

[2] Arch. Ped., January, 1903.

blood, but in my experience has never been rust-colored. The physical signs are entirely out of proportion to the symptoms. There is always some dullness, which is most easily detected by a careful comparison of the two sides, and usually extends to the angle or the middle of the scapula. Rales are, as a rule, abundant, and of the peculiar quality best described as consonating. They are moist rather than dry, though both types may be found. In the presence of minor subjective symptoms the listener will often be surprised when approaching the base of the chest to find his ear bombarded by a chorus of exquisitely crackling sounds. The rales are heard best in inspiration, and are often increased by coughing. In the majority of cases the disease involves the lower lobe of the left lung, but this may be a mere coincidence, as the number of cases is as yet too small for a definite conclusion. Girls predominated among my patients. As to age, the majority were between ten and twenty years—one was twenty-seven and one twenty-eight years. All the cases have ended in recovery without a vestige of the morbid process remaining.

On looking, not exhaustively, through the literature I find nothing directly bearing upon the subject. A number of authors in their chapters on bronchopneumonia state that at times the disease is most marked in one lobe, and when confluent may simulate lobar pneumonia. Such types are, however, described as exceptionally severe, with high fever, marked dyspnea, profound prostration, and great danger to life. They differ thus radically from the disease with which we are dealing. Beddard [3] speaks of a primary lobular pneumonia which is usually confluent and is diagnosticated as lobar. This, however, has a sudden onset, with high temperature and severe nervous symptoms; the duration is short, the pyrexia is quite regular and sustained, and it often ends by crisis. This, of course, does not correspond to our disease. West [4] described three types of bronchopneumonia, none of which is identical with the one under consideration; although he recognized a secondary bronchopneumonia, not, however, of lobar type, with a protracted course lasting three months or more. The nearest approach is found in Powell and Hartley's book.[5] They speak of a confluent form involving adjacent lobes of a large portion of the lung, sometimes a whole lobe, producing more or less dense consolidation. It may be associated with ordinary bronchitis of catarrhal origin, and very often occurs in the course of whooping cough. They have also met with it in certain cases of heart disease, and as

[3] Allbutt and Rolleston's System of Medicine, vol. v, London, 1909.
[4] Diseases of the Organs of Respiration.
[5] Diseases of the Lungs, 1911, fifth edition.

a complication in pulmonary tuberculosis. In none of my cases was whooping cough, heart disease, or pulmonary tuberculosis a factor in the process; moreover, in severity and course the condition described by Powell and Hartley and the one here discussed are very different. Babcock recognizes a confluent bronchopneumonia, but does not go into details regarding the symptoms or course. Wilson Fox does not mention it.

Treatment. In the treatment the measures that have seemed to me of some avail are counter-irritation to the chest, abundant feeding, and either a simple cough mixture with a small dose of an opiate, or one of the creosote preparations. Whenever the weather was favorable I advised that the patient be taken outdoors. A sojourn at the seashore in proper season is also beneficial.

The essential features of the condition I have described may be epitomized as follows:

1. The disease is a confluent lobular pneumonia of lobar distribution characterized by long duration, low fever, and the following physical signs: impairment of resonance, bronchovesicular breathing, and showers of crackling rales.

2. It must be looked upon as one of the causes of obscure long-continued fever.

3. The disease always seems to end in complete recovery both symptomatically and anatomically.

4. In the beginning typhoid fever may be suspected, in the later stages tuberculosis.

5. The disease is, I believe, often overlooked, due to the fact that we seldom examine the lower posterior aspects of the chest in ambulatory cases, especially when the symptoms are rather trivial. I am quite sure the diagnosis of tuberculosis is often made in these cases of chronic cough, with low, continued fever; but if the chest is carefully examined, back and front, above and below, the peculiar, almost specific character of the disease will be discovered, and then the thought of tuberculosis will be no longer entertained.

CHRONIC NONTUBERCULOUS BRONCHOPNEUMONIA [1]

For a number of years I have been interested in a form of disease of the lungs which has not received much attention at the hands of systematic writers. An early paper published in 1913 [2] was followed by a few corroborative articles, but it is only within recent years, chiefly through the conjoint work of the roentgenologists and the clinicians, that the frequency and the importance of the condition have been recognized.[3] In the earlier paper, my conclusions were as follows: 1. The disease is a confluent lobular pneumonia of lobar distribution characterized by long duration, low fever, and the following physical signs: impairment of resonance, bronchovesicular breathing, and showers of crackling rales. 2. It must be looked on as one of the causes of obscure long-continued fever. 3. The disease always seems to end in complete recovery, both symptomatically and anatomically. 4. In the beginning, typhoid fever may be suspected, in the later stages, tuberculosis. 5. The disease is, I believe, often overlooked, owing to the fact that the lower posterior parts of the chest are seldom examined in ambulatory cases, especially when the symptoms are rather trivial. I am quite sure the diagnosis of tuberculosis is often made in these cases of chronic cough, with low, continued fever; but if the chest is carefully examined, back and front, above and below, the peculiar, almost specific character of the disease will be discovered, and then the thought of tuberculosis will be no longer entertained. (Of these conclusions, further experience has shown that the third is too optimistic.)

The disease derives its importance from the fact that it is a cause, at least a possible one, of prolonged ill health; furthermore, it may lead to the diagnosis of tuberculosis and to useless as well as costly confinement in a sanatorium, and finally, it is a cause of recurrent colds. Until a few years ago it was not known that this

[1] Read in the Post-Graduate Course of the Academy of Medicine, New York, November 18, 1932.

Reprinted from The Journal of the American Medical Association, March 3, 1934, Vol. 102, pp. 673-676.

[2] Riesman, David: A Lobar Form of Bronchopneumonia of Long Duration Occurring in Children and Young Adults, Am. J. M. Sc. 144:313 (Sept.), 1913.

[3] Riesman, David: Protracted Nontuberculous Unilateral Bronchopneumonia of Lobar Distribution, Pennsylvania M. J. 26:255-261 (Jan.), 1922.

type of pulmonary disease might be related to infection in the paranasal sinuses. Ignorance of this fact was in some degree responsible for the frequently unsatisfactory results of treatment.

The disease is most common in children and young adults but is encountered at all ages. I have at present under my care two men, aged 54 and 65, in whom the disease presents all the characteristic features.

Physical examination in a typical case shows the signs confined to a lower lobe, perhaps the left more often than the right. There is slight impairment on percussion, and the tactile fremitus is normal, increased or diminished. The most striking feature presents itself on auscultation; then one hears many moist rales, either fine and sticky or coarse, and more abundant after coughing. The voice sounds may be diminished, normal or increased. In the whole picture nothing is really significant or important on examination except the rales of lobar distribution.

Etiology

In my first paper I looked on the disease, which I then called a lobar form of bronchopneumonia, either as a direct sequel of influenza or as due to primary infection with the influenza organism or with other common varieties of bacteria, chiefly the pneumococcus and the streptococcus. I am excluding from consideration here the inflammatory diseases of the lungs caused by yeasts, fungi, streptothrix, coccidioides and other organisms of similar nature, as they rarely show lobar or unilateral distribution. Psittacosis is also not included, as that generally runs an acute course and presents a much graver clinical picture.

With wider experience I have learned a few facts that are important in understanding the causes of the disease in question. In the University Hospital through the co-operating study of the roentgenologists, Drs. Pancoast and Pendergrass, we have come to feel that the majority of cases of the chronic type of bronchopneumonia are associated with disease of the sinuses, and we are inclined to believe that the sinuses are often the primary factor in the morbid process. This idea is not entirely new but was suggested by a French writer a few years ago; his name I do not recall. At the present time it is well known to a number of roentgenologists and to pediatricians and tuberculosis specialists, as well as to laryngologists and bronchoscopists.

Now that the X-rays have revealed the presence of infection in the accessory nasal sinuses in association with chronic lung infec-

tion, and since improvement follows the clearing up of the sinus trouble, the conclusion seems justified that the two are connected as cause and effect; that is the view of Manges.[4] The Dunns,[5] among other effects of paranasal sinusitis, mention bronchitis, acute and chronic (occasional misdiagnosed tuberculosis), bronchiectasis and lung abscess. One must admit the possibility that two conditions may be present without being dependent one on the other. In all probability influenza may become a localized, subchronic process in the lung. It is also possible that the lung disease, whether influenzal or not, may be primary and the sinus disease secondary.

While in many instances the sinus involvement is clearly indicated by the symptoms, especially in persons with a history of frequent colds, there are many cases in which the involvement would escape detection if roentgenograms were not taken; hence the importance of making in every case of these chronic lung infections, or in recurring colds in children, roentgenologic study of the paranasal sinuses. The following case shows the value of such an examination even in a young child:

Case I.—E. H., a girl, aged 2 years, had been short of breath since the age of 3 months. She had had repeated attacks of pneumonia; dyspnea and bronchitis followed after the second attack of bronchopneumonia.

A roentgenogram showed a marked increase of the hilus and trunk shadows, probably a tracheobronchitis, from a sinus infection. In an older person the appearance could have been due to bronchiectasis. A roentgen examination showed that the frontal sinuses had not developed; the ethmoids were clouded on both sides; the maxillary sinuses were probably clouded on both sides; an opaque foreign body, a button, was seen in the left nasal passage. Four days later the button had disappeared; unsuccessful attempts were made to find it. Three months later the ethmoid cells were much clearer and the maxillary sinuses had cleared up. Five months later the condition was improved but by no means normal; there was still a purulent tracheobronchitis. The child had also had some asthmatic attacks.

Can the disease occur at the apex? There is no inherent reason why it should not, but just as tuberculosis prefers to begin its work in the upper lobe, so this condition of which I speak, chronic or subacute bronchopneumonia of lobar distribution, prefers the lower lobe. It would be difficult, except by prolonged observation, to differentiate between tuberculosis and the process in question when the upper lobe is involved. A few cases have been described in the German literature in which, through accidental death, an opportunity for autopsy was given and the process proved to be a nontuberculous pneumonia. Jacobi[6] describes chronic pneumonia located

[4] Manges, W. F.: West Virginia M. J. 26:588 (Oct.), 1930; Arch. Pediat. 49:141 (March), 1932; Pennsylvania M. J. 35:240 (Jan.), 1932.
[5] Dunn, A. D., and Dunn, F. L.: Ann. Int. Med. 6:235 (Aug.), 1932.
[6] Jacobi, Abraham: Arch. Pediat. 20, 1903.

in the apical region, especially on the right side, as a frequent occurrence in children. I doubt, however, whether he would today give his explanation of thirty years ago that these lesions were nontuberculous and resulted either from a bronchopneumonia or from a syphilitic process. To him, syphilitic disease of the lung apart from pneumonia alba of infants was a common occurrence. Today it is known that syphilis of the lung is rare and difficult of diagnosis. The most recent textbooks do not mention it as a possible factor in the case of chronic pneumonia. I am inclined to think that, even though the disease in the cases described by Jacobi did not look like tuberculosis, the majority were due to that type of infection.

Clinical Course

For a certain group of cases this has been well set forth by Allen K. Krause.[7] The patient usually complains of some impairment of health, which he may date back to an attack of influenza. In children it may have followed measles or whooping cough, simple bronchitis or bronchopneumonia. From that time on the patient may have been subject to repeated colds, although often this tendency is outgrown even though the physical signs of a basal lesion remain. The cough may be slight or severe, or it may be absent. Expectoration is scanty; rarely it is blood streaked. The loss of flesh is minimal. In many cases there is hardly anything to call attention to the lungs. At times there is a protracted subfebrile course—a temperature between 99 and 100 F. for weeks—suggesting a low grade typhoid fever or tuberculosis. A roentgen examination may show very little—some haziness, perhaps, of the lung markings, but in severe cases that have lasted a long time, fibrotic changes, adhesions to the diaphragm, and bronchiectatic cavities may be discovered.

Dr. J. Alexander Miller [8] has suggested a good classification of chronic nontuberculous lung disease. He divides the cases into (a) subacute, (b) subacute with recurrences and (c) chronic. My own cases very readily fall into these three groups.

The disease usually terminates in recovery, but the spot originally affected remains a locus minoris resistentiae, so that whenever the individual has a cold or bronchial attack the old area will again show physical signs, especially showers of rales. It is not at all certain, as Batty Shaw observes, that the recurrent attacks in such patients are the result of reinfection from the outside. They may be recrudescences of the existing internal infection. Many

[7] Krause, A. K.: Tr. Am. A. Physicians 46:227, 1931.
[8] Miller, J. A.: Am. J. M. Sc. 154:805 (Dec.), 1917.

patients may become chronically bronchitic and are in fact carriers. The infection is a "reinfection from within."

When complete restoration does not occur, the inflammatory process may penetrate more deeply and may eventually lead to definite bronchiectasis from which full recovery is unlikely; hence the importance of early recognition and treatment. In a discussion of the subject with an "allergic" friend, he made the suggestion that some cases of asthma might take their origin in the disease I am describing. My personal experience suggests that this is quite probable.

I can illustrate the condition by citing a few cases:

Case II.—J. R., a man, aged 52, came under my observation in 1919 complaining of dyspeptic symptoms and constipation. He has been under my care ever since. His lungs were normal until October, 1929, when he had cough with expectoration, and a subsiding neuritis of the right brachial plexus. At that time I found scattered rales through the right side of the chest but much more marked over the left side posteriorly. These rales continued and were eventually limited to the left side of the chest. The sputum was free from tubercle bacilli. On his occasional visits I found nearly always the same sticky moist rales over the left base with a little pain on that side. The vocal resonance and breath sounds were increased. Just a year ago he had a shower of moist rales in the left base, although his chief complaint was indigestion, regurgitation of food and intermittent irregular heart beats. (He had an attack of erysipelas in the spring and another one during the summer.) Only last summer the chest began to become clear. Roentgen examination revealed a marked increase in density at both bases with intensification of trunk shadows and bilateral cervical rib.

Case III.—L. A., a young man who has been under my care since he was a little boy, coughed a good deal and had an asthmatic tendency in his early years; his sinuses were bad. For years, physical examination showed at the right base posteriorly impaired resonance and subcrepitant and sonorous rales and increased tactile and vocal fremitus. Whenever he had the slightest cold I was able to find the same type of rales at the right base. Roentgen examination of the chest showed a definite area of increased density at the right base strongly suggestive of a chronic pneumonic process. There was no suspicion of a tuberculous process in the apex; the trunk shadows were somewhat intensified but there was no mottling found at their distributions. The rales were still present in 1928, a matter of sixteen years since the boy had come under my observation, but by about 1930 after treatment of his sinuses they disappeared.

Case IV.—S. S., a man, aged 45, a tailor, a native of Russia, came under my observation in 1923. He had a 4+ Wassermann reaction and his chief trouble was indigestion. In February, 1924, he came to see me on account of a cold and sore throat. The heart was rapid, 112; the temperature, 98.4; the blood pressure, 135 systolic, 60 diastolic; he weighed 135 pounds (61.2 Kg.). Physical examination showed as the most interesting finding showers of fine and bubbling rales over the lower lobe of the left lung; tactile fremitus and vocal resonance were normal over this area. This condition persisted for a long time. Not until May, 1924, was there a note in my record that the rales had practically disappeared. Later he came on account

of a cough. The rales were again present in quantity over the left lower lobe posteriorly, and the percussion was slightly impaired. There was tenderness over the right maxillary sinus. In the spring of 1925 the rales were very much diminished. In July he complained of burning in the epigastrium, a coated tongue and constipation. Again numerous rales were present over the left side of the chest, although he did not complain of any respiratory symptoms. In 1927 the rales were very few. At the end of 1927, after a hot bath, he became a little hoarse. Examination showed a number of moist rales in the same area as in the past. They disappeared within a month. In the spring of 1928 his chest was entirely clear; also in June, 1930. His last visit was in April, 1933, and at that time I found his chest normal on examination.

Case V.—L. T., a man, aged 36, married, complained, December 7, 1931, of cough and expectoration. He had been well except for frequent colds until June, 1931, at which time fever, cough and expectoration developed and he was put to bed. The cough, the expectoration and the irregular fever continued for five or six weeks. Then the temperature gradually became normal, but the cough and expectoration persisted. His physician stated that there were rales throughout the left lung. A roentgenogram taken at that time was said to have shown tuberculosis. With abatement of the fever he was allowed up, but the cough and the expectoration, which was never blood streaked, persisted, with occasional evening rises of temperature to 99.5 F. Physical examination showed a good deal of pus draining from both ethmoidal areas and from the left sphenoid. Both antrums were opaque on transillumination. Examination of the chest showed slight impairment at the left base and the left axilla, with diminution of breath sounds and a few rales. The blood was within normal limits. The sputum was repeatedly found negative for tubercle bacilli and on culture showed a pure growth of influenza bacilli. Roentgen examination of the chest showed slight haziness of the left lung field, with exaggeration of trunk shadows to the left base. The patient was admitted to the hospital, where, a bilateral ethmoidectomy and a bilateral antrum drainage were instituted. Rapid recovery from these operative procedures ensued; it was followed by a course of autogeneous vaccine made from the secretion from the ethmoids and antrums. Since then the patient has been seen repeatedly. He has been free from colds. His nose and throat physician, Dr. H. P. Schenck, reports that the condition of his nose is satisfactory. There are now no symptoms, and physical examination is entirely negative.

Here is a history of an illness of seven months' duration, characterized by a low grade pneumonitis limited to one lower lobe and associated with extensive sinus disease. The case was mistaken for tuberculosis. Dr. Pancoast, who studied the case roentgenologically, writes: "On reviewing the history and the course of the disease as judged from the physical signs, which are rather characteristic, with the finding of extensive sinus disease, which we know to be an etiologic factor in this type of nontuberculous basal pneumonitis, we would call this Riesman's pneumonia."

Diagnosis in such cases is impossible for the man who examines only the front of the chest or the front and the supraspinous fossae.

Only by the unvarying routine of examining the entire chest, back and front, above and below, will the condition be discovered. When signs are found in the lung, roentgen examination of the chest should be made. A roentgenogram as well as specialistic study of the sinuses is also desirable.

In the differential diagnosis, some of the dust-inhalation diseases, and infections with organisms of the streptothrix, leptothrix and blastomyces and coccidioides groups must be kept in mind. The differentiation may require frequent sputum examinations as well as sputum culture on special mediums. When a definite sinus disease exists, the conclusion that the case is of the simpler type of chronic pneumonitis is usually justified. In expert hands the fluoroscopic examination with study of roentgenograms may prove of the greatest help.

Tuberculosis comes into the picture whenever the disease runs a protracted course. However, a primary tuberculosis of the base is exceedingly rare. Norris and Landis deny its occurrence in adults, but Lawrason Brown,[9] Lyman [9] and Jacob [10] have observed it; I myself have seen two or three cases. Nevertheless, the presumption should always be that a basal lesion is not tuberculous unless a sputum examination reveals the presence of tubercle bacilli.

Treatment

Rest in bed is demanded in the febrile and usually in the subacute cases and in cases, febrile or not, presenting acute exacerbations. Locally, counterirritation may prove useful—mustard or a weak iodine application. For the cough, a simple remedy with creosote may be used; when the cough has been severe, I have found the following combination helpful: terpin hydrate, 2 gm., and codeine sulphate, 0.12 gm.; the ingredients are mixed and divided into twelve capsules. One is given every three hours.

If there is sinus infection, local treatment by a competent specialist is indicated. I am rather averse to radical measures, although opening of an infected antrum in a radical manner may be advisable.

Attention to the general health, with special efforts to prevent recurrent colds, is of prime importance. Regulation of exercise, work and play is required; cold bathing and massage are useful. The diet should contain an abundance of vitamins and cod liver oil in the cold season and viosterol at other times. Vaccines prepared from sinus secretion or sputum or stock vaccines often work beneficially. Climatic therapy is useful; Florida, California and

[9] Personal communication to the author.
[10] Jacob, M.: Med. J & Rec. 129:32 (Jan. 2), 1929.

parts of Arizona are good winter climates. For those who cannot afford to go away the sun lamp may prove useful. In the summer season I have found the rocky coast of Maine and of Massachusetts to exercise a beneficial influence. But in addition to all other forms of medicinal or climatic treatment, psychotherapy occupies a prominent place. When the process has gone beyond the curable stage and bronchiectasis has developed, therapy is more difficult. The bronchoscopist, even the thoracic surgeon, may be needed. I shall, however, do no more than mention this phase of treatment.

STUDIES IN EXPERIMENTAL PNEUMONIA [1]

The pneumococcus is conceded by all to be the cause of pneumonia in man, but the experimentum crucis, the reproduction of the same disease in animals, has not been made. Wadsworth succeeded in producing bronchopneumonia in rabbits by a preparatory immunization against virulent cultures. Lamar and Meltzer have come nearer than any other experimenters in producing a lesion comparable to that found in man. They did this by means of an ingenious method of intrabronchial insufflation, which, however, does not duplicate the conditions under which the human body becomes infected. We have repeated their experiments in eleven dogs and have succeeded in producing pneumonia in seven, the four failures being probably due to using a catheter with a lateral instead of a terminal opening. We are, however, not convinced that the process induced in the animals can be called lobar. It appears to us that in our cases at least we had to deal with a confluent lobular bronchopneumonia.

Lungs removed as early as one-half hour after intrabronchial injection of living pneumococci show active hyperemia and beginning edematous infiltration of the involved areas. In twenty-four hours consolidation is complete, the lung being solid, airless, and dark red in color. The whole of one lobe is never involved. In thirty-six to forty-eight hours the pleural involvement is more marked, and in seventy-two hours resolution has often begun. In a week to ten days the lungs have almost, if not completely, returned to a normal condition.

Histologically, the alveoli are found encircled by congested capillaries and filled with edema within a half-hour after injection. The alveoli surrounding the bronchi are filled with epithelial cells and mononuclear and a few polynuclear leukocytes. In twenty-four hours the alveoli are full of exudate composed largely of polynuclear leukocytes, a few mononuclears, and epithelial cells. Fibrin is as yet inconspicuous. In seventy-two hours evidence of resolution

[1] From the Laboratory of Experimental Pathology, University of Pennsylvania.
Reprinted from Transactions of the Association of American Physicians, 1912, Vol. XXVII.
Written in collaboration with John A. Kolmer, M.D.

may be noted. Many of the polynuclear cells show signs of degeneration; the mononuclear cells still predominate, and evidences of fibrin formation are now more apparent.

In this connection it is interesting to note that dogs do not as a rule suffer with croupous pneumonia. In them the process is usually lobular in type. The lesions show the presence of more fibrin and less evidence of mononuclear infiltration.

The success of the method, as Lamar and Meltzer have stated, seems to be due to a blocking of the finer bronchioles and thus converting their termini into closed cavities. An analogous condition may prevail in the human subject when the pneumonia is secondary to a bronchitis. In the absence of bronchitis, and such absence is the rule, any other swelling of the bronchial mucosa might act similarly in producing closed cavities. Such swelling might be due to nervous influences, to vasomotor changes, or to anaphylactic phenomena. That the nervous system has an influence in the production of lobar pneumonia has been maintained by a number of authorities, but proof is difficult to produce. Section of the pneumogastric nerve if it leads to pneumonia at all leads to inspirational bronchopneumonia. The vasomotor relations of the lung are but poorly understood. The work of Rosenow, of Chicago, suggests the thought that pneumonia may occur in a given individual because of a previous sensitization with pneumococci present in the mouth or upper air passages. We thought that we might be able in some way to sensitize animals and then by reinfection with pneumococci to produce lobar pneumonia in them. To this end we administered intravenously in dogs and rabbits extracts of pneumococci and pneumococci themselves, and injected the animals intravenously after an interval of twenty-one days with pneumococcus extract. In no instance did anaphylactic phenomena develop, showing that no real sensitization had been produced. In a second series the animals received pneumococcus extract subcutaneously, and three weeks later living cultures of pneumococci. No primary toxic symptoms developed, and aside from a few areas of collapse the lungs at autopsy were found normal. In a third series, after similar preparation, the animals received intrabronchial and intratracheal inoculations, with the same result as in animals that had not been previously sensitized. With the kind coöperation of Dr. R. M. Pearce an attempt was made to discover whether retention of pneumococcus protein could be demonstrated in the lungs of experimental animals. Such a demonstration might have an important bearing upon the local lesions of pneumonia. Without detailing the experiments, which are given at length in our paper, suffice it to say that there

is not deposited in the lungs of the rabbit sufficient pneumococcus protein to sensitize guinea-pigs.

In an endeavor to obtain some light upon the crisis of pneumonia, that remarkable and baffling phenomenon, we made another series of experiments, of which we wish to make a preliminary report. We injected rabbits subcutaneously with extract of normal lung, extract of lung in the stage of red hepatization, and extract of lung in the stage of gray hepatization. Sixteen days later the animals were reinjected, this time intravenously, with the same material with which they had been sensitized. Those receiving the normal lung and red hepatized lung died in every instance of anaphylactic shock in five or six minutes. Those receiving extract of gray lung became ill, but recovered without exception in ten minutes. Though we have speculated upon this interesting phenomenon, we have at present no theory to offer, but hope to continue the investigation.

We wish to express our thanks to Drs. Allen J. Smith and R. M. Pearce for their helpful interest in our work.

DIAGNOSTIC PROBLEMS IN PNEUMONIA [1]

In this paper I shall endeavor to set down some of the accumulated thoughts on the diagnosis of pneumonia that the years have brought me. The nature of the subject will compel me to roam over a wide, more or less formless, field. I shall not attempt a complete presentation of the subject, but shall consider those manifestations of the disease that do not have their diagnosis written plainly on them.

Typical cases of pneumonia, like typical cases of any other disease, are easy of recognition, provided we are sufficiently alert. But a curious amaurosis occasionally afflicts the wisest physicians and makes them temporarily blind to the obvious. They do not see the forest for the trees. In a measure, we can guard against such a psychic lapsus by doing what Sir William Osler once advised a student to do when the latter failed to see some large glands on the opposite side of a patient's neck; namely, "to walk around," to get a fresh point of view.

Postoperative Pneumonia

Pneumonia is often overlooked because it does not present the classical symptoms and signs by which we are wont to recognize it. This holds true particularly of pneumonia following operations. There may be no cough, no pain, at least not any pain that subordinates the postoperative pain; there may be a little fever and a moderate increase in the respiration rate. The lesion is rarely in front. If, therefore, one fails to examine the back, a small patch in one of the lower lobes may be overlooked. It is often possible to slip the stethoscope to the likely place; sometimes one can find a patch in the axilla.

The nature of these postoperative pneumonias has given rise to much discussion. At the present moment it is generally agreed that the cause is a collapse or atelectasis of a part of the lung, and that this collapsed area afterwards becomes consolidated.[2]

[1] Read in part before the Lackawanna Medical Society, Scranton, Pa., and the Williamsburg Medical Society, Brooklyn.

Reprinted from the Journal of the American Medical Association, April 19, 1924, Vol. 82.

[2] Elwyn, Herman: Postoperative Pneumonia, J. A. M. A. 82: 384 (Feb. 2) 1924.

Collapse of the lung, with subsequent infection, seems to follow more often on abdominal operations than on those on the chest or on the extremities. Pelvic operations are less likely to have pneumonia as a sequel than operations on the upper abdomen.

Sometimes following operations there is a massive collapse of the lung, a very rare postoperative condition manifesting itself by absent breath sounds, with dullness or dull tympany on percussion and displacement of the heart toward the side of the lesion. Usually after a few days the breath sounds over the dull area become bronchial, so that the clinical picture as well as the morbid process is that of lobar pneumonia. These findings can be confirmed by roentgen-ray examination.

The mortality in postoperative pneumonia is variable. In the sixty-three cases reviewed by Elwyn from the surgical wards of Mount Sinai Hospital, New York, there were nine deaths, or 14.28 per cent. In my own experience, which is much more limited in this type of pneumonia, the mortality was not quite so high.

In very rare instances, a postoperative consolidation is found at the apex. The mode of onset, the physical signs, the apparently definite relation to the anesthesia or to the operation seem to warrant a diagnosis of lobar pneumonia, but one must always be careful in apical cases of this character, as the following example will illustrate.

A man in the prime of life, and apparently well otherwise, had been operated on for strangulated hernia. Two or three days afterward he developed what appeared to be a typical pneumonia of the right upper lobe. As in my experience ether pneumonias usually result in recovery, I predicted a favorable outcome. However, we waited and waited for the resolution, which did not take place. We made sputum examinations many times for tubercle bacilli; eventually, after weeks, they were discovered, and gave proof of what we had been led to suspect, that the seemingly plain postoperative lobar pneumonia had been really a tuberculous pneumonia.

Tuberculous Pneumonia

Spontaneous tuberculous pneumonia at times resembles ordinary lobar pneumonia so closely that, in the beginning at least, the correct diagnosis is well nigh impossible, and that fact often leads to embarrassing situations. The following is a case in point:

A young man had been roller skating to excess. One night, on leaving the rink, he got chilled. When I saw him with his physician a few days later, I found a consolidation of the right upper lobe, typical in its auscultatory signs but a little more marked on percussion in the supraspinous fossa than in front. The history seemed so clear, as to cause and effect, that no other diagnosis than that of pneumococcic lobar pneumonia seemed possible. There was, however, no leukocytosis. Herpes also was absent. The

case turned out to be one of tuberculous pneumonia, and the man died three or four months later of a sudden pneumothorax.

A correct diagnosis is facilitated by bearing in mind the following points:

1. Acute cases of tuberculous pneumonia nearly always affect the upper lobe.
2. Painstaking examination will show some slight aberration in the physical signs—perhaps persistence of the lesion in the supraspinous fossa, with delayed or absent involvement anteriorly.
3. The patient often has had a period of ill health prior to the acute onset. Indeed, he may have had a tuberculous process of some sort, pulmonary or pleural.
4. Leukocytosis is usually absent, but I have seen once or twice a well marked increase in the white cells in acute tuberculous pneumonia.

Clinical Pneumonia Without Chest Signs

Another puzzling group includes those cases in which there are clinical symptoms of pneumonia but no physical signs in the chest. In children the throat should always be examined, as tonsillitis sometimes has a very acute and stormy beginning not unlike that of pneumonia. But the most probable cause is a central pneumonia. Some writers deny the existence of central pneumonia, but it seems to me a perfectly rational assumption. A very careful examination may even in central pneumonia reveal certain signs that sustain the suspicion. One of these signs is a change in the percussion note over a small patch, usually inside or just below the angle of the scapula or high up in the axilla. Another is suppression or muffling of the breath sounds over this area. Perhaps on coughing a few fine rales will appear at the end of inspiration. These signs can be detected only if one goes over the chest inch by inch.

Pneumonia and Pleurisy

Pneumonia and pleurisy are often confounded. I do not mean plastic or fibrinous pleurisy, which is itself almost an invariable accompaniment of lobar pneumonia. I mean pleurisy with effusion. The error is due to the fact that in some effusions, for reasons I need not dwell on, one can hear well defined bronchial breathing and bronchophony over the flat area. Even a modified pectoriloquy may be heard. Mistakes are avoided by remembering that:

1. The tactile fremitus in effusion is diminished or absent.
2. If the hands are moved up and down the sides of the chest,

if an effusion is present, the interspaces on the affected side are flush with the ribs, so that the latter are less plainly felt.

3. The percussion note is flat rather than merely dull, and the resistance to the experienced percussor is greatly increased. The dulness may be movable with change of posture. Grocco's triangle is also of help.

4. There are no rales, as a rule, over the effusion; breathing is usually dry and the cough sounds distant. However, this is by no means invariable; if the underlying lung is congested or consolidated, rales may come through.

5. The voice sounds have a high pitched, bleating, twangy quality called egophony.

6. The apex beat is usually displaced in the opposite direction.

7. Exploratory tapping or the roentgen ray may be necessary to settle the diagnosis.

Pneumonia Simulating Typhoid

That pneumonia may sometimes simulate typhoid or paratyphoid fever is illustrated by the following case, seen Sept. 21, 1923:

A man, aged 22, went to a party, drank some cider, came home at 11 o'clock feeling sick and feverish, and at 4 in the morning had a chill and fainted. He had headache, general aching pains, some nausea and vomiting, no cough whatever, and a temperature that ranged from 99 to 101. The leukocytes numbered 9,400, with a polymorphonuclear count of 74 per cent. The respirations were 24; the pulse was from 80 to 86. Four days later a little cough began with scanty expectoration; the spleen was enlarged on percussion; the pulse was dicrotic. There were no rose spots; the Widal test was negative.

When I saw him with his family physician, the only significant thing that I was able to find was a little impairment in the right lower lobe below the angle of the scapula. The voice sounds were a little harsher, and a few very fine, crackling rales could be heard. Respiration was not materially increased; the temperature was about 103, and the pulse was in the eighties. The blood pressure was 122 systolic, 55 diastolic. There was no herpes, and no complaint except continuing headache. At that time the patient had been ill five days. All the symptoms, taken with the low leukocyte count, justified the suspicion of typhoid or paratyphoid; rather the latter on account of the acute onset. Within thirty-six or forty-eight hours the case became clear through the appearance of a definite consolidation of the right lower lobe, confirming the importance of the slight physical signs that I had found in the lung on my visit.

In another case that I saw a number of years ago—that of a boy, aged 14 years, which had been diagnosed as typhoid fever—a little herpes on the upper lip induced me to make a very thorough examination of the chest. I found a small consolidated patch posteriorly, which shortly afterward expanded into a large one.

Abdominal Pneumonia

A type of case that may throw the best clinician off his guard is that in which the symptoms of pneumonia are, in the beginning, abdominal. These abdominal pneumonias are perhaps a little more common in children, but I have seen them in adults, and when they occur they may simulate appendicitis, gallstone colic, or perforation of a peptic ulcer. I have known a patient to be made ready for the operating table as having appendicitis and to escape the operation by only a hair's breadth.

There are two things about such cases that suggest abdominal conditions—the location of the pain in either the upper or the right lower abdomen, and the occurrence of vomiting. Now, vomiting in pneumonia, in my experience, happens most often if the initial chill takes place soon after a meal. There is but one good rule to follow, and that is in every case of acute abdominal trouble to make a thorough examination of the chest, with the thought in mind that the case might be one of pneumonia or more rarely one of pleurisy.

The leukocyte count is high both in pneumonia and in appendicitis. As a rule, however, the count is higher in the former than in the latter. It is a good rule, whenever the white cells are above 20,000, to suspect the lungs and to explore them thoroughly.

The occurrence of meningeal symptoms may obscure a pneumonia, or, when that is known to exist, may raise the question of the presence or absence of meningitis. Fortunately, the latter is a rare complication of pneumonia, and symptoms suggesting it are usually due to a toxic meningism. However, it may require lumbar puncture for final judgment. The discovery of a pneumococcic meningitis usually spells the patient's doom.[3]

Senile Pneumonia

Pneumonia in the aged—that common passport into the undiscovered country—is often difficult of recognition because it is not frank in onset or clearly defined in course. There may be only a slight cough, no leukocytosis, and little or no fever. This last statement regarding the trivial nature or the absence of fever is one to which I think most men would subscribe; nevertheless it requires revision. I have often found that in old persons, especially in those with false teeth, it is impossible to get the temperature correctly in the mouth. Only a rectal temperature will give accurate reading, and when the temperature is taken in that manner it will be found that many seemingly afrebrile patients really have fever.

[3] Quite recently, Dr. J. A. Kolmer of Philadelphia (personal communication to the author) has seen recovery in a case of pneumococcic meningitis from the combined use of Huntoon's antibodies and ethyl-hydrocuprein.

What I have said about senile pneumonia is equally true of the so-called terminal pneumonias—those that arise at the end of lingering diseases and usually go unrecognized because unsuspected and not betraying themselves by characteristic signs. A flush on the cheek, a single herpes vesicle, a slight increase in respiration rate—any one of these may give the requisite hint, but it must be looked for.

Other Diagnostic Perplexities

A curious confusion may arise during the course of acute pericarditis. With the development of an effusion of considerable size, we often can detect over the left lung posteriorly percutory and auscultatory signs of pneumonic consolidation. The first case of this type that I recall happened during my internship at the Philadelphia General Hospital. My chief, the late Dr. F. A. Packard, was convinced, and naturally I was also, that the patient had lobar pneumonia. The necropsy showed pyopericardium and no lobar pneumonia. I have seen similar cases since, and am sure that the condition is among the most perplexing in the realm of physical diagnosis. It might be properly called pericarditic pseudopneumonia. Without direct experience, one will surely consider it true pneumonia and nothing else. Its diagnosis hinges on the remembered fact of its existence. The anomalous signs are due to compression of the lung by the effusion.

The following case illustrates a rare diagnostic perplexity:

Mrs. F., a pregnant woman, suddenly was seized with chill, fever, and pain in the lower right chest and flank. Her physician naturally suspected lobar pneumonia. When I came to examine her I found nothing whatever in the lungs but detected a sharp point of tenderness in the right loin and obtained a history of slight urinary disturbance. I ventured a diagnosis of acute pyelitis, which was borne out by examination of the urine and by the subsequent course of the case. Pyelitis is a frequent mischief maker for the diagnostician—it must be kept in mind whenever a protracted fever has no obvious explanation.

The influenza epidemic of 1918 was a great but costly teacher of pneumonia and its vagaries. Unhappily, those of us who were engaged in practice at that time, either civil or military, were too rushed to gain all the possible knowledge the experience afforded. Nevertheless, as a lesson in physical diagnosis, the epidemic was of enormous importance.

Let me recall a few points learned in that trying time that have a bearing on our present problem. It will be remembered that pneumonia was extremely common. In the opinion of many, it was

a complication. I myself believe that it was due to the same cause as the influenza. Sometimes it was difficult of detection. But multiplying observation taught me that if I paid special attention to an area just within or just without the angle of the scapula, I was usually able to detect a slight change in the percussion note—a shortening rather than an actual dulness—or an enfeeblement or suppression of the breath sounds. In cases a little more advanced a few rales could be heard, especially after a short cough.

I want to emphasize the *sign of suppressed breathing*. It is present very early in lobar pneumonia, whether influenzal or pneumococcic, and, I believe, has not received adequate attention in books on physical diagnosis. Later, of course, the breathing becomes loud and high pitched, the well known bronchial breathing of consolidation.

Jaundice in pneumonia brings up the questions of etiology and prognosis. Answering the latter first, I should say that, by and large, jaundice makes the prognosis more grave. This is particularly true if the jaundice appears early and is pronounced. If it develops in the latter part of the illness, it has a far less serious significance. As for the cause of the icterus, there are several possibilities:

1. A cholangeitis or hepatitis. In favor of this is the enlargement of the liver usually demonstrable; moreover, a number of observers[4] have found the lesions of cholangeitis at necropsy, with involvement of the gallbladder. However, the evidence is not yet conclusive.

2. Hemolytic jaundice. It is probable that the severe forms of jaundice appearing in the early stages of pneumonia are of a toxic or hemolytic origin. The color is usually a deep yellow; the liver is enlarged and tender. There is pronounced tympany. The urine, as a rule, shows the signs of a toxic nephritis—albumin, tube casts and blood are present; the urine contains a large amount of bile; the feces are somewhat light in color, but are not devoid of bile pigments.

Problems in Diagnosis Arising During the Course of Pneumonia

Perhaps the most frequent problem is the explanation of failure of resolution. We are accustomed in lobar pneumonia to look for a crisis on the hippocratic critical days, the seventh and the ninth; and in the majority of cases ending favorably we do not look in vain. When the crisis does not occur, search must be made for the reason. The most common cause, especially in children, is the presence of empyema, free or interlobar. Empyema may be suspected if the temperature is irregular, if sweats occur, and if there

[4] Anders: Am. Med., March 18, 1905. Clairmont: Wien. klin. Wchnschr., Oct. 26, 1899.

is a rapid development of anemia. An unhealthy pallor in a child having had pneumonia is a very suggestive symptom.

As regards the physical signs of empyema, I need say little. Not one is absolutely diagnostic except puncture of the chest. A highly resistant flat percussion note, movable dulness and displacement of the apex beat indicate fluid. The roentgen ray is of great value and should be resorted to in doubtful cases.

Interlobar empyema is difficult of recognition. There may be a point of tenderness that helps to locate the trouble and gives a hint as to where the needle should be inserted.

A word more about empyema, and that is concerning its prognostic significance. From some striking experiences I have obtained the impression that the occurrence of empyema may mean that a patient with an apparently hopeless attack of pneumonia is going to recover. The story of a particular case will make clear what I want to say:

A lad of 17 had double pneumonia; his condition was so desperate that the late Dr. Musser, who saw him with me, held out no hope. In a few days there were signs of fluid which, on puncture, proved to be purulent. A thoracotomy was done and the patient recovered.

It is an age-old experience that the formation of an abscess is in certain diseases a favorable omen; this, I believe, applies to pneumonia with empyema.

Abscess of the lung is more frequent than is usually believed, but is hard to differentiate from empyema. The symptoms are much the same as those of empyema. There may be purulent sputum. In pneumonia of the upper lobe with symptoms of sepsis, the immovability of the exudate and its sharp restriction to the affected lobe are suggestive of abscess.

Another cause of delayed resolution is pericarditis, which is not an infrequent complication of lobar pneumonia, especially of the left lung. It is surprising how easy it is to overlook this—perhaps, because of the noisiness of the respiration, the friction sound over a small area is not heard; perhaps also because in the examination of the heart some listen only at the apex, a point at which friction is seldom heard initially. Careful auscultation over all parts of the heart, particularly while the patient holds his breath, may reveal a friction sound.

Middle ear disease, parotitis and phlebitis are conditions that may interfere with the occurrence of a crisis at the proper time.

Delayed or absent resolution is sometimes, as I have indicated in an earlier part of this paper, an expression of a tuberculous process, the case being either one of primary caseous lobar pneu-

monia or the lighting up of an old tuberculous focus during the acute pneumococcic process.

In very rare instances, slow resolution is dependent on slow liquefaction of the exudate through lack of proper ferment action, and will eventually take place.

Organization of the exudate, with the development of fibrosis of the lung, is a rare cause of delayed or absent resolution.

During the influenza epidemic, I saw a number of cases of pneumonia in which the fever subsided promptly, but in which nevertheless the physical signs persisted for a long time. The residual condition seemed to be one of lobar pulmonary edema rather than of consolidation. The problem was to know when to permit the patient to get up. At the same time, the cause of the persistence of the edema remained unsolved.

A rare complication capable of presenting great diagnostic difficulties is acute dilatation of the stomach. The symptoms[5] are vomiting, abdominal pain and distention, visible gastric peristalsis, obstipation, rarely diarrhea, and collapse unless proper treatment is promptly instituted. Proper treatment consists of gastric lavage through a stomach tube.

Though perhaps not altogether germane, I feel I ought to say a few words about an inflammatory lung affection that is most puzzling diagnostically and prognostically. I refer to a lobar form of bronchopneumonia seen especially in children and young adults and giving rise to a low protracted fever. The symptoms are slight, often minimal—a little cough, a subfebrile temperature, scanty expectoration and prostration somewhat disproportionate to the symptoms.

The physical signs are, in a sense, much more striking than one would expect from the symptoms, and yet they are frequently overlooked because they are usually confined to one lower lobe and are chiefly auscultatory in character. They consist of a shower of crackling rales on inspiration, more abundant and louder, as a rule, after coughing.

Many physicians have the practice, in ambulatory cases—and the patients I speak of are usually ambulatory—of examining only the upper lobes, often only the first two interspaces anteriorly. Such restriction of the physical examination is the cause of a multitude of diagnostic errors.

The condition of which I am speaking, which I have called the lobar form of bronchopneumonia,[6] I have found diagnosed as typhoid fever and as tuberculosis. The former error is due to the

[5] Fussell: Am. J. M. Sc. 142: 794, 1911.
[6] Riesman, David: Am. J. M. Sc. 146: 313, 1913; Tr. A. Am. Phys. 28: 430 1913; Pennsylvania Medical Journal, 1921.

complete overlooking of the lung condition; the latter arises from a false interpretation of the physical signs and symptoms. If it is remembered that primary tuberculosis of the base is exceedingly rare, the second mistake is not likely to be made.

I shall not discuss the causes of the lobar form of bronchopneumonia except to say that it may be of influenzal origin. What I chiefly wish to do is to emphasize the importance of examining the bases of the lungs, posteriorly and laterally, in all cases.

Pneumonia in Children

I have already referred several times to pneumonia in children, and will now sum up the salient points of this phase of the subject.

1. Lobar pneumonia is more common in infants and children than the textbooks teach. Even the pneumonia of measles is often typically lobar.
2. The physical signs of primary lobar pneumonia are at times late in appearing. The combination of high fever with leukocytosis is suggestive.
3. The signs may be apical or basal; sometimes they appear first in the axilla.
4. An expiratory grunt is a very suggestive symptom.
5. Convulsions, delirium and meningeal symptoms are common in the pneumonia of young children.
6. Abdominal symptoms, pain and vomiting, may be altogether of thoracic origin.
7. Empyema is a frequent termination, and manifests itself by continuing fever, pallor, sweating, etc.
8. Primary lobar pneumonia in children is a very benign disease; even if empyema develops, the prognosis is good, conditioned, of course, on proper treatment.

GASTROINTESTINAL DISEASES

MERYCISMUS OR RUMINATION, WITH A REPORT OF TWO CASES [1]

Among the aberrations of function presented by the human stomach, none is more interesting or more strange than that known as rumination or merycismus (*merukismos*, rumination).

Although the ancient writers, particularly Aristotle, were acquainted with rumination in animals, they have left no records indicating that they possessed any knowledge of its occurrence in man. The first author to mention it was the great Italian anatomist, Fabricius ab Aquapendente,[2] the teacher of William Harvey, who lived at Padua towards the close of the sixteenth and the commencement of the seventeenth century. In one of the chapters of his book, entitled, "De Ruminatione," [3] he describes with much clearness two cases of merycismus—the one was a nobleman who is said to have had two horns on his forehead; the second a Paduan monk who ruminated because his father had a little horn on his forehead—"*quod ejus pater paulo supra frontem in capite corniculum durissimum.*"

Since Fabricius' time quite a large number of cases have been reported, particularly by European writers, but only a few instances have been observed in this country. The literature has been carefully reviewed by Johannessen [4] and by Singer,[5] to whose monographs the writer would refer for a more extended bibliography than the one given at the end of this paper.

We may define rumination as a periodic regurgitation of the food unattended by nausea, retching, or disgust, the regurgitated material being either voluntarily ejected from the mouth or again swallowed, remastication not being an essential part of the act.

Writers are generally in accord in considering this regurgitation analogous to the process of rumination in the lower animals. In

[1] Read before the Philadelphia Neurological Society, March, 1895.
Reprinted from the Journal of Nervous and Mental Disease, June, 1895.

[2] Fabricius ab Aquapendente, Hieronymus. *Opera omnia anatomica et Physiologica cum Praefatione.* J Bohnii, Lipsiæ, 1687, p. 135.

[3] Fabricius gives the following excellent definition of rumination: "Ruminatio igitur nihil aliud est, quam cibi in os regestiovel clarius, ruminatio est localis cibi motus quo sursum per gulam in os regeritur, manditur, et laevigatur, inde rursus devoratur." "De Ruminatione," p. 135.

[4] Johannessen. *Zeitsch. f. Klin. Medicin.*, Bd. X, p. 264, *et seq.*

[5] Singer. *Deutsch. Archiv. f. Klin. Medicin.*, Bd. LI, 1893, p. 472, *et seq.*

them we find that rumination is peculiar to certain classes of herbivora, being evidently a developmental or evolved character, the result of adaptation to environment. Herbivora, particularly the ruminating genera, in the wild state are compelled to ingest large quantities of coarse food very hastily, because, to use the words of Robert Meade Smith,[6] "in eluding their enemies, they rely chiefly upon sharpness of vision, acuteness of hearing and agility." They have in consequence come to be provided with a peculiarly complicated and capacious stomach, which in the majority of ruminants consists of four compartments: the rumen or paunch, the honeycomb bag or reticulum, the psalter, omasum, or maniplies, and the abomasum or rennet. Of these the last is alone comparable to the human stomach.

The food after its imperfect primary mastication, passes into the first and second stomachs, while fluid and finely divided particles may at once enter all four compartments. Rumination begins a variable time after the meal. The bolus is formed and regurgitated into the mouth, remasticated, and then swallowed in a state of fine subdivision, permitting it to pass through the narrow aperture between the reticulum and maniplies. From the latter it is transmitted to the true stomach to be there subjected to the action of the proper digestive juices.

The factors bringing about this complicated process are principally two—a lessening of the intra-thoracic pressure and an aspiration of the gastric contents.

At the moment at which regurgitation begins the glottis is closed and the diaphragm is forcibly contracted; this leads to an enlargement of the thoracic cavity and a consequent rarefaction of the air. The decrease in pressure causes, on the one hand, an aspiration of the blood in the jugular veins into the heart; on the other, a suction of the gastric contents into the esophagus, the cardiac orifice being synchronously relaxed. As soon as the bolus has entered the gullet, it is carried upward by an antiperistalic movement.

The stomach itself is probably passive, as we may infer from Magendie's famous experiment on the mechanism of vomiting. Magendie found that when he excised the stomach of a dog and substituted for it a bladder, the injection of tartar emetic was just as capable of producing vomiting as before. Regarding the participation of the abdominal pressure, writers are not in complete unison, some holding that it is necessary, others that it is not.

Rumination is a reflex act and is presided over by a center situated in the medulla oblongata, the afferent pathway being con-

[6] Robert Meade Smith. *Physiology of the Domestic Animals.*

stituted by the pneumogastric nerves, the efferent by the phrenic nerves and the motor nerves of the abdominal muscles, the stomach, and the esophagus.

As far as the process of rumination has been studied in man, it has been found identical in its mechanism with that of herbivora, the factors of paramount importance being the closure of the glottis and the descent of the diaphragm. But while the mode of its production has been quite fully elucidated, we are as yet ignorant of its ultimate cause.

The anatomic lesions that have been noted have thrown no light on the origin of the phenomenon.

Arnold [7] and Luschka [8] found in their respective cases dilatation of the lower end of the esophagus, the so-called *antrum cardiacum*, and also observed an unusual thickness of the internal branch of the spinal accessory nerve; that which unites with vagus. As in ruminating animals the gullet terminates in a funnel-shaped expansion (the *gouttière ésophagienne* of the French), and as in them the inner branch of the accessory nerve is very thick, Arnold and Luschka concluded that the existence of these anomalies accounted for rumination in man.

But unfortunately for this theory the cardiac antrum has been found in cases that did not present merycism during life, while in other instances the esophagus was normal; and as regards the hypertrophy of the nerve, its size is known to vary considerably under normal conditions.

In Singer's cases Von Hacker was able to determine, by esophagoscopic examination made *intra vitam*, a probable dilatation of the lower end of the esophagus, which Singer attributes to the patients' habit of swallowing imperfectly masticated pieces of food. In a few cases the stomach has been found dilated.

Bourneville and Séglas,[9] in two autopsies, found both stomach and esophagus normal.

All these contradictory observations prove that there is no constant anatomic substratum, whence it follows that we must rank the condition, at least for the time being, among the functional disorders of the stomach, and consider it, as Oser [10] has done, a motor neurosis.

As both experimental examination and esophagoscopy have shown that the cardia is invariably closed toward the stomach, except during the transit of the food, we must of necessity believe

[7] Arnold. *Untersuchungen im Gebiete der Anatomie und Physiologie*, Bd. I, p. 211, Zürich, 1838. Quoted by Singer.
[8] Luschka. *Virchow's Archiv.*, Bd. XI, 1857, p. 247. Quoted by Singer.
[9] Bourneville et Séglas. *Du Merycisme*. Quoted by Singer.
[10] Oser. *Die Neurosen des Magens und ihre Behandlung*. Wien, 1895.

that in rumination there is, as in vomiting, a temporary relaxation of the orifice. That a permanent insufficiency exists, as has been claimed, is unlikely, as this would inevitably lead to a perpetual regurgitation of everything ingested.

An important element in the causation of rumination is unquestionably the neurotic constitution. Nearly all writers are agreed on that point.

A German physician, Näcke,[11] who is a sufferer from the affection, and who has studied his case minutely, is convinced of its relation to neurasthenia. Whenever his nervous system is most unstable, the rumination is most energetic.

The frequency of the disease in the educated—physicians, students, and clerks—would also indicate its alliance to the neurasthenic state.

In a few instances, notably in the case reported by Körner,[12] in which a governess taught the practice to her two wards, the habit was acquired by imitation.

Bourneville and Séglas, as well as others, have pointed out its occurrence in idiots and the insane. In such cases it may be dependent upon bulimia.

The disease is far more common in males than in females; as a rule it causes no serious disturbance unless the patient habitually rejects the regurgitated food. With but few exceptions it seems to have resisted every form of treatment. The phenomenon is not generally under the control of the will.

Something ought to be said concerning the condition of the gastric juice—here again we meet with the same variability as in the morbid lesions. Perhaps in the majority there is subacidity, in some even achlorhydria, as in the two cases here reported, although a sufficient number of analyses was not made in them to predicate positively the absence of free hydrochloric acid. In a few instances, as in the case of Alt,[13] hyperacidity was noted. It was shown by Linossier and Lemoine,[14] that the acidity varies in the same case on different examinations.

The symptomatology is pretty constant. The writer cannot better describe it than by detailing the histories of the two cases that he has recently observed.

Case I.—Mr. Wm. S.[15] was sent for a physical examination by Dr. Stem, of Berlin, N. J. He is 44 years of age, married, an Englishman by birth, an engineer by occupation.

[11] Näcke. *Neurolog. Centralblatt*, 1893, XIII, p. 2.
[12] Körner. *Archiv f. Klin. Medicin*, Bd. XXXIII. Quoted by Singer.
[13] Alt. *Berliner klin. Woch.*, 1888, pp. 519, 544.
[14] Lemoine et Linossier. *Compt. rend. Soc. de Biol.* 1893, 9s, V, p. 339.
[15] This patient was shown before the Neurological Society.

Family History—Father died of asthma, mother of consumption. There is no neurosis in the family, no one suffers, as far as he knows, from stomach troubles.

Previous History—At the age of eighteen he had white swelling of the left knee; suppuration ensued and continued for many years; after a period of arrest, the sinus opened again and continues to discharge up to the present time.

He came to this country at the age of sixteen years, has always worked faithfully at his trade, was healthy, not intemperate in the use of liquor or tobacco, nor guilty of sexual excesses. He has been married twice, and is the father of twelve children, of whom eight are living and well. During the last three years he has had a number of pulmonary hemorrhages; has had cough and has lost flesh; night sweats have not occurred. He has always been a large eater, very fond of meat, but does not think that he eats inordinately fast, and states that he chews his food fairly well.

Physical Examination—The patient is below average height, pale, and somewhat emaciated, and weighs 115 pounds. There is partial consolidation of the right lung; expiration is prolonged and bronchial, particularly toward the manubrinm sterni. Fine subcrepitant rales are audible over the infiltrated area. The heart sounds are normal except for accentuation of both second sounds at the base. The liver dullness extends in the mid-clavicular line from the sixth rib to the costal margin; the spleen is not enlarged.

There is no epigastric tenderness or prominence.

The stomach is apparently not dilated; outlined by means of auscultatory percussion, the long diameter is found to be 16½ cm., the depth 8½ cm. Of the deglutition murmurs, only the first one, that synchronous with swallowing, is audible.

There is lateral spinal curvature; the back is dotted over with small areas of atrophy of the natural pigment.

Tubercle bacilli are present in the sputum. Examination of the blood gave 4,975,000 red corpuscles, 12,500 white corpuscles, and 82% hemoglobin. The fact that the count was made about an hour and a half after a large meal may explain the slight leukocytosis.

The urine is normal.

The habit of ruminating, the existence of which was discovered on investigating the patient's history, first manifested itself about twenty years ago; he cannot recall the circumstances connected with its onset, but is positive that at the time he was in perfect health, regular in his habits, not dyspeptic, nor had he seen anyone subject to the same affection.

From that day until the present writing he has, with occasional intervals of short duration, presented the following condition: About half an hour after meals the food begins to return to the mouth without the slightest effort and without the faintest intimation of nausea, and possessing its natural taste. He has no difficulty in distinguishing the kinds of food—after he has eaten of a large number of articles, he can readily differentiate among them. The quantity regurgitated is small and fills the mouth comfortably. If he is out in the open, he generally rejects the food; but if indoors, or in the cars, or busily engaged, he swallows it again. Regurgitation is most apt to occur after the noon-day meal.

As a rule the material is finely enough divided not to require a second chewing, but at times it contains pieces of meat of considerable size, these he picks out and remasticates before swallowing.

The whole process repeats itself at intervals of from five to ten minutes, for about one and a half to two hours; when he is sitting quietly the intervals are somewhat longer. At the end of rumination the food tastes just as pleasantly as at the beginning.

At times, however, the stomach contents become sour; when such a condition exists, the regurgitation continues for about three hours, the material constantly growing more acid until it tastes like vinegar and nearly "cuts his throat," as he expresses it.

He can neither suppress nor inaugurate the process of regurgitation directly, but by assuming the recumbent position he can check it unless he has eaten certain articles, like rice-pudding or smoked meats.

The order in which the food returns depends less upon the order in which it is ingested than upon its nature. Rice-pudding, he thinks, whether eaten first or last, would always come up first. The particular articles which are most liable to be regurgitated are, rice-pudding, smoked sausage, smoked fish, especially mackerel; eggs, ham, pie, and other sweetmeats; at times bread and butter.

Among liquids, he names porter and beer. Beer, he states, comes back as frothy and refreshing as when he drank it; indeed, he thinks, he enjoys it more the second time; whisky does not return; coffee does; tea does not; milk is regurgitated uncurdled for half an hour after ingestion.

Rumination is always preceded by a feeling of fulness in the epigastrium; but there is no belching, although eructations are common between meals, after regurgitation has ceased. To the patient it seems as if the food was forced up by gas collecting beneath it and propelling it upward. He is conscious of its entire passage from the stomach along the gullet to the mouth.

Ordinarily, the ingesta return perfectly sweet continuously for days and weeks; he is then entirely comfortable. But at intervals, for unaccountable reasons, the food becomes acid, and after a few days severe, cramp-like pains develop on each side of the epigastrium. As soon as the bowels are freely moved, the pains cease and the acidity of the food disappears.

Occasionally, when the acidity reaches an extreme degree, the bowels will become loose spontaneously, the acid material apparently acting as a cathartic.

He has never vomited. When he was asked to what he could compare his symptom, he said it resembled more the chewing of the cud by the cow than anything else.

The regurgitated material is small in amount, semi-liquid, and of a mush-like consistence. The writer had the opportunity of examining it twice, on different days.

It was acid in reaction, and of a sour but not offensive odor. Uffelmann's test indicated a trace of lactic acid; the presence of HCl could not be demonstrated either with Congo-red paper or Günzburg's test. One of the specimens had separated into three distinct layers—the upper and lower consisting of flocculi of food material, the middle of a turbid fluid holding small particles in suspension. The first sample contained two pieces of meat, 1¼x¼ and ¾x¼ inches respectively.

On one occasion, the gastric contents were removed with the stomach tube, two and one half hours after an unrestricted meal. About 100 c.c. of a sour-smelling liquid containing solid particles were obtained.

The reaction was acid to litmus. HCl was absent, lactic acid was present in considerable amount. The total acidity, which was, of course, not due to HCl, corresponded to 3.4 c.c. of a deci-normal sodium hydrate solution. Neither starch nor erythrodextrin was present; but with Fehling's test a large quantity of sugar was found; a trace of albumin was also present; the presence of propeptone could not be positively determined; there may have been a trace; the biuret test was readily obtained, even after the filtered fluid had been boiled, indicating the presence of peptones.

On boiling the fluid exhaled a most delightful aromatic odor, difficult to describe.

Dr. Stem has treated the patient in various ways; latterly under the use of a carminative mixture containing Oleum caryophylli, Sp. chloroformi, Tr. capsici, Tr. nucis vomicae, and Tr. cardamomi comp., the rumination has ceased. During the last three weeks he has regurgitated the food but once. Yet, strange to say, he feels far more distress in his stomach now than when the rumination was active.

Case II.—R. B., *æt.* about 60; married; Pennsylvanian by birth; contracting carpenter.

Family history is negative except for the fact that a niece had for a number of years the same trouble from which he suffers. No history of neuroses. Previous history—the patient had typhoid fever and articular rheumatism in his youth.

He was always a large and rapid eater, his favorite dish being to the present day salt pork. In the fall of 1893 he had influenza from which he recovered rather slowly. He now has tuberculosis of the right lung; the sputum contains tubercle bacilli. The stomach is not dilated; the outline obtained on auscultatory percussion measures 19 cm. transversely, and 10 cm. in depth. Three deglutition murmurs are audible: the first immediately on swallowing; the second in seven, and the third in twenty seconds.

From his early boyhood, perhaps from the age of twelve, until he was twenty-two years old, he was addicted to rumination. He has no idea whatever of the cause of the habit; he was, as has been stated, a large meat eater, and was inclined to bolt the food.

Being in the habit of discarding the regurgitated food, he became greatly reduced in strength, and was treated for a long time by an able country practitioner for dyspepsia, but without effect. Finally, a few doses of a medicine given to him by an herb doctor cured the complaint. He gave the same remedy to his niece with a like result.

Two years ago the condition returned and has persisted until the present day. Rumination begins about five minutes after the ingestion of food and continues for nearly three hours. Generally there are, he thinks, about six distinct acts of regurgitation. There is neither nausea nor vomiting, and the food tastes as sweet as in the beginning. As a rule he ejects the bolus, but at times swallows it; large pieces are chewed a second time. He has no control over the process, nor can he at will institute it; he has more distress in the stomach when he ruminates than when he does not.

During active outdoor exercise, the habit is generally in abeyance; inactivity or the dorsal decubitus intensifies it. In this particular he differs from Case I., in whom the phenomenon is most energetic during exercise and least so during repose. The regurgitation is preceded, as in Case I., by a feeling of wind in the stomach.

Among the articles of diet ice-cream, bread, pie, apples, rice-pudding, milk, and especially fat meat are most prone to return. He told the writer that if he ate twenty different dishes, he could distinguish them all in the ruminated matter.

Two small specimens of the food were obtained for examination, one regurgitated one half hour, the other two hours after dinner. Both were sour and semi-solid, the second being somewhat more liquid than the first.

The reaction was acid, HCl was absent, lactic acid was present only in traces, if at all.

On account of the tuberculosis, the patient was placed on creosote, with the result that both the pulmonary symptoms and the gastric condition improved, but a complete cure of the rumination has not been achieved.

These two cases, the histories of which have been given, correspond in many particulars, but very strikingly in the fact that the stomach condition is not associated with a general neurasthenic state, as was the rule in a large number of cases reported in literature.

There may be a relaxation of the cardia, but the writer believes this to be a favoring or predisposing, not an etiologic factor. The coexistence of phthisis with the merycismus is merely an accident.

We have in both patients a history of a too liberal indulgence in meat diet, linked, clearly in Case II. and probably in Case I., with imperfect mastication. The gastric juice in both is deficient in HCl. The first is a common failing, yet rumination is rare; the second may rank among the causal factors of the merycismus, but achlohydria is not constant; in some cases there has been hyperacidity. It is possible, however, that different conditions of the digestive juices may lead to the same phenomenon, and the writer is inclined to attach considerable importance to the subacidity and consequent fermentation, particularly since both patients ascribe the inauguration of each act of rumination to a distention of the stomach with gas.

The theory of atavism, which explains a number of obscure functional and structural anomalies, can scarcely be applied to the condition under consideration, as the connection between man and the ruminating herbivora, if there be any, is too remote.

In addition to the two cases which have come under the writer's personal observation, he has heard of two others that presented the symptom at one time but are now free from it. If these two cases are taken into account, we have four instances of rumination, a comparatively large number, which justifies the belief that the condition is more common than the references to it in text-books would seem to indicate. The patient is apt to consider his affection a peculiar form of vomiting, and not until he is carefully questioned, will its true nature be revealed.

The treatment of merycismus is exceedingly unsatisfactory, very few instances of cure being recorded. The carminatives, electricity, nerve sedatives, and other agents have been employed, but as a rule with but temporary results. In those cases in which the gastric juice is greatly altered, a correction of the defect may bring about a cure. Thus in Alt's case, in which hyperacidity existed, treatment directed against that state, permanently stopped the rumination.

In view of the usual underlying condition, neurasthenia, something might be hoped for from an improvement in the patient's general state.

STOMACH FROM A CASE OF RUMINATION [1]

This stomach comes from the case of rumination the history of which I have reported elsewhere. No macroscopic lesion was found that could explain the rumination. This has been the result of most autopsies in cases of merycism. Arnold and Luschka found dilatation at the lower end of the esophagus and an unusual thickness of the internal branch of the spinal accessory nerves, the branch that unites with the vagus. As in ruminants the gullet terminates in a funnel-shaped expansion, and as in them the internal branch of the spinal accessory nerve is very thick, Arnold, and also Luschka, concluded that the affection was accounted for by these lesions. But subsequent studies have not confirmed this, and as far as the dilatation of the esophagus is concerned it is not present in this instance.

[1] Reprinted from Transactions of the Pathological Society of Philadelphia, 1895-97, Vol. XVIII.

HISTORY TAKING AND PHYSICAL EXAMINATION IN DIGESTIVE DISORDERS [1]

When a patient comes to a physician for the first time he places on him a heavy responsibility; under certain conditions the heaviest a human being is called upon to bear. Two questions, implied or expressed, must be answered if the patient is to be repaid for his confidence and outlay: What ails me? What must I do to be cured? The conscientious physician looks on these questions as a challenge which can be met only by a true diagnosis and clear-cut, helpful advice. Such a diagnosis is a problem in logic, no less rigorous and exacting than a problem in any of the natural sciences. The difference consists in the elusiveness and multiplicity of the medical premises. The physician's end and aim is exactly like that of the astronomer, the mathematician or the physicist—to find the truth.

In the study of a case the history is all-important, not only for the diagnosis but also for the psychologic understanding of the patient. But the taking of a history is not child's play. It is a real art, difficult to acquire. While the truly first rate medical historian, like the poet, is born, not made, nevertheless, by practice and by cultivating sympathetic listening, any conscientious physician can become a reasonably good historian. The young physician is apt to leave the hospital weary of history taking and with the quasi-conviction that it is of no great consequence. The sooner he overcomes this repugnance the better.

The history should be taken in a quiet room and there should be no interruptions. The patient must receive the impression that the physician has all the time in the world to listen to his story. This is especially important in that large group of cases called "nervous dyspepsia." While listening to the history, he must consciously and subconsciously strive to fathom the psychology of the patient.

But, in order to take a satisfactory history, the physician must be more than a patient listener; he must know the physiognomy of disease, so that he may frame his queries intelligently and avoid

[1] Opening lecture of the Seminar on Gastro-enterology of the Philadelphia County Medical Society.

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irrelevant questions. He must know what he is trying to elicit. I do not mean thereby that, like the physician in Shaw's play, he should have a preconceived notion of what he wants to find. That is one of the charges brought against medical specialists.

If the history is carefully taken it nearly always gives a clue to the probable diagnosis; in that way it serves as a basis for further investigation and helps in the emphasis on certain features of the physical examination and in the rational application of laboratory methods.

The greatest difficulty confronts us in attempting to determine whether a given group of symptoms is functional or structural in origin. The symptoms and even the laboratory observations may be the same in two cases, yet one may be organic and the other functional. Every surgical clinic affords proof of the errors arising through this mimicry, and every practicing physician has regretted experiences that prove to him the fallacy of the ordinary criteria of disease. What can help in such a doctor's dilemma? Perhaps that heaven-born gift, intuition, the subconscious psychologic insight which comes to us when we study the patient personally. It is because it tends to neglect that subtle insight that I am not favorably disposed to the hopper method of studying cases which obtains in certain clinics. Such a method precludes the utilization of the sixth sense.

The physical examination, which in practice usually follows the taking of the history, should always be thorough. No organ should be neglected. Every physician should adopt a routine method which not only will make omissions less likely, but will conserve the physician's time.

While I have always more or less followed a routine system, the practice became crystallized during service in the army. Under pressure, the board of which I was a member examined a large number of candidates for the officers' training corps. We, as de facto final arbiters in all cases, had to develop a system both thorough and speedy. I believe that this experience, which I am sure was that of thousands of other physicians similarly placed, is one of the useful by-products of an otherwise unproductive war.

With a well defined method, the guide given by the history will enable the physician to vary the method so as to concentrate on special areas or organs with a definiteness of purpose that a sloppy history makes impossible.

A physician can become a reasonably good diagnostician only by constantly practicing the technic of diagnosis. There is a close analogy between clinical medicine and music. One may know harmony and counterpoint and all that makes up the science of

music, but unless by dint of hard practice one masters the technic of one's instrument there will be no music. A physician may possess all the textbook knowledge; he may be capable of passing a wonderful written or oral examination, but without the technical expertness to apply this knowledge he will be hopelessly lost at the bedside in the complexities of a medical case.

In the physical examination thoroughness is the highest desideratum. One may get valuable information in gastro-intestinal diseases from the examination of organs in no direct connection with the alimentary tract. Inspection of the skin may show jaundice, indicating disease of the biliary tract, or perhaps of the spleen. Inspection furthermore may show anemia or cachexia, calling attention to the possible existence of pernicious or other anemias and of malignant disease. In cancer of the colon, a profound anemia is often the most conspicuous sign, evident before a palpable tumor appears. The eyes may reveal the earlier stages of jaundice and the pupils may be of the Argyll Robertson type—a valuable hint in obscure cases of persistent, painless or painful vomiting, suggesting to the alert physician the possibility of gastric crises as the cause of the syndrome and causing him to test the knee jerks and the station and to make the Wassermann test.

A blue line on the gums may reveal lead as the cause of an otherwise unfathomable colic. Addison's disease may be suggested by finding pigment spots on the oral mucosa. A sore tongue may be the first clue to the existence of pernicious anemia in its early stages. The significance of the tonsils and of the teeth does not need emphasis. Perhaps I ought to point out a curious relation between the tonsils and the appendix (the abdominal tonsil) to which I have called attention elsewhere.[2] Tonsillitis may cause appendiceal symptoms; sometimes the patient is scarcely aware of sore throat. Hence, in children especially, it is a good practice to look at the throat in ill defined cases supposed to be appendicitis.

A good deal can at times be learned from an examination of the neck. Most important perhaps is the discovery of a small, hard gland above the clavicle, the so-called Virchow or Troisier gland, which indicates the existence of malignant disease either in the chest or below the diaphragm. If the patient has gastric symptoms, then in all probability the gland means cancer of the stomach. More than once have I been able to arrive at the correct diagnosis of an obscure case through this telltale gland in the neck. Of course, I do not mean to say that glands above the clavicle

[2] Riesman, David: Extra-Abdominal Conditions Simulating Acute Abdominal Diseases, J. A. M. A. 84: 1973-1975 (June 27) 1925.

are always due to carcinoma of the stomach. They are frequently found in mediastinal and other malignant tumors in the chest and not rarely in tuberculosis.

Toxic goiter may be the cause of severe vomiting and diarrhea. At times the goiter is so small that only after careful study is it possible to prove its etiologic relationship to the striking gastro-intestinal symptoms.

Examination of the heart is one of the most important items in the physical examination of a patient presenting gastro-intestinal symptoms. Not infrequently the very earliest signs of beginning myocardial failure are loss of appetite and a sense of oppression in the chest relieved by belching. To the patient and to the unobservant physician the symptoms, being so clearly gastric, seem to be produced in the stomach, when in reality they are due to failing circulation. Another cardiac condition in which the gastric symptoms and signs may totally mislead the unwary is mitral stenosis with hepatic enlargement confined to the left lobe. The swollen liver produces a tender epigastric tumor which in the presence of vomiting and anorexia suggests the existence of malignant disease of the stomach. One patient with this type of syndrome came very near to operation. In this instance there was nausea, vomiting, loss of appetite and a projecting tender mass in the epigastrium. The case was diagnosed as carcinoma of the stomach, and arrangements had been made for an operation. I was asked to study the patient as an operative risk. I found that he had mitral stenosis and that the epigastric mass was an enlarged left lobe of the liver. In several other instances of mitral stenosis with decompensation I have found that the left lobe of the liver bore the brunt of the congestion. The reason for this peculiar enlargement I do not know. No doubt there is an anatomic basis for it.

It is well known that angina pectoris may manifest itself by pain in the epigastrium or by pain in the gall-bladder region. And coronary occlusion, a disease about which I spoke in the preceding seminar, may produce all the signs and symptoms of acute intra-abdominal catastrophe. All sorts of gastro-intestinal diagnoses are made, such as peptic ulcer, biliary colic, food poisoning and acute pancreatitis. In coronary occlusion, while the symptoms may be abdominal, careful study will reveal a terrific drop in blood pressure, collapse of the circulation, cold extremities, feeble heart sounds, perhaps a pericardial friction, leukocytosis, fever, and at times an absence of the dorsalis pedis pulse.

The lungs must likewise not be neglected in an examination in supposed gastro-intestinal disease, for the reason that pneumonia

and pleurisy may mimic to perfection the symptoms of appendicitis or gallstones. I hold it as most important never to diagnose the latter conditions in a child, and rarely in an adult, without a most complete examination of the chest. Only a few days ago, I saw a boy of 5, in whom a diagnosis of appendicitis had been made, to all intents and purposes justifiably, for he had abdominal pain, tenderness, vomiting and leukocytosis, and yet the case was not one of appendicitis but of lobar pneumonia.

While pneumonia and pleurisy may through an obscure sensory reflex simulate acute abdominal disease when there is no such disease, tuberculosis, probably through toxemia, may produce pronounced gastric symptoms, especially loss of appetite and distress after eating, with complete obscuration of the tuberculosis in the lungs. Persistent dyspepsia in an adolescent demands in every instance a careful examination of the lungs and a two-hourly recording of the temperature for one or two days. In this connection it may be wise to state that carcinoma may occur in persons under the age of 30, producing, like tuberculosis, a rapid loss of weight. Carcinoma of the stomach in the young, at least in my experience, is usually attended by a good deal of pain and runs a rapid course.

Leaving the chest and coming to the abdomen, we find that in order to make an examination that will be helpful the physician needs fingers that can press deeply without hurting, fingers that are provided with roentgen-ray eyes, and, above all, a knowledge of anatomy and physiology. No region contains so many organs and none presents a comparable number of diagnostic problems. An incident of my internship in the Philadelphia General Hospital is illustrative. One day one of my colleagues asked the visiting chief—perhaps the best diagnostician on the staff—to see a patient with an obscure abdominal condition. When the chief came out of the ward, he had a puzzled look on his face and said in his characteristic drawl, "I believe I know something about the chest, but I don't know a thing about the belly."

I find it convenient to divide the abdomen into the traditional nine regions: three above, three across the middle and three below, and to have before me in my mind's eye the organs and structures normally contained in each of them.

In former papers I spoke of the right upper quadrant of the abdomen as "the Balkans" of the body; perhaps with due consideration of the prevailing international harmony the term "Central America" is more appropriate.

Pain located in the epigastrium or in the right upper quadrant

suggests primarily a peptic ulcer, disease of the gallbladder, cancer or other less easily defined disorders. As these possibilities are the first to be formulated, one proceeds to question the patient for the purpose of differentiating among them:

1. The relation of the pain to meals is a primary consideration. If the pain comes on when the stomach is empty and is relieved by food, it suggests hyperacidity and ulcer, particularly duodenal ulcer. The patient may volunteer the information that he goes to bed with a glass of milk and a cracker at his bedside or that he takes sodium bicarbonate whenever he feels the pain. This information, plus a few other anamnestic data, such as periodic recurrence of the pain with intervals of freedom, prepare one for further steps in the investigation. The roentgen-ray examination, the test for occult blood in the feces, and gastric analysis are now in order. Of the three, the roentgen-ray test is of the greatest value.

2. If the pain is often nocturnal, of sudden onset and accompanied by a sense of gaseous distention and upward pressure, it is suggestive of disease of the biliary tract. One would then inquire into the reference of the pain, the presence or absence of jaundice or chill, and, very significant, whether it is severe enough to require a hypodermic injection of morphine. If the patient is a pregnant woman or one recently confined, the diagnosis of gallstones gains greatly in probability.

The next step is to try to find tenderness over the gallbladder area. This can be done in several ways. One can press with the thumb over the gallbladder as the patient takes a deep breath, or one can use what I have described as ulnar percussion, striking a quick, not too violet, blow with the ulnar side of the hand over the gallbladder area as the patient holds his breath at the end of a deep inspiration, and doing the same thing on the opposite side for comparison. Or one can employ the Mann test, which consists in having the patient sit on a chair completely relaxed and leaning forward, while one stands behind him and presses the fingers under the costal margin.

The diagnosis is now sufficiently fortified for an intelligent use of the roentgen-ray laboratory, and here we get a most dependable answer as a rule if the roentgenologist employs the Graham-Cole test. It is to the great credit of American medicine and to Evarts Graham in particular that our diagnostic powers have been enlarged by such an invaluable contribution. Biliary drainage as crystallized by Dr. Lyon at times gives useful information, but it cannot replace the roentgen-ray examination after the Graham method.

If a patient in middle life presents himself with the story that

he has pain after eating and loss of appetite, and if he has never had any gastric distress before, no matter how uninforming the physical examination may be, one should at once suspect malignant disease and proceed with a well-defined plan for its detection. Here the test meal and roentgen-ray examination may be the sole avenues toward a correct diagnosis.

When the roentgenologic report and clinical interpretation do not tally, then one or the other or both opinions may be wrong. It then becomes necessary to review the case from a new angle and to look for additional data. Of great value, in my opinion, is the joint study by the clinician and the roentgenologist of the roentgen-ray films. I have learned a good deal about gastro-intestinal and thoracic diseases through this practice and cannot recommend it too highly. Even the roentgenologist, objective as his point of view must be, gains something by studying the films with a clinical colleague at his side.

I might at once refer to another matter germane to the present subject. It is one of which one of the greatest of American surgeons—il maestro di color che sanno—has often spoken: the value of attending operations on one's gastro-intestinal patients and learning through the autopsia in vivo; or, if through mischance, the autopsia in vivo becomes the autopsia in morte, the value of being present at the autopsy.

If the patient has attacks of pain, such as I have mentioned, coming in paroxysms, of a character that might be compatible with a diagnosis of gallstones, one must bear in mind that in rare instances the gastric crises of locomotor ataxia are the real cause of the seizures. It is on that account that I have early in this paper called attention to the importance of examining the pupils and the reflexes.

Pain in the left upper quadrant is less common than pain elsewhere and less easily fathomed, notwithstanding the fact that there are fewer organs in that part of the abdomen. We have here the spleen, the splenic flexure of the colon, the stomach, the tail of the pancreas, the diaphragm and the kidney, as well as blood vessels and nerves. As a general rule, left-sided pain should suggest disease of the stomach, cancer or diverticulum of the colon, diaphragmatic hernia, splenic infarction or some other disease of the spleen, or renal calculus. However, the pain may be referred from a distant place. I have seen pain in the left hypochondrium from such conditions as gallstone and aneurysm of the thoracic aorta.

A peculiar source of pain in either the left or the right hypochondrium which may prove a diagnostic pitfall is herpes zoster, which on the right side may be mistaken, before the eruption manifests itself, for gallstone colic.

Another condition that has to be considered as the cause of acute abdominal pain is embolism of the kidney or the spleen. If in the right kidney the symptoms may strongly suggest appendicitis. The diagnosis is usually made without difficulty by finding a source of emboli in the heart.

Pain in the center of the abdomen, as well as in the two upper quadrants, may be caused by visceroptosis. It is unnecessary to point out the differential diagnosis between this and the conditions with which it may be confused—duodenal ulcer and gallbladder disease—but it is important to bear it in mind before making a diagnosis of such a structural lesion as the last two mentioned, which are frequently surgical conditions.

Visceroptosis is often associated with neurasthenia or nervous dyspepsia. Chronic gallbladder disease may similarly produce neurasthenic symptoms. One must ever be careful, both in taking a history and in making a physical examination, not to be swayed too greatly to the one or the other side by the multitudinous complaints of the patient.

Visceroptosis is likewise often associated with colonic stasis. However, stasis may also occur in the absence of visceroptosis. It is always to be suspected in thin, flat, undernourished, long-waisted persons. When this type of habitus is discovered on examination and the history is reviewed in the light of the observation, one frequently does not by any kind of laboratory method learn anything more about the existence of stasis than was known before. Constipation is present, but as that is a common ailment, especially among women, it has very little diagnostic significance. My old preceptor in Ohio used to say that woman is the female of the species *Homo,* constipated, and with a pain in her side.

It should be remembered, that colonic stasis may exist even though the bowels move daily.

The diagnosis of colonic stasis is made largely on the roentgen-ray evidence. While the poorly defined symptom complex called autointoxication, is attributed to such stasis, there is little, if any, chemical evidence of such autointoxication. Nevertheless, I feel, purely on clinical grounds, that there is such a condition, and I furthermore know that it is amenable to cure by proper treatment.

A rare source of pain is a small epigastric hernia, no larger than a grape or a marble. I have seen occasional examples of this, the

patient usually having been subjected to many gastric indignities and much expense, because the little knuckle had not been found.

In the right lower quadrant the appendix is the chief offender, but a pain in the right lower quadrant need not be due to disease of the appendix. It may be due to a renal calculus. If one were to make a card index of postoperative failures, one would find quite a considerable number of patients who had been subjected to removal of the appendix because the calculus had not been discovered. Disease of the uterine adnexa is likewise a cause of pain both in the right and in the left lower quadrant, and may simulate, on the right side, appendicitis. Vaginal examination must not be neglected.

Colitis is an important disease of rather easy diagnosis, but one must be sure that there is no cancer of the colon or rectum as the cause of what is called colitis. A rectal and if necessary a proctoscopic examination should be made.

Many patients are treated for bleeding hemorrhoids when they have a carcinoma of the rectum or rectosigmoid.

Pain in the lower left quadrant may be due to colitis, to disease of the ovary or tube, to constipation of a severe type, to cancer of the sigmoid, or to a diverticulum.

Examination of the lower extremities naturally cannot supply a great deal of information in the analysis of gastro-intestinal conditions. I have mentioned absent reflexes in cases of gastric crises. Absence of the dorsalis pedis pulse may in the differential diagnosis of coronary disease turn the scale of probabilities in favor of that disease.

There are two other symptoms revealed, partly by the history and partly by the physical examination, that require a good deal of diagnostic acumen for their proper reference: One is hemorrhage and the other ascites. Suppose a patient says that he has vomited blood. How shall one approach such a case? Assuming that blood is vomited and not coughed up, one has to consider the probabilities. The most frequent cause is an ulcer of the stomach or the duodenum and next cancer of the stomach. The physician would therefore point his questions primarily in those directions and guide the physical examination in the same direction. If no clue is obtained justifying the diagnosis of either of these conditions, then there are other possibilities to consider. Cirrhosis of the liver, a comparatively rare disease, may cause a profuse hemorrhage from the stomach or from the veins at the lower end of the esophagus. One has also to think of the spleen, certain disorders of which, as Banti's disease or splenic anemia, may cause gastric

hemorrhage; and then, finally, of the different forms of the hemorrhagic diathesis. If the physician has these various possibilities in mind, he will naturally guide the subsequent examination more intelligently.

Hemorrhage from the bowel, the so-called melena, has a great variety of causes. I shall not go into them, except to say that a rectal examination is indispensable. It may be necessary to supplement it with the use of the proctoscope or sigmoidoscope and, of course, such other laboratory tests as are suggested by a study of the case.

To illustrate how confusing the picture sometimes is, I might cite the case of a man, about 55 years old, weighing more than 200 pounds (91 Kg.), with high blood pressure, who on a very hot day fell over in a faint while seated on the toilet. His wife heard him fall, rushed upstairs to the bathroom, and with difficulty got him to bed. A physician was called, who examined him and said that it was a heat stroke. The patient remained weak and prostrated, so that I was asked to see him. I was struck by his color. He was exceedingly pale. I asked his wife whether he had vomited any blood. She said no. I then inquired into the color of the bowel movements. She said that she had been struck by their appearance, which was like that of tar. It was not difficult to conclude from this statement that the man had had an internal hemorrhage. I had a blood count made, which showed a hemoglobin of 30 per cent. The family physician and I thereupon agreed that the man should be transferred to the University Hospital, where we instituted an immediate transfusion. No blood was ever vomited by this patient. I have had a few similar cases, and have come to the conclusion that the hemorrhage in them was not due to ulcer but to arterial disease with hypertension. Most frequently, however, a sudden large hemorrhage from the bowel is due to a bleeding duodenal ulcer.

Ascites is a symptom of no great diagnostic import when it is part of a general dropsy, in which case it is referable either to circulatory failure or to renal insufficiency; but when ascites is present without general dropsy, then we may have a very difficult diagnostic nut to crack. Here too certain general principles must guide us. In the first place, the ascites may be due to conditions outside the abdomen; to wit, adherent pericardium, polyserositis or a rare form of myocardial failure. Secondly, it may be due to disease within the abdomen. Here the age of the patient and perhaps the color may guide us. In a young person, if colored, one would suspect tuberculosis. One must also suspect tuberculosis in white persons of comparative youth. This is particularly true if

the ascites is a "silent" one; that is, without pain. If the patient is a woman between 30 and 40, then my fear would always be malignant disease of the peritoneum arising either in the ovary or in the stomach. A vaginal examination may establish the diagnosis, or a very careful palpation after tapping may reveal a mass along the greater curvature of the stomach or elsewhere in the abdomen.

Cirrhosis of the liver is also a cause of ascites. As a general rule the other features are fairly definite, such as a large liver, engorgement of the veins, and a history of alcoholism. These signs may be absent and there may be no history of alcoholism. A large spleen associated with ascites suggests that the case is one belonging to the Banti group.

Persistent vomiting is a symptom that sometimes taxes one's diagnostic skill in determining its cause. It may have a local origin, such as a pyloric obstruction, or a stricture of any kind at the lower end of the esophagus, or it may be due to intestinal obstruction. Confronted with a case of this type, one should make it a rule, apart from the usual physical examination, to inspect and to smell the vomitus, and one should always place one's fingers into all hernial openings, and, of course, make a rectal examination. Having excluded organic diseases of the gastro-intestinal canal itself, one has to think of uremia, which may closely simulate intestinal obstruction, of acidosis, especially if the vomiting is periodic, and perhaps of brain tumor, although the symptoms of the last are usually sufficient to attract attention to the head. The symptoms of appendicitis—pain, vomiting, leukocytosis—may be simulated by diabetic acidosis to a degree not imagined by one unfamiliar with the possibility.

I have had a few patients who came under my observation with a diagnosis of chronic gastritis, because of periodic attacks of severe vomiting. I recall distinctly one case that had been treated by a gastro-enterologist with lavage and various other measures known to the highly trained specialist. A careful analysis of the case showed that it was one of migraine; the patient's consciousness was filled more with the vomiting than it was with the pain in the head, so that he did not volunteer information about the headache until questioned. Uncontrollable vomiting may be produced by Addison's disease. The vomiting is associated with extreme hypotension. Hence, when vomiting and hypotension occur together, while one might think of exogenous poisoning, the possibility of tuberculosis of the suprarenal glands should be kept in mind.

A number of years ago I was asked to see a woman of middle

age who had been vomiting for two or three days. As the urine contained some albumin, the diagnosis of uremia had been made. On the surface of things the diagnosis seemed reasonable, but when I made a vaginal examination I found a very tender mass, which proved to be a twisted ovarion cyst.

Another cause of vomiting that sometimes may not be revealed in the history is early pregnancy.

I have considered the body from the head to the feet. Let us now turn the patient over and see whether we can learn anything by examining the back that might help us in the diagnosis of gastro-intestinal diseases or in their exclusion.

There is tenderness on pressure or percussion in the loins in pyelitis which might help in excluding appendicitis and diseases of the spleen. But there is another thing to be looked for, as I can illustrate by the following case:

A woman had pain in the right lower quadrant of the abdomen with some tenderness and rigidity. Her physician, a very good man, diagnosed appendicitis and the appendix was removed and was declared to be diseased, which leads me to say that I have never seen an appendix removed at an operation that was considered normal by the operator. However, the patient did not improve. She was sent to Hot Springs, Va., for the baths and came back no better. When I saw her I found persistent rigidity on the right side of the abdomen and a deep-seated prominence which impressed me as a spasm or contraction of the psoas muscle. I then turned the patient over on her stomach and examined the vertebral column. In the region of the lumbar spine I found a small projecting knuckle which was tender on pressure. She herself had been entirely unaware of it. It could be nothing else but Pott's disease, a diagnosis which was confirmed by the late Dr. Willard, who saw her in consultation with me. While I have not had any other case exactly paralleling this one, I have heard and read of cases in which tuberculous disease of the spine produced symptoms that suggested the presence of intra-abdominal or of intrathoracic disease.

We have up to this point dealt largely with the graver conditions producing gastro-intestinal symptoms. I should be remiss if I did not say something about a large group in which the gastro-intestinal symptoms are not of grave import, although the patients come to us vociferously insistent on relief. These are the cases of so-called gaseous indigestion, acid, flatulent dyspepsia and nervous dyspepsia. In penetrating through the mystic maze presented by these dyspeptic patients one must always hold a functional diag-

nosis, such as indigestion, nervous dyspepsia or neurasthenia, in reserve until by the most painstaking history, physical examination and laboratory research one has excluded organic disease; and by organic disease I do not mean organic disease of the stomach and duodenum alone but also of the gallbladder and of the appendix, which may give rise to symptoms that are predominantly gastric.

The patients whom I have in mind complain of distress after eating, gaseous distention, eructations, diminished or capricious appetite, and constipation. Pain in the epigastrium, the left hypochondrium, the precordial area or between the shoulder blades is frequent; it closely simulates pain of organic origin, but is quickly relieved by the belching of gas. The patients themselves attribute the pain to gas—they want their backs rubbed, or they resort to carminatives or to enemas. In all such cases it is important to use every means for differential diagnosis, not to fall into error by overlooking a diseased gallbladder, an adherent appendix, or a beginning myocardial failure.

One gets much help in the analysis of these troublesome cases by entering carefully into the patient's habits of eating. A fruitful cause of dyspepsia and indigestion is the cafeteria and lunch counter.

Neglect of the teeth, not only as to their sanitary care, but also as to their use according to nature's scheme, is likewise a fruitful source of trouble. Many use their teeth like the predatory animals for biting but not for chewing. Excess in tea and coffee, excess in anything, may be harmful and therefore should be envisaged as a possible cause in the taking of a history.

One must also bear in mind that many persons unwittingly live on an unbalanced diet. It therefore behooves us to study the patient's dietary habits. In truth we need to know such dietary habits, not only to discover the etiologic factors pertaining to the patient's troubles but also because our knowledge of foods and dietotherapy is woefully incomplete. A student in the medical school learns how to use digitalis, epinephrine and pituitary extract, but he does not learn how to use milk, eggs, carbohydrates or fats, except in connection with diabetes; but that is another story.

From the large class of functional gastro-intestinal conditions it is possible to separate a group to which the Vienna school has applied the name of vagotonia, the chief characteristics of which are hyperchlorhydria with gaseous distention, bradycardia, local or general hyperhidrosis, cold clammy hands, local erythema, eosinophilia, and constipation or constipation alternating with diarrhea. This varied and variable aggregation of symptoms is attributed to overstimulation of the vagus nerve. While the ascrip-

tion of the symptom complex to this cause is by no means to be taken as proved, the concept of vagotonia may help to throw some light on a dark place in clinical medicine.

It is a short step from vagotonia to another subject that increasingly demands our attention; namely, psychology in medicine. Whatever our preconceived ideas may be toward modern psychoanalysis, it is wise to discard them and to approach the subject with an open mind. Much can be learned as to the causes of the various manifestations of neurasthenia, including nervous dyspepsia, by the method of approach which we owe to the psychoanalytic school. It is unnecessary at this time to go into further details on this subject. I am hoping, however, that students in medicine will not hereafter be graduated without some knowledge of the psychoanalytic method and its language.

PRE-ICTERIC ITCHING *

In his clinical lectures Robert James Graves,[1] the great Irish physician, reports two cases of itching preceding jaundice that are cited by nearly every succeeding writer who refers to the subject. The first case was that of a woman, aged 20, suddenly seized with pain in the right hypochondrium and epigastrium; three days later, and ten days before the jaundice appeared, she began to have excessive itching of the skin preventing sleep. This itching ceased with the advent of the jaundice. In the second case, that of a man laboring under a most severe jaundice, the itching preceded the jaundice by two months and subsided when the discoloration of the skin became established. Graves saw at once that these two cases were irreconcilable with the view that the itching in jaundice depends on a deposition of bile pigment in the skin. Hilton Fagge [2] is authority for the statement that Thomas Addison once suggested that an attack of jaundice might be impending when a patient complained of itching, for which no explanation could be found; the prediction proved correct. Murchison,[3] Budd,[4] and Frerichs [5] mention pre-icteric itching, but cite no observations of their own, referring merely to the two cases of Graves. Quincke,[6] Rolleston,[7] and Osler [8] also speak of it. According to Quincke, Herter attributes the itching to dryness of the skin. In a case of carcinoma of the ampulla of Vater reported by Havilland Hall,[9] severe itching appeared one week before the jaundice, and in a similar case of Halsted's,[10] itching was the first symptom.

Within the last few months three cases of this anticipatory itching have come under my observation.

Case I.—H. G.; physician; aged 33; came to see me on September 1, 1906, deeply jaundiced. He had been well until six weeks before, when he had an attack of cramp in the lower abdomen with vomiting and diarrhea. The pain was not severe; lasted one and one-half hours, and was relieved by a free evacuation of the bowels. He did not feel well afterwards, and two weeks later began to have severe itching of the legs at night. Circular brownish patches appeared upon the skin of the lower extremities and as far up as the waist line. After the itching had lasted a fortnight, jaundice supervened, and with its advent the itching became much less pronounced,

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but continued in a mild degree until about September 25, by which time the jaundice had disappeared. During the attack, the patient lost a good deal of flesh and strength, due, he thought, to his limiting himself to one meal a day. There was marked dyspnea on exertion, and in the beginning a little fever, up to 101°. The tongue was heavily coated; there was great thirst; the bowel motions were putty-colored; liver and spleen were enlarged, but not tender to touch. There were no heart murmurs. A blood count made on September 1, showed hemoglobin 70 percent; white blood-corpuscles 7,600; red blood-corpuscles 5,300,000. The urine was free from albumin and sugar; acid in reaction; specific gravity 1,019; dark amber, and contained bile. Under the microscope, hyaline and leukocyte casts, cylindroids, and a few bile-stained leukocytes were found.

The attack had a curious sequel. After the jaundice had vanished, the patient began to suffer from pains in all of his bones and larger joints. The slightest exertion was painful; the mere lacing of his shoes, drawing the string over his thumbs, caused pain; turning the handle of the door required a great effort; and even the act of walking was painful. The glands of the neck and in front of the ear were enlarged and tender; there was also a rapid and pronounced loss of hair. This strange symptom-complex lasted six weeks; it was not attended by fever, and the salicylates had no effect upon it. Even now—I saw the patient today—he has not regained his full vigor, although he is free from pain and feels otherwise quite well.

Case II.—Patrick F., aged 65; white; a native of Ireland; was admitted to the Philadelphia Hospital, September 7, 1906, with intense jaundice. He had not been ill since childhood; had used alcohol and tobacco to excess. About four weeks before admission, he had a severe attack of epigastric pain; and about a week later, and two weeks before the jaundice appeared, he began to have itching, which was worse at night, and was especially marked in areas where he perspired. While in the hospital his skin was normal to the touch; he would always perspire freely after a hot bath. Scattered over the trunk and extremities were small brownish macules, which had appeared since the development of the jaundice. He was rapidly losing flesh and strength; occasionally it was possible to make out a mass in the right upper quadrant of the abdomen. There were no heart murmurs. A tentative diagnosis of cancer of the head of the pancreas was made, and it was also considered possible that a stone might exist.

Case III.—M. T.; a young woman; single; aged 28; Austrian; servant; had an attack of epigastric pain five weeks before admission to the Jewish Hospital; two weeks later jaundice appeared. For four days prior to her discovering the discoloration of the skin, she had severe itching of the palms, arms, and back. When I saw her the jaundice had almost disappeared after having lasted about three weeks. The itching continued for two weeks during the jaundice, and was most marked, after the icterus had reached its height, on the chest and back. She perspired but little during her illness. Bile was present in the urine, and was also demonstrated in the blood-serum. There was no murmur over the heart throughout her stay in the hospital. A diagnosis of catarrhal jaundice was made, but it is possible that the patient has gallstones.

In these three cases the pruritus, which as a general rule comes on with or soon after the jaundice, appeared before the latter. This peculiar circumstance suggests a brief consideration of the causa-

tion of the itching accompanying hepatic diseases. I think the older view that it is due to a deposit of bile pigment in the skin can no longer be maintained; it was questioned already by Graves, by Budd, by Murchison, and by Frerichs. Rolleston, among modern writers, also doubts whether itching is due entirely to the presence of bilirubin; and admits the possibility that other concomitant poisons may give rise to it, or that the dry, ill-nourished condition of the skin is the cause. Quincke holds that it is impossible to state whether the deposit of bile pigment in the skin has anything to do with the itching.

The following facts, it seems to me, militate against the view that the pigmentation is the cause of the itching.

1. Itching, according to Frerichs and Lancereaux,[11] occurs in only about one-fifth of the cases of jaundice.
2. It bears no constant relation to the depth of the jaundice.
3. It may come and go repeatedly in a given case, while the jaundice persists undiminished, as in a woman under my care at the present time.
4. The occurrence of itching that appears before the jaundice, and coincidently runs with it for some time.
5. The prompt, sometimes instantaneous, disappearance of the itching after drainage of the gallbladder is established, long before the jaundice has had time to disappear.

The liver performs so many duties in the economy that when its activity is interfered with, a number of consequences, more or less important, must follow. The most conspicuous, although not the most important, is jaundice, for which the explanation is simple enough, namely the deposition of bile pigment in the skin. Another symptom is bradycardia, generally attributed to the circulation of the bile acids and bile salts. More obscure is the tendency to hemorrhage, which may be due to biliary acids; but this is by no means proved. The cause of the itching is unknown. In all probability it is some metabolic poison, or poisons, which the liver, in its normal state, either neutralizes as they pass through in the portal blood, or destroys when brought to it by the blood of the hepatic artery. Inasmuch as the itching is so promptly relieved when the bile is deflected from the system by a fistula between the gallbladder and the stomach or bowel, or through an external opening, the poison would seem to be contained in the bile. In ordinary cases of icteric itching it enters the circulation with the bile, probably by way of the lymphatics; but in pre-icteric itching or in itching depending upon hepatic disturbances without jaundice, it passes into the blood independently.

The question arises, has pre-icteric itching a diagnostic or a prognostic significance? The reported cases are too few for a definitive opinion; but it is significant that three out of six cases were malignant. My friend, Dr. M. J. Stern, who has had considerable experience in diseases of the biliary passages, has also noticed pre-icteric itching to occur more often in malignant than in benign affections. Bouchard and other French writers likewise claim that the early advent of itching in jaundice is suggestive of malignant disease.

Conclusions

1. Itching sometimes precedes the onset of jaundice by a variable length of time.
2. This itching may cease the moment jaundice is established, or it may continue indefinitely.
3. Itching, whether pre-icteric or icteric, is not due to a deposit of bile pigment in the skin.
4. When itching exists for which no cause can be found, the liver as a possible factor should not be overlooked.
5. Pre-icteric itching is suggestive, though not pathognomonic, of the existence of malignant disease involving the liver or the biliary passages.

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10. Halsted: Johns Hopkins Hospital Bulletin, January, 1900, p. 4.
11. Lancereaux: Traité des maladies du foie et du pancréas, p. 70.

MEDICAL ASPECTS AND DIAGNOSIS OF DISEASES OF THE GALL-BLADDER[1]

The diseases of the gall-bladder in which we are most interested are cholecystitis and cholelithiasis. As an independent affection, inflammation of the gall-bladder is not common. In the majority of cases the gall-bladder is the seat of stones. Nevertheless, we must take cognizance of non-calculous inflammation. It is met with in typhoid fever, pneumonia, food-poisoning, etc., and manifests itself by tenderness in the gall-bladder area, by leukocytosis, and usually by jaundice. But even in apparently primary cases an unsuspected gall-stone may exist, as I once observed in a case of typhoid fever. As non-calculous cholecystitis, whether due to the typhoid bacillus or to other causes, may closely resemble gall-stone colic, some physicians and surgeons, to avoid embarrassing explanations to the laity, no longer make a diagnosis of gall-stones, but merely of gall-bladder trouble. Surely it is an uncomfortable feeling not to find at operation the gall-stones one has predicted. In such an impasse one thinks of the practice of Conan Doyle's Dr. Winter, who carried stones in his pocket to meet these emergencies. Acute cholecystitis, especially the calculous form, is often of a fulminant character, producing all the signs of a severe septic infection with localized peritonitis. In one case, seen several years ago, in which the gall-bladder was filled with stones and pus, the onset was so acute as to suggest perforation of a gastric ulcer. In the diagnosis of such cases the history is of great moment; the patient generally has had attacks of pain in the upper abdomen and has suffered from indigestion and possibly jaundice. If the patient is a stout woman past thirty, the suspicion of gall-bladder infection is strengthened. On physical examination the gall-bladder in these cases can sometimes be felt, especially if a rolled-up blanket or pillow is placed under the back and the abdomen is palpated very lightly with the warmed hand. A large gall-bladder generally means a stone in the cystic duct. In such cases the liver often

[1] Read as part of a symposium at a meeting of the American Gastro-enterological Association, Washington, May 8, 1916.

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projects a considerable distance below the costal arch in the form of the so-called Riedel's lobe. Cholecystitis sometimes occurs in women of advanced years who never have had any gall-bladder trouble before. As I have seen it the attack has always followed a gross indiscretion in diet, and during the first day or two has resembled "ptomain poisoning." The symptoms are sudden epigastric pain with nausea and vomiting, prostration, and moderate fever. On the second or perhaps the third day an enlargement in the liver region with great tenderness on pressure can be made out. This enlargement is evidently the swollen gall-bladder. A slight leukocytosis and congestion over the base of the lungs complete the clinical picture. Jaundice has not occurred in my cases.

I shall not dwell on the well-known symptoms of gall-stone colic except to say that the pain is much more often in the epigastrium than the text-books state. It may travel to the back, to the right side or to the left, and to either or neither shoulder. Nausea and vomiting while common are not rarely absent. A chill is of significance. Most patients complain of a sense of upward pressure during an attack of gall-stone colic. If a patient states that in one or more attacks the pain was so severe as to require a morphin injection, I take that as contributory evidence of biliary colic. Jaundice is not common; its presence is of great diagnostic value, its absence without significance. If every patient's urine is examined within forty-eight or seventy-two hours after an attack, traces of bile will not rarely be found. Many patients who declared that they never were jaundiced told me on inquiry that after an attack of pain they had passed very dark urine.

The pain in gall-stone colic may be left-sided. In a patient whom I saw several years ago with Dr. Farr the pain was never anywhere except in the left hypochondrium. Operation revealed a single large stone in the gall-bladder, with adhesions between the latter and the stomach.

An attack of pain in the upper abdomen which under other circumstances I would attribute to gall-stone, I should feel quite sure *was* due to that cause if the patient was a pregnant or puerperal woman. This is due to the fact that, as I have often observed, the first attack of biliary colic not rarely occurs during or soon after pregnancy.

It is always well in cases of upper abdominal pain of obscure origin to have the bowel movements searched for gall-stones. They are not infrequently found.

Pancreatic stones may cause symptoms similar to gall-stones. They are so rare that little need be said about them. It has been

stated that the Roentgen ray shows pancreatic calculi more clearly than it does gall-stones.

Gall-stone disease may be simulated by floating kidney even to the point of jaundice. The discovery of a loose kidney and a history that the pain is relieved by lying down, and that the attack subsides with the passage of a large amount of pale urine would make us think that the attack was a so-called Dietl's crisis and not biliary colic.

In several instances I have been much perturbed by a difficulty in deciding between appendicitis and gall-stone. If the patient is young, thin, and spare, and has a history of some intestinal disturbance, either diarrhea or constipation, at the time of the attacks, I should consider these facts suggestive of appendicitis rather than of gall-stones, even if the pain were near the costal border. Perhaps the sign pointed out by Dr. Aaron will prove helpful.

Surgeons are prone to draw very sharp distinctions between gall-bladder disease and gastric ulcer, no doubt because many of the cases they see group themselves readily under one or the other heading; but a physician seeing ambulatory cases in his office and in dispensary practice often has great difficulty in deciding whether a patient has gall-stone disease or gastric or duodenal ulcer. Many who complain of definite symptoms that seem to point to one or the other have neither, and are examples of so-called functional disturbance. I have seen several such patients in whom operation showed nothing to account for their symptoms.

The most difficult cases are undoubtedly those in which the gall-bladder is adherent to the stomach or bowel, either as the result of primary disease of these parts—generally ulcer—or of repeated attacks of cholecystitis. We have, then, a fusion of hepatic and gastric symptoms, often with hyperchlorhydria, and it requires long and patient study to determine which is the underlying disease. A duodenal ulcer adherent to the fundus of the gall-bladder may produce symptoms scarcely distinguishable from gall-stone colic. In the diagnosis three things are necessary: A careful history, a roentgenologic study by an expert, and a physical examination, with all the modern laboratory investigations, including the use of the duodenal tube of Einhorn. Each of these methods may be counted upon to give about 30 per cent. of evidence. In cholelithiasis the Roentgen ray proves reliable, i. e., shows the stone, in about 50 per cent. of the cases; it gives far better results in gastric and duodenal ulcer.

One of my patients, a physician, had symptoms of cholecystitis with tenderness in the gall-bladder area. The pains were so severe

that he had taken to inhaling ethyl chlorid, and was using the drug in large quantities, $20 worth in a week. Operation showed a duodenal ulcer about to perforate, with the gall-bladder adherent to the base of the ulcer. In the patient's history the symptoms of duodenal ulcer seemed to be almost completely overshadowed by the secondary trouble in the gall-bladder.

One point of importance that has impressed me as of possible value in these cases is the persistence of the pain. Attacks of pain only of gall-bladder origin rarely lasts longer than a few hours or a day or two, while those of ulcer frequently last much longer. Gall-bladder attacks are more often nocturnal than those due to gastric ulcer, and are less related to the food intake. It is true, duodenal ulcer usually causes pain at night, but the pain is relieved by food, drink, or alkalies, and is much more regular in appearance, the patient being wakened from sleep almost at the same hour every night. Many patients suffer from gall-stone colic whether they diet or not.

Sometimes cholangitis closely simulates gall-stone disease. In addition to pain there may be intermittent fever, with or without jaundice. Such cases are most perplexing. Sometimes there is nothing but an intermittent fever (Charcot's intermittent fever), which may extend over a period of weeks and even months. Jaundice may or may not be present. In one very protracted case that came under my observation, jaundice never occurred. Although gall-stone is the most natural diagnosis, the operation may reveal nothing but a gall-bladder filled with dark, thick, infected bile. Standing at the operating table one is inclined to think that the findings are insufficient to explain the clinical symptoms, and yet drainage of the biliary passages is all that is necessary to bring about a cure.

Gall-stone colic may be closely simulated by the crises of locomotor ataxia, the pains of which are often so severe as to require morphine injections. I believe it is a good rule in all cases of supposed gall-stone colic to test the knee-jerk, the station, and the pupils. As regards the last, it should be remembered that one might think an Argyl-Robertson pupil existed, when in reality the myosis was due to morphin. As a rule the gastric crises attacks are irregular in occurrence and extend over a long period (from several days to two weeks), and are not noticeably influenced by drugs, even by morphine. The Wassermann test is of value.

Pleurisy and pneumonia may counterfeit the picture of gall-bladder disease in a well nigh perfect manner. I recall the case of a patient who had been seized with pain in the right upper abdomen, jaundice following a day or two later. The attending

physician had diagnosed gall-stone colic, but a careful examination disclosed lobar pneumonia.

Sometimes a sharp pain in the *back* or in the right chest *posteriorly* is a manifestation of gall-stone disease. I have seen several instances. The diagnosis is extremely difficult; one must be governed by the absence of renal symptoms, and perhaps by finding, notwithstanding that the pain is in the back, tenderness in the gall-bladder area.

Cases are common in which the symptoms are those of nervous dyspepsia. The patients never have severe pain, but suffer for years from "gas," belching, bloating, indigestion, and various neurasthenic manifestations. The fact that neither diet nor the rest cure to which many are subjected is of any permanent value should arouse the suspicion of organic disease, which might be ulcer, appendicitis, or gall-stones. To differentiate properly among these possibilities, especially between ulcer and gall-stone, is impossible by any rule of thumb. The clinician must in the last analysis be guided by his sixth sense, clinical intuition.

That there should at times be difficulty in distinguishing between gall-stone disease and angina pectoris might seem incredible, yet it is true. Only a careful analysis of the history and a thorough physical examination will prevent mistakes. Apart from this indirect relation between gall-stones and angina pectoris, due to a remote similarity in symptoms, there are also more direct relations existing between the gall-bladder and the heart. The facts, as I have observed them, are about as follows: In a certain number of patients who have suffered from gall-bladder infection, often unknown to themselves, cardiac symptoms appear. These vary in character. Quite frequently a systolic mitral murmur is found, usually without any signs of cardiac failure. In other cases, in which the myocardium is evidently affected, the symptoms are those of sudden acute heart attacks characterized by dyspnea and cyanosis; in still others the attacks are as far as one can tell anginal in character. Now it is a curious fact that in nearly every case, at least in my experience, the heart symptoms have disappeared after operation. The importance of this phase of the subject is that one may consider the case one of a hopeless heart affection and overlook the causative factor, removal of which would cure the cardiac condition. On the other hand many a physician is deterred from advising operation on finding some cardiac disturbance or a heart murmur, because he looks upon it as a contra-indication to operation. In reality it is to be looked upon, unless too far advanced or clearly due to an independent disease, as a distinct indication for operation.

Lately attention has been called to a possible relation between infections of the gall-bladder and disease of the joints. Granted that multiple arthritis is in many instances a secondary process, there is no reason why the gall-bladder may not be the primary focus as well as the gums or the tonsils. In one case of arthritis deformans, in which a gall-bladder packed with stones was removed by Dr. Deaver, the joint condition was in nowise influenced. As the patient had had, however, the trouble for years, little was to be expected.

Much difficulty is presented by certain cases of chronic obstructive jaundice. While in middle-aged and elderly persons chronic jaundice is always suggestive of malignant disease, especially of the pancreas, it is possible to have such jaundice as the result of adhesions, stone, or chronic pancreatitis. I have sometimes thought that early itching was more common in malignant disease. If the gall-bladder is palpable the chances are against stone and in favor of external obstruction. Jaundice varying in intensity is nearly always due to stone in the common duct. There may not be in such cases any history of pain or at least any history of sharp colic. A patient with chronic jaundice may lose a great deal of flesh without having carcinoma. The significance of these facts is their bearing on treatment, a discussion of which is beyond the scope of this paper.

CLINICAL CAUSES AND DIAGNOSTIC AND PROGNOSTIC SIGNIFICANCE OF JAUNDICE *

Herbert Spencer says in one of his books, I think in *First Principles,* that mankind in its progress passes through three stages, the unanimity of the ignorant, the disagreement of the inquiring, the unanimity of the wise. Upon most questions in medicine we are still in the first stage, upon many in the second, upon none in the third. It was while thinking about jaundice that this expressive dictum of Herbert Spencer came to my mind. Up to a very recent period, as time goes, we were in comfortable agreement that jaundice was twofold, obstructive and toxic; the former due to gross obstruction of the outflow of the bile, the latter due to excessive destruction of red cells and consequently greater manufacture of bile by the obliging liver—all jaundice was therefore hepatogenous. The second period of our progress was not long in coming. It was shown by Virchow and others that a substance identical with bilirubin could be formed from extravasated blood outside of the liver. This led many to the conviction that bile was made both in the liver and outside of the liver. When at a later period, however, Minkowsky and Naunyn showed in experiments on birds that after the removal of the liver bile was no longer formed bilogenic monopoly was again restored to the liver.

Then came Aschoff and his pupil McNee,[1] and demonstrated, or seemed to demonstrate, that bile production was the property of certain large endothelial cells widely scattered through the body and identical with the stellate cells of Kupffer in the liver. To these endothelial cells found in the liver and in the spleen, in the lymph nodes, bone marrow, Aschoff gave the name of reticuloendothelial system, and to this system he and his followers ascribe the property either of making bilirubin out of disintegrated or dead red cells or of preparing such cells for conversion into bilirubin by the liver.

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* Part of Symposium on Jaundice before the American Gastro-Enterological Association, May 5, 1926; containing also a report of some cases of epidemic jaundice.

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Whipple and Hooper afterward showed that in the dog whose liver had been excluded from the circulation bile pigment was still formed and appeared in the blood.

Among the last and most important investigations in this field are those of Mann, Bollman, and Magath,[2] of the Mayo Clinic, who succeeded in extirpating the liver from dogs and keeping the animals alive for from twenty-four to thirty-six hours, a longevity never before attained. In such anhepatic dogs they found that bilirubin continued to be formed. Their observations were soon confirmed by Rich [3] and Makino.[4]

But scarcely had the work of Mann, Bollman and Magath been published when the conclusions drawn from it were challenged by Melchior, Rosenthal and Licht,[5] of Breslau. Repeating in general the technique of Mann and Magath, they tested the bile-forming power of the hepatectomized dogs with toluylendiamine and phenylhydrazine, which in control dogs produced marked icterus. They found that after the removal of the liver no appreciable icterus followed the injection of the poisons.*

As the matter stands today, insofar at least as the experimental evidence is concerned, no definite proof has been brought that bile is chiefly formed outside of the liver, in the so-called reticuloendothelial system, or of the fact, a corollary of the first, that the liver is merely an excretory organ for bile made elsewhere, as the kidney is for urea, with the formation of which it is in nowise concerned.

Nevertheless, I am inclined to believe, on clinical grounds, that bile can be formed extraphetically. I have seen jaundice in cases of large fatty liver, the acute yellow hypertrophy of Rolleston, in which under the microscope scarcely an intact polygonal cell remained. The sections had all the appearances of areolar fatty tissue and could be recognized as of liver origin only by the presence of bile ducts.

Perhaps one more point should be mentioned in support of the theory of Aschoff and McNee and other recent experimenters as to the formation of bile outside of the liver, namely, the fact that van den Bergh and Gansslen, Zipperlen and Schüz [6] have found more bile pigment in the blood of the splenic vein than in that of the splenic artery, the spleen being as we know one of the most important constituents of the reticuloendothelial system.

* Aschoff, in a recent article (Klin. Wchnschr., 1926, 5, 1260) published after the present paper was written, takes issue with the Breslau experimenters and insists that their researches do not disprove the observations and conclusions of Mann and Magath. As regards the nondevelopment of jaundice in hepatectomixed dogs after toluylendiamine and phenylhydrazine injections, Aschoff is of the opinion that the repeated glucose injections necessary to keep the dogs alive, may have had a share in preventing icterus. In any event the work of Mann and Magath proves the intravascular formation of bile pigment outside of the liver cell.

I have gone into these few details because in the obscure field of clinical jaundice every datum of scientific research bearing upon the probable seat of bile formation is helpful to a better understanding.

The Clinical Causes of Jaundice. The classification proposed by van den Bergh into mechanic and dynamic is, in the main, satisfactory but perhaps a little too rigid. McNee has lately suggested a modification which is not unlike that of older writers and which helps I think to clarify the subject. McNee, an ardent reticulo-endothelialist, distinguishes: (*a*) Obstructive hepatic jaundice; (*b*) toxic and infectious hepatic jaundice; (*c*) hemolytic jaundice.

(*a*) Obstructive Hepatic Jaundice. The clinical causes of obstructive hepatic jaundice, mechanical jaundice, are in the main the following:

1. Obstruction by stone or other foreign body in the common bile duct. This is one of the most frequent and most easily understood types of jaundice. Before the introduction of the van den Bergh test it was supposed to occur in about 10 per cent of cases of gall stone—at least, that was the surgeon's figures. I found it more frequent when, instead of asking only about the color of the skin, I also inquired as to the color of the urine.

The van den Bergh test has shown the great frequency of moderate bilirubinemia in many cases of biliary colic in which there is no visible jaundice and no choluria.

2. Through tumor of the bile ducts or of the head of the pancreas; also through pressure upon the ducts by large glands, by aneurysm of the hepatic artery, etc.

3. Through stricture of the duct as a result of scar formation.

4. Through inflammation of the mucosa of the duct with the formation of a mucous plug. This is the commonly accepted explanation for so-called catarrhal jaundice; however, no one it seems has ever found such a plug in acute catarrhal jaundice. More probably we are dealing in catarrhal jaundice with a cholangitis and mild hepatitis, or with acute swelling of the head of the pancreas analogous to mumps.

5. Through traction on the bile ducts by a floating kidney.

6. Through injuries—cutting of the bile ducts during operation. Jaundice under these conditions appears almost immediately, is permanent painless, but accompanied by intolerable itching, thus simulating the jaundice due to malignant obstruction.

7. Passive congestion of the liver in chronic heart failure. I am placing this in the group of obstructive jaundice although the

mechanism of congestive jaundice is by no means clear. The obstruction of the ducts if it exists, is intrahepatic.

8. Cirrhosis of the liver. Here, too, whatever obstruction exists is intraheptic, but other factors cannot be ruled out.

9. Carcinoma of the liver with intrahepatic or extrahepatic pressure.

In many cases of what appears to be purely mechanical or obstructive jaundice, for example, that due to a stone blocking the common duct, the liver is the seat of degenerative and inflammatory changes, of a hepatitis which may become a not easily evaluated factor both in the jaundice and in the general clinical picture.

(*b*) Toxic and Infectious Hepatic Jaundice. This group comprises types of jaundice in which there is no gross mechanical obstruction in the extrahepatic ducts, barring an occasional exception to which I shall refer. Bile is present in the urine and in the feces. By the van den Bergh test the blood serum is said to give a delayed direct as well as a negative direct reaction (biphasic reaction, McNee).

Illustrations of this type of jaundice are:

1. *Weil's Disease.* This is now known as Spirochetosis icterohemorrhagica or leptospirosis. The disease became prominent as a clinical entity during the World War, which brought confirmation of the finding of the Leptospira icteroides originally discovered by Japanese observers. A number of true cases of spirochetosis have been reported in this country, among them two by Sailer.[7]

The disease sets in with chill, headache and prostration; occasionally the onset is gradual. Nausea, vomiting, abdominal and muscular pains, jaundice and fever complete the picture. Sometimes in bad cases a peculiar odor manifests itself. The liver is enlarged; the spleen not constantly.

The causative parasite normally lives in the wild rat; it is highly pathogenic for guinea pigs and can be kept alive and virulent in them for an astounding number of generations. It is present in human blood until about the seventh day of the disease and in the urine up to the fortieth day or longer. It should be looked for in dark-field illumination.

Immune bodies appear in the blood of patients and can be produced experimentally in animals so that both cure and prophylaxis in times of epidemic may become feasible.

2. *Infectious Jaundice, Nonspirochetal.* This as a rule is a mild type of jaundice. It is most common in children, and has of late years prevailed in widely scattered sections of this country. After

an incubation period of from eight to ten days the disease sets in abruptly with fever, constipation and abdominal pain. Jaundice appears in four or five days or later—up to the twentieth day—and lasts for from seven to ten days, although it may disappear in a few hours or continue for six weeks.

The disease resembles acute catarrhal jaundice, indeed sporadic cases would undoubtedly be so diagnosed. Except for a milder course and absence of mortality, it is similar to Weil's disease, but the most careful search by Blumer, Wadsworth and Noguchi has failed to show any leptospira.

The three following cases occurring in one family illustrate this type of jaundice.

Case Reports

Case I.—P. D., aged thirteen years, was seized on the evening of April 13, 1926, with high fever and headache. The fever continued on the next day and nausea appeared. On the following day there was no fever but persistent nausea and some vomiting, with a crop of hives and much itching. On April 17 the eyeballs were yellow. The stools were pale but not putty colored; the urine contained considerable bile. There was a slight enlargement of the liver, not of the spleen, and no abdominal tenderness.

Case II.—S. D., aged twelve years, started on April 15, 1926, two days after her sister, with similar but milder symptoms. Her jaundice was slight, although bile was readily demonstrated in the urine. When last seen, on May 2, there was still a faint tinge to the conjunctiva.

Case III.—E. D., aged fifteen years, a third sister, was taken ill suddenly on April 19, 1926, four days after the second case, with no other symptom than fever (up to 104° F.) which continued for forty hours. On April 25, after she had been well four days, but still in bed, she became distinctly jaundiced and had pronounced general itching. There was also some vomiting.

It is interesting that having had routine examinations of the urine made in all three cases, bile was detected in the third patient's urine before the color of the eyeballs attracted attention.

In another case, also a young girl, which I did not see, but about which I was consulted, careful search was made for leptospira by Dr. Lynch, of the Pepper Laboratory, with negative results.

Such cases as those here described are in the beginning usually called grippe or influenza—often abdominal influenza—during the period of apparently causeless fever, nausea and vomiting. The subsequent discovery of jaundice is considered a sequel or a complication. I believe the whole process is a unitary disease due to some obscure transmissible infection which with the modern technique should not elude us for long.

While epidemic jaundice is a mild disease, it seems to bear a relation to acute yellow atrophy or acute degenerative hepatitis, as is shown by the following case:

Case IV.—Dr. A. E. F., aged fifty-two years, a man in perfect health, was seized with jaundice, which in the course of two weeks became very intense. There was no pain at any time, only great prostration. The urine was black and the stools in the beginning were clay-colored. When I first saw the patient, I concluded, not finding a palpable gall bladder, that I was dealing with one of those rare cases of silent stone or with a toxic hepatitis. Two days after my visit to him in his home town, he was brought to the Hospital of the University of Pennsylvania. He had a deep canary color, no fever, no tenderness and was apathetic, almost stuporous. The liver was not enlarged, perhaps it was a trifle smaller than normal; the spleen was not palpable. A somewhat striking feature was a peculiar body odor like that of fresh laboratory meat broth. Two days later he died in coma, our diagnosis being acute degenerative hepatitis. Autopsy showed complete freedom from disease on the part of the gall bladder and bile ducts but advanced degeneration of the liver. Both during life and after death careful search was made for spirochetes, but with negative results.

Now, there is in connection with this case a most interesting and suggestive fact which I ascertained prior to the man's death. During the few weeks before he fell ill, there had been an epidemic outbreak of jaundice in his community. He had attended from 18 to 20 cases, 5 of them being in one household. One cannot escape the belief that an infection was at work and that the doctor had received through his multiple contacts such an intensive dose of the poison that he developed what is comparable to an acute yellow atrophy of the liver.

I am trying to obtain some rats from the place where the jaundice has prevailed, but if the observations of Blumer and other investigators are borne out, our results will be negative.

3. *The Jaundice of Infectious Diseases.* Typhoid fever, pneumonia, septicemia, etc.

As a rule, the jaundice of pneumonia is a mild complication, but in rare instances it is severe and darkens the prognosis greatly. The sputum in the grave cases is a bright green color due to biliverdin. If one may use the van den Bergh reaction as a basis, the jaundice of pneumonia is in part due to an active hemolysis and in part to a toxic hepatitis.

4. *Toxic Jaundice.* Particularly that due to arsphenamin, chloroform, and other poisons.

Much discussion has arisen as to whether the jaundice occurring after arsphenamin injections is syphilitic, that is, due to the Treponema pallidum or to gummatous lesions or to a toxic effect of the arsenic. If to either of the first two one might be inclined to

push the arsphenamin; if to the last, nothing would be more harmful (Gordon and Feldman [8]). Blood bilirubin studies have shown that in certain cases the bilirubin content is increased when arsphenamin is given, long before any icterus is manifested externally. If the use of the drug is continued the bilirubinemia becomes more marked and finally, the threshold being passed, jaundice appears. It is due to a degenerative hepatitis which is best combated with glucose. If the van den Bergh test is regularly made in cases receiving the arsenicals the drug will be discontinued and glucose will be given as soon as the icterus index begins to mount and before severe liver damage has taken place (Gerrard [9]).

5. *Postoperative Jaundice.* I have already spoken of this as a possible consequence of trauma to the bile ducts during operation, but there is yet another type of postoperative jaundice—that in which there is an infective cholangitis or a septic thrombophlebitis of the portal vein. This type of jaundice is most frequent as a sequel of operations in cases of suppurative appendicitis and possesses a rather well-defined clinical physiognomy. Jaundice sets in a few days after operation, early in the development of the infection. (It can occur also in cases of appendicitis not operated upon.) Fever is present with chilly sensations, high leukocytosis, tenderness over the liver and localized edema. Lassitude, anorexia and emaciation are striking symptoms. The patients often remark that "they are too tired to sleep." The Roentgen ray is of value in the diagnosis.

(*c*) Hemolytic Jaundice. The term hemolytic jaundice* (icteroanemia) connotes a jaundice due to blood destruction and not to primary disease of the liver cells or any part of the liver. That at least is the meaning given to the term by the majority of French writers and by Minkowski, a German pioneer in this field. On the other hand, Naunyn and his followers, while attributing the jaundice to excessive blood destruction, believe that excessive amounts of pigment made in the liver cause the formation of thrombi in the bile capillaries. On that basis the jaundice would be the result of an intrahepatic obstruction. However, the newer researches on the origin of bile pigment strongly point to the possibility, as indicated in an earlier part of this paper, of an extrahepatic source for bile pigment, though perhaps not the only source. It is therefore probable that hemolytic jaundice is independent of obstruction of the bile capillaries.†

* For a full discussion of this subject see Pearce, Krumbhaar and Frazier (The Spleen and Anemia, Philadelphia and London, 1918) and Meulengracht (Der chronische hereditäre hämolytische Ikterus, Leipzig, 1922).

† Dr. I. S. Ravdin calls my attention to an interesting statement by Riolanus, Jr., indicating that as far back as the seventeenth century a distinction was made between obstructive

The blood destruction occurs chiefly in the spleen, liver, lymph nodes and bone marrow; but with respect to some of the conditions belonging under the head of hemolytic jaundice we have little knowledge of the place of blood destruction.

Two types of hemolytic jaundice are recognized: (*a*) The acquired type (Hayem-Widal); (*b*) the congenital or familial (cholémie familiale) (Chauffard-Minkowski). In both, far greater amounts than the threshold value of 4 units of bile pigment may be present in the blood without bile appearing in the urine—hence the synonym, acholuric jaundice. In most cases the bile is excreted as urobilin in increased amounts in the feces and also in the urine.

A number of features are common to both types:

1. There is a chronic jaundice, with the presence of bile pigment in the blood serum, but without bile in the urine (acholuric jaundice).
2. The signs of biliary obstruction are absent—there is no itching, no bradycardia, no clay-colored stools.
3. There are no bile salts in the blood.
4. Anemia is common to both types, but is more marked in the acquired, reaching at times as low a figure as 1,000,000 red cells.
5. The spleen is enlarged and firm.
6. Urobilinuria, an indication of blood destruction, is present.
7. Fragility of the red cells. This sign, first pointed out by Chauffard, is found in both types but is more marked in the congenital or familial than in the acquired. Normally, hemolysis in hypotonic salt solution begins at 0.42; in hemolytic jaundice it begins as high as at 0.6.

Blood regeneration is evidenced by an increase of reticulocytes.

8. Splenectomy is usually curative.

While the cases viewed in a large way fall into two groups, congenital or familial and acquired, the differences are scarcely fundamental and there are many borderline cases, as, for example, congenital cases with negative family history. Such cases are perhaps better classified with the acquired type.

Gall stones are quite common in familial or congenital hemolytic jaundice, but seem to bear no etiologic relation to the jaundice. In some cases, as pointed out in an admirable paper by Dutton,[10] crises occur during which symptoms of obstructive jaundice are added to the clinical picture. These crises are attributed by Dutton

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and nonobstructive jaundice. Riolanus (A Sure Guide or the Best and Nearest Way to Physick and Chirurgery, translated by Nicolas Culpepper, 1691) says: "When I see in an extremely yellow jaundice the whole skin infected with choler and that the urine dye cloths yellow, the stools being in the meantime whitish, and when I see in another sort of jaundice both urine and stools yellow, this confirms to me that there are two forms of choler and several ways for the expurgation of them."

to a heightened activity of the neuromuscular reflex apparatus of the bile passages (see also Hopkins [11]).

In the acquired type acute exacerbations with deepening jaundice are frequent.[12] The acquired cases as a rule also present a severer clinical picture than the congenital. The latter, in Chauffard's words, are often more icteric than sick. A number of German writers [13] have called attention to the frequent coexistence of tower skull (Turmschädel) with hemolytic jaundice.

One may place under the head of acquired hemolytic jaundice, the icterus found in pernicious anemia and allied conditions in which the van den Bergh test shows increased values of the icterus index but in which there is no choluria.

Pathogenesis. The fundamental fault in hemolytic jaundice is either some lesion of the blood, such as might be called a dystrophy of the red cells, or an anomaly of the spleen that endows it with an exaggerated hemolytic activity. Since splenectomy is a curative measure, the latter hypothesis seems more reasonable. The spleen of hemolytic jaundice is not alone spodogenous, as it is in health, but it also destroys red cells in increased numbers and prepares others for destruction.

Difficult to explain on the lienal theory, however, is the fact that after the removal of the spleen the osmotic resistance of the red blood corpuscles to hypotonic salt solution sometimes remains as before, or does not return completely to normal.

Familial hemolytic icterus behaves in its hereditary transmission as a dominant character.

Icterus Neonatorum. This is a type of hemolytic jaundice due to rapid blood destruction. It occurs in about 50 per cent of infants. The blood gives a positive indirect but negative direct van den Bergh reaction.

A rare example is the familial type of jaundice of the newborn, a grave disease occurring less often in the children of the first and second pregnancies than in those of later birth. Those that recover often show permanent cerebral or cerebellar defects.

Dissociated Icterus. French writers, and Hoover and Blankenhorn in this country, have called attention to dissociated icterus, that is, one in which bile salts and bile pigment are separate and do not occur together in the blood or urine. They recognize: (*a*) An hepatic dissociated icterus in which bile salts and bile pigments are separately present in the plasma as the result of separate hepatic excretion into the blood; (*b*) a renal dissociated icterus in which the bile pigment alone is present in the plasma due to renal excretion of the bile salts. The subject is one requiring further investigation.

General Features of Jaundice. 1. Yellowish discoloration of the skin, of the mucous membranes and of the deeper tissues is the most striking feature of jaundice. It is to be looked for first in the conjunctiva, and in colored races on the inside of the lower lip, the blood being pressed out with a glass slide.

The color varies from a light lemon or canary yellow to light or dark orange or olive brown. The darkest types are seen in the most chronic cases of obstructive jaundice, although a dark color of the skin is not necessarily proof of a high degree of bilirubinemia. Tears, cartilage, nerves and muscle tissue do not show staining. Pneumonic sputum in cases of jaundice is often light green in color due to oxydized bilirubin.

2. Itching of the skin is one of the most distressing of all jaundice symptoms. It occurs in obstructive not in hemolytic or toxic jaundice. It may precede the icterus—preicteric itching—hence it is probably not due to the bile pigment, but to bile salts or other constituents of the bile. In bad cases of itching the skin is more or less covered with scratch marks and often shows infection.

Surgical drainage or cholecystoenterostomy almost immediately puts a stop to the itching long before the color has faded from the skin; this is another point in favor of the view that the itching is not due to the bile pigment.

Xanthoma occasionally forms in long-standing jaundice.

Some cases of jaundice have a peculiar odor like that of fresh meat broth. This is particularly true of icterus gravis and of spirochetal jaundice.

The blood serum normally is slightly bile stained, the amount of bilirubin present, as measured by the delicate van den Bergh test, being from 0.5 to 2 mg. in 100 cc. of blood (1 to 2,000,000 to 500,000). A false augmentation of color may be produced by the presence of considerable amounts of carotin or lutein derived from the diet.

I shall not give the details of the van den Bergh test.* It will suffice here to say that in this test Ehrlich's diazo reagent is added to the blood serum. Normally the bilirubin of the blood gives the so-called delayed direct or indirect reaction, while that in the bile gives the immediate direct reaction. In the case of the blood, the immediate development of a bluish-violet color indicates, in

* The following are among the more important references to this subject: Van den Bergh: Presse méd., 1921, **29**, 441. Van den Bergh and Snapper: Deutsch. Arch. f. klin. Med., 1913, vol. **110**. Meulengracht: Arch. Int. Med., 1925, **35**, 214. Stetten: Ann. Surg., 1922, **76**, 191. Bernheim: J. Am. Med. Assn., 1924, **82**, 291; Arch. Path. and Lab. Med., 1926, **1**, 747. Ravdin: Am. J. Med. Sci., 1925, **169**, 850; Surg. Clin. North America, February, 1926. Greene, Snell and Walters: Arch. Int. Med., 1925, **36**, 248. Greene, McVicar, Rowntree and Walters: Arch. Int. Med., 1925, **36**, 418, 542.

van den Bergh's opinion, the presence of an excess of normal bilirubin and is to be interpreted as signifying obstructive jaundice with the resorption of normally formed bile from the liver. If the addition of alcohol to the serum-diazo mixture causes a deepening of the color, or the appearance of the characteristic color when there had not been any before, the reaction, called positive indirect, is interpreted as being due to bile pigment that has not been acted upon by the polygonal cells of the liver, and hence the test is significant of hemolytic jaundice. Whether this sharp differentiation drawn by van den Bergh and by McNee is correct has not been proved; indeed the most recent researches throw doubt upon it.

Icterus Index. The icterus index, a term first used by Stetten, is based upon a colorimetric comparison of the depth of color of the blood serum and a standard solution of potassium bichromate, 1 to 10,000, as proposed by Meulengracht.† The depth of color is expressed by a number called the icterus index, the normal index ranging from 4 to 6. Bernheim has published the following table expressing the range of the icterus index.

Zone of hypobilirubinemia	2.3 to 4
Normal zone	4 to 6
Zone of latent jaundice	6 to 15
Frank jaundice	Above 15

All cases with an index above 15 show jaundice, but a yellow skin and sclera may persist for some days after the index goes below 15, because bilirubin disappears more rapidly from the blood than from the other tissues.

Value of the Icterus Index. By means of the index it is possible to detect latent jaundice, that is, a bilirubinemia without clinical icterus. In cases of colicky pains of indefinite nature the presence of latent jaundice points to a biliary origin. The index may be used to follow the changes in the degree of jaundice in patients with frank icterus. As pointed out by Snell,[14] the test helps in the discovery of hepatic congestion in early myocardial failure, in the differentiation of hemolytic from other anemias, and in the early demonstration of jaundice due to obstruction in the common duct.

Bernheim has shown that in gastric ulcer there is a normal bilirubinemia, while in duodenal ulcer (except in cases with hemorrhage) there is a hyperbilirubinemia. The retention of bile may be due to an extending duodenitis or to a certain degree of hyperglobulia which has been found not infrequently in ulcer of the duodenum. In diabetes mellitus the icterus index is high—the

† This test has been advantageously modified by Bernheim, who has substituted a glass standard for the 1 to 10,000 potassium bichromate solution.

lowest index in 41 diabetic patients was 7.5; the highest, 15; the average, 10. The severe cases showed the highest indexes.

Bernheim has pointed out a possible use of the icterus index in the prognosis of pneumonia. No case with a normal bilirubinemia ended fatally. Although death did not occur in all cases showing hyperbilirubinemia, in no fatal case was this condition absent. As in many instances it is not possible to foretell the outcome from the clinical aspect, it is desirable to make further tests of the icterus index in the hope that it may prove of use both in prognosis and in the choice of therapeutic measures.

Hypobilirubinemia, revealed by the icterus index, is found in cases of secondary anemia not due to blood destruction but caused by hemorrhage or by lessened production—conditions in which less hemoglobin is liberated. In Bernheim's series every case of secondary anemia with a red cell count below 3,000,000 showed hypobilirubinemia.

Carotinemia. This condition, described by Hess and Myers, and to which I have already referred, is due to the prolonged use of carrots and other vegetables, fruits, eggs, and other foodstuffs containing yellow pigments (lutein, xanthophyl, carotin). It produces a high icterus index—Greene and his associates found it as high as 26. By chemical tests, either the van den Bergh or the Meulengracht, it is readily shown that the actual amount of bilirubin is not above normal. A feature differentiating carotinemia from icterus is its tendency to be more prominent on the thicker epithelium, such as the palms and soles.

I might add further that the indirect reaction of van den Bergh has helped in the detection of latent jaundice in pernicious anemia and dibothriocephalus anemia and, as pointed out on a previous page, in the recognition of latent jaundice due to the toxic action of arsphenamin.

One more blood change might be mentioned—Thewlis and Middleton [15] have demonstrated the existence of a leukopenia in uncomplicated cases of catarrhal jaundice. They show that sometimes the leukopenia precedes the appearance of the jaundice.

The Urine in Jaundice. In obstructive jaundice the urine is bile stained, but often the intensity of staining varies in different voidings for reasons that are hard to find. In hemolytic jaundice the urine as a rule is not bile stained (acholuric jaundice).

Urobilin or urobilinogen appears in the urine in cases of jaundice in which obstruction, if present, is not total, so that some bile can get into the intestines and be acted upon by bacteria. Hence its determination has been suggested as a test to distinguish catarrhal

jaundice from that due to carcinoma of the head of the pancreas or the common bile duct, as in the usual case of carcinoma no bile whatever enters the intestine, therefore none can be transformed into urobilin (Wallace and Diamond [16]).

In cases of severe or of long-standing jaundice albumin and bile-stained tubecasts are present in the urine. Leucin and tyrosin appear in the urine in acute yellow atrophy. They were not found in the case of fatal icterus gravis reported in an earlier part of this paper.

The Feces. The clay or putty-colored stools of jaundice due to extrahepatic obstruction are well known. Such stools are seen at times in cases of toxic jaundice, evidently through an associated intrahepatic obstruction. In cancer of the head of the pancreas the feces are pale and shiny, due in part to unabsorbed fat and in part to the absence of bile; they look like buckwheat-flour dough and spread out thinly on the floor of the vessel.

Other Effects of Jaundice. In true hemolytic jaundice the fragility of the red blood cells is increased. While normally the breaking up of the cells occurs at between 0.44 to 0.34 per cent saline solution, in hemolytic icterus it begins at 0.6 or even 0.7 and is complete at 0.5 per cent.

A *lessened coagulability* has long been known to occur in chronic jaundice and has been much dreaded by surgeons as a cause of hemorrhage. Its causes are not well understood. Although calcium injections prevent postoperative hemorrhage in jaundice cases, there appears to be no special loss of calcium in the blood. It may be, as suggested by Snell, that in jaundice the calcium and the bilirubin enter into some sort of combination which virtually entails a lessened calcium content.

Metabolic Effects of Jaundice. Most common are subnormal temperature and slow pulse. Emaciation may develop rapidly in obstructive jaundice, even in the absence of malignant disease. I have seen extreme loss of flesh in nonmalignant obstruction.

Nervous Disturbances. The most distressing of these is itching, which in stone or in malignant obstruction may become more unbearable than pain. It robs the patient of sleep and contributes to his rapid decline. Irritability and mental depression may occur even in mild types of jaundice, while in toxic jaundice there may be muttering or agitated delirium, coma or convulsions.

Diagnosis. In approaching the subject of the diagnosis of jaundice, or rather of its causative condition, we may with profit follow the advice of Deaver and ask: "Is the jaundice painless or is it painful?"

Painful jaundice is usually due to mechanical causes, especially to stone, to cholecystitis or to cholangitis. In rare cases the jaundice of calculus is painless—the so-called silent stone. It is not necessary that there should be successive attacks of colic—one definite painful seizure is of great help in the diagnosis of calculous obstruction.

If the jaundice is painless, the possibilities are many—with clay-colored stools and choluria, the suspicion falls on the pancreas or some other nearby structure. The most valuable diagnostic feature of jaundice due to disease of the pancreas is a large gall bladder (Courvoisier's sign). By gentle palpation the gall bladder may be felt; often it can be seen to move under the skin during respiration if the examiner will sit at the patient's side, with his eyes almost on a level with the abdomen.

Glycosuria favors the diagnosis of pancreatic disease, but does not permit exclusion of disease of the bile passages or liver.

I have thought that itching appeared earlier in malignant than in calculous obstruction; and as I have stated, the itching may be preicteric.

The icterus index is of value. A variable icterus index speaks in favor of stone, a constant or increasing figure is most common in extraductal or noncalculous obstruction.

Referring once more to the large gall bladder, it should be stated that, while most common in cancer of the head of the pancreas, it is also found in carcinoma of the papilla. Mention should also be made of a possible source of error due to the occurrence of the so-called Riedel's lobe, an elongated linguate projection of the right lobe of the liver, sometimes found in gall-stones. It may readily be attributed to tumor or a large gall bladder.

I shall not refer to the various functional liver tests which may possibly prove of value in the final differentiation of the causes of jaundice. At present the tests give us information of the state of the liver rather than of the causes of jaundice. Such information is, however, of value in forming a comprehensive judgment of the patient as a surgical risk. When carried to a greater state of perfection they will undoubtedly become part of our routine pre-operative study of jaundice cases.

Prognosis. The prognosis of jaundice can be as little stated in a few words as the prognosis of fever. It depends on the cause, on the resistance of the patient and very often on the intelligence of the medical adviser and on the skill of the surgeon.

In the hemolytic forms of jaundice, barring the graver anemias and hemolytic poisons, the prognosis is favorable. Cure is often achieved by splenectomy.

Regarding the other types of jaundice, I would say that no form of obstructive jaundice should ever be taken lightly. It is always possible for a jaundice of mild beginning to become grave, as the case of the doctor I have cited above so well illustrates.

Jaundice may affect the outcome of the operation done for its relief. One should hesitate to promise early recovery in any case of jaundice no matter how simple the contemplated operation may be. In some elderly persons—analogous to what happens at times to the kidneys after prostatectomy—a postoperative hepatic insufficiency develops. There is but little drainage of bile, the appetite is in abeyance, the patient is exceedingly languid and seems incapable of making a fight for his recovery. Death may ensue in three or four weeks despite active treatment. It is probable that not only the liver but also the pancreas has a share in the disastrous outcome.

Under the use of calcium chlorid intravenously by the Walters method hemorrhage has been practically eliminated as a danger after operation upon jaundice cases. The prophylactic and postoperative use of glucose solution has lessened the incidence of liver disfunction or nonfunction. Nevertheless, I am of the opinion that in the presence of jaundice it behooves the surgeon to limit his interference to the essential minimum. I have seen lives sacrificed through the operator's eagerness to correct all pathologic defects in the abdomen. It is probable that the liver function tests will eventually make operations safer.

The prognosis is also influenced by the state of the other organs, particularly of the kidney and of the heart. A closer relationship exists between the kidney and the liver than is appreciated or is explainable in the light of our present knowledge. As for the heart, the prognosis is not so vitally affected by its condition if that be not too serious. In fact when the history permits the decision that the bile duct tract disease antedates the heart trouble, then we may conjecture that the gall bladder disease may be responsible for the disease of the heart and that operation may not only cure the disease of the biliary passages but also that of the heart as well.

In no other circumstances is it so important to take a comprehensive view of a patient's powers of resistance as in cases of jaundice that require operation. The laboratory tests, as I have stated above, are of value not only with respect to the jaundice itself, but also in throwing light on the functional capacity of the liver, kidneys, heart and pancreas. But in the last analysis the best judgment is reached by him who has had a large clinical experience and uses it wisely.

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DISEASES OF THE NERVOUS SYSTEM

A CASE OF POLIOENCEPHALITIS IN A BOY OF EIGHT YEARS ENDING IN RECOVERY [1]

Dr. Riesman showed a boy of eight years, who had recovered from what had seemed to be an attack of polioencephalitis. Except for migraine in the father and brother, the family history was excellent. There had been no serious prior illness and only a few trivial falls that were without consequences.

On the morning of August 13, 1906, he awoke with double vision. On the 14th he was dizzy and staggered; felt a little nauseated, but did not vomit; perspired profusely; had a bad taste in his mouth; and spat a good deal of saliva. On the 15th, although able to play, he would often run to his mother and say he was dizzy and afraid he would fall; and twice he did fall. About this time left-sided ptosis appeared, and the gait became staggering. A neurologist who saw him made a diagnosis of brain tumor.

On August 24, when he first came under the care of Dr. Riesman, his condition was pitiable. He was almost helpless, and usually had to be carried. The face had a sleepy, expressionless look. The eyebrows and forehead were contracted; the left eye nearly closed by ptosis. The eyeballs themselves were fixed, owing to a complete external ophthalmoplegia. The head was bent forward and tilted to the right. There was risus sardonicus, especially when he tried to laugh. One could not then tell whether he was crying or laughing. He could not whistle, and speech was indistinct. He would begin a sentence fairly well, but as he progressed the words would become more and more slurred, until they ceased to be intelligible. There was some difficulty in swallowing, and liquids regurgitated through the nose. He staggered on walking, and was inclined to fall toward the right. After attempting to walk a few steps, which he did out of doors, he would soon tire and ask to be carried. About the end of August a paresis of the left arm set in—dynamometer left 10, right 35. There were no sensory disturbances, except astereognosis of the left hand. The knee-jerks were somewhat variable, as a rule not exaggerated; ankle clonus and Babinski reflexes were present, more marked on the left side.

[1] Reprinted from Journal of Nervous and Mental Diseases, 1907, Vol. XXXIV.

There was slight headache, and occasionally some tenderness on percussion just to the left of the occiput. No trouble with the sphincters; heart-sounds normal; pulse irregular—84 to 102; respirations 24 to 29; no fever at any time; lungs normal; abdomen soft; bowels obstinately constipated; appetite poor; vomiting occurred a few times, seemingly induced by food or medicine; was not projectile, and was preceded by nausea. Occasionally there were attacks of diarrhea with cramps, which were probably caused by the medicine he was taking—hydriodic acid. An eyeground examination made about the middle of August had shown no changes in the fundus; on a second examination, a slight congestion-edema was found. The diplopia, which had lasted only one day—August 13—returned on September 8.

Early in September improvement began, first shown by a tendency to hold the head erect. The risus sardonicus became less pronounced, and finally disappeared; movement returned in the eyeballs, first in the upward, then in the inward direction. The external recti remained paretic.

At the time the boy was shown, he seemed to be entirely well, except for diplopia, which was due to persistent weakness of the abducens.[2]

The diagnosis of the case was attended with difficulty. A number of neurologists had seen him and had diagnosticated tumor. Dr. Riesman's first impression was that the case was one of myasthenia gravis, but more careful reflection led him to consider it one of polioencephalitis superior (Wernicke). The involvement of the left arm indicated that the process had also extended to the cord. The rapid and almost complete recovery seemed to be against the existence of a serious organic lesion and made the propriety of the word encephalitis somewhat doubtful.

As to the pathogenesis, nothing was known; it was easy to assume, but difficult to prove the existence of some toxic agent.

Dr. Gordon said he did not know how soon after his examination of this case Dr. Riesman made the examination. He was requested to make an examination and gave an opinion on the case last summer. When he examined the patient he had Dr. Perkins' negative report concerning the eyes. When Dr. Gordon examined the child he found that the patient walked with zigzag movements, with a tendency to walk always towards the right; he had distinct nystagmus, he had paresis of the external recti; when he examined him for station he presented a distinct Romberg sign, he had also ataxia of the upper extremities. He found distinct Babinski on the

[2] This weakness is gradually disappearing.

left with exaggerated knee-jerk, the knee-jerk on the right side was distinctly diminished. At that period of the case he did not have any marked difficulty in swallowing, but the relations told him that the child would have at times some difficulty. However, he ate his food. They gave Dr. Gordon a history of a fall with headache, vomiting, which he understood was not connected with the food. Having that picture before him, he concluded after excluding everything else that it was probably a cerebellar condition. He did not say tumor. Since then Dr. Gordon had not seen the case. At present the patient presents still some difficulty in walking, he has still a tendency to walk towards the right; the knee-jerk on the left side is different from the right; he has distinct Babinski on the left and edema of the disc with diplopia. The case presents undoubtedly some obscurity, but to say that it was a case of myasthenia gravis Dr. Gordon could not agree; he is more inclined to believe that the condition is organic.

Dr. C. K. Mills said that when he saw the case first it was to him as it has been to others, difficult of diagnosis. He thought, however, it was not clearly, in spite of the symptoms which pointed in that direction, a case of cerebellar tumor. Dr. Riesman and Dr. Mills at the time discussed the question of myasthenia gravis or bulbo-spinal paralysis, to which diagnosis Dr. Riesman was inclined and Dr. Mills thought with good reason; it seemed to him, at least, that it was the probable diagnosis. The case might be one of somewhat widely distributed polioencephalitis. If the patient's symptoms were due to a polioencephalitis he would probably have fared worse than in the outcome as now seen. After all we do not know exactly what myasthenia gravis is etiologically, and it is possible that a toxemia of some sort had to do with the origin of this case. It is well known that there are cases of myasthenia gravis lasting a comparatively short time, cases fatal after recurrences of attacks, cases of recovery and others of partial recovery.

Dr. Potts thought the symptoms described in this patient resembled very much the symptoms that were present in a patient he had in the Philadelphia Hospital a couple of years ago, and in which he made a diagnosis of polioencephalitis. Dr. Dercum agreed with this diagnosis. Typhoid fever was followed by ocular palsies, intense bulbar symptoms, in coördination of the extremities, weakness of the legs, increased knee-jerks, ankle clonus and the Babinski phenomenon. This patient afterwards died, but an autopsy was not obtained. The existence of permanent symptoms in Dr. Riesman's patient was certainly against myasthenia gravis as was also the existence of the ankle clonus and the Babinski reflex. He did

not think that the symptoms coincided with the usual idea of myasthenia gravis. He was inclined himself to think of encephalitis in this case. It would have been of some interest and some value if a careful electrical examination of the muscles had been made.

Dr. Perkins stated that at the time he saw the boy his vision was absolutely perfect, but his general condition was so grave that it was impossible to estimate accurately the presence of a paralysis of the right rectus. There were no abnormal fauces conditions present. The case having come to him not by being referred by a physician, but because he had treated some members of the family, he was absolutely in the dark as to previous medical history. The boy had a hypermetropia of moderately high grade.

Dr. Dercum stated that we must bear in mind that the knee-jerks are unequal, that the left is exaggerated as compared with the right and that there is a distinct Babinski of the left side. These symptoms are not in keeping with myasthenia gravis. It is not improbable that some toxin acting upon the nuclei, and giving rise to polioencephalitis, also acted upon other nervous centers and in turn gave rise to the other general and local symptoms found in this case.

Dr. Spiller thought that because of the constancy of the symptoms in this case without periods of amelioration or exacerbation and without increase in intensity of symptoms after fatigue, the condition was unlike myasthenia gravis and that probably the case was one of basal encephalitis. He reported a case with Dr. Buckman, of Wilkes-Barre, of myasthenia gravis confined to the ocular muscles, which showed exhaustion paralysis when an object was fixed. Dr. Buckman had written that complete recovery had occurred. Dr. Spiller did not believe that the Babinski reflex would exclude myasthenia gravis. Babinski had not said that his reflex was always the result of an organic change, but had spoken of perturbation of the pyramidal tract. Dr. Spiller believed that a functional disturbance of this tract sufficient to cause marked paralysis as in myasthenia gravis might produce the Babinski reflex.

Dr. Eshner said that at the time he saw the boy he thought the symptoms were unmistakably those of organic disease and he thought probably involved the cerebellum. He believed that there was a growth gummatous or gliomatous in character. The improvement that the boy showed was simply amazing. It would be interesting if Dr. Riesman would state the treatment the boy had been given, how much iodide and mercury, if these were used.

Dr. Gordon said as far as the result of treatment was concerned, he could cite a case he had had for four or five years. A case of

cerebellar tumor, the child is still living, in which large doses of the iodides had been given, up to 115 grains three times a day. The ataxia, headache, and the vomiting disappeared; the improvement under Dr. Riesman's treatment is not surprising to him if there is an organic condition.

Dr. S. F. Gilpin stated that in listening to the history of the case and the history of the recovery, he would like to suggest the diagnosis of multiple neuritis, even though the knee-jerks were plus and the Babinski reflex present.

Dr. Riesman, in closing, said that seeing how difficult it was at this time to make a diagnosis, it was not surprising that there should have been a great diversity of opinion at the outset. The case had come to him labeled with a variety of diagnoses that had been made by different members of the Neurological Society. The majority were on the side of brain tumor, the hopelessness of which condition had been explained to the parents, who in consequence were in the greatest mental distress. Dr. Riesman did not think it was brain tumor when he saw the case, because of the absence of headache, of vomiting, and of choked disc, one, or all of which could, with reason, have been expected to be present in a case showing such profound focal disturbance of the nervous system. His first impression of the case was that it was one of myasthenia gravis because the symptoms had come on in gradual sequence, and some of them had seemed to be aggravated as, for instance, the difficulty in walking and speaking, by effort. The first symptom had been ptosis, then had come drooping of the head, then ophthalmoplegia and paresis of the face, then paresis of the arm. In that diagnosis he had the approving counsel of Dr. Mills, who could not convince himself of the existence of brain tumor, and was inclined to attribute the symptoms to some toxic agent. At the height of the boy's illness, when his life seemed in peril, no one could have predicted the outcome of the paralysis in case of survival. The external ophthalmoplegia had been complete. At the present time the external rectus was still paralyzed; but Dr. Riesman questioned whether that would be permanent. Dr. De Schweinitz was of the opinion that the right external rectus was probably congenitally weak, but that there was a definite paralysis of the one on the left side. The vomiting had not been projectile, but had always been due to some discoverable cause. The speech had been decidedly a fatigue speech, as had been observed by the mother and nurse. With regard to the Babinski reflex, Dr. Riesman did not think its presence could be used as a point against myasthenia gravis; the strongest argument against such a diagnosis was,

aside from the incomplete character of the fatigue phenomena, the persistence of the ocular palsy. An affection of such a pronounced character as myasthenia could easily produce disturbances of the reflexes resembling those of organic disease. Although myasthenia was considered as not dependent upon an anatomic lesion, he could not conceive of a disease going from bad to worse and frequently ending in death, as having no organic basis. Neither the changes in the muscles that had been found, nor those in the thymus gland, could in themselves explain the condition. It seemed to him to be a toxic process, which produced some structural change of such a fine character that up to the present time it had not been possible to discover it. Returning to the subject of diagnosis, Dr. Riesman said that he had come to the conclusion that the case was one of polioencephalitis for the reasons already indicated. The treatment had been simple; the boy had been put at rest in the charge of a trained nurse, and had received cascara for the bowels and increasing doses of syrup of hydriodic acid. He had gained weight and seemed as well and bright as he has ever been, except for persisting double vision due to the abducens palsy.

Note.—There has been a decided improvement in the condition of the eyes since the foregoing remarks were made.

Additional Note.—The boy grew up to be a healthy man and is now a successful dentist in Philadelphia.

EPILEPSIA TARDA *

Generalized convulsions occurring for the first time in adult life are not infrequently viewed as indicative of uremia or of some gross brain lesion. Such preconception, however, leads to many errors in diagnosis and prognosis.

It is our purpose to call attention anew to the recently somewhat neglected subject of so-called epilepsia tarda and to attempt an analysis based on our own experience and a review of the literature.

Great confusion exists concerning the meaning of the term epilepsia tarda (senile epilepsy). Some authors [1 2 3] would restrict it to those cases of "idiopathic epilepsy" of later life which present no evidence of cerebral arteriosclerosis or other organic disease. Others, on the contrary—and this includes most of the modern writers—feel that senile epilepsy is in some way related to disturbances of the cerebral circulation incident to cerebral arteriosclerosis and atheroma. In surgical literature one finds "epilepsia tarda" designating cases of delayed Jacksonian convulsions due to prior cranial injury. Further confusion is obvious from the statement of a widely used medical dictionary that "senile epilepsy is senile bradycardia coming on in paroxysms and resulting from coronary sclerosis . . ."

We would label with the term epilepsia tarda those patients who exhibit recurrent generalized epileptiform seizures after forty years of age and who fail to show any sufficient etiologic factor other than a background of circulatory inadequacy, with special reference to periodic insufficiency of the cerebral circulation.

This tentative definition commits us to the hypothesis that the convulsions of epilepsia tarda are initiated, in part at least, by moments of deranged cerebral circulation—the pre-existing background for which we believe to be usually demonstrable. That there is another factor—the unknown X of all forms of epilepsy must be admitted. An approach to this unknown, we feel, may be made possible through a study of the types of epilepsy tarda in which a knowable factor seems to operate.

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Patients with epilepsia tarda as observed by us may be conveniently divided into groups as follows:

1. The arteriosclerotic group.
2. The hypertensive group.
3. The mixed hypertensive-arteriosclerotic group.
4. The endocrine dysfunction group, including (a) diabetes mellitus, (b) dyspituitary and hypothyroid disorders.
5. The cardiac group, including Adams-Stokes disease, aortic stenosis, etc.

No cases of group five are included in the present report. Nor is any mention made of those allied conditions of transient paralysis and aphasia described by Osler,[4] Riesman,[5] and others. The convulsions of general paresis are also omitted in our report—although they too doubtless belong to the arteriosclerotic group of epilepsia tarda. As may be seen from the following case reports the groups are by no means sharply defined, but merge one into another.

Case Reports

Case I (Arteriosclerotic Type).—Mrs. F. G., age 69. 11/6/25—Patient was well until two years ago when she fell unconscious on stairs and was found in generalized convulsion. No cranial injury but arm was broken. Convulsion lasted several minutes; unconsciousness lasted an hour. Since then the patient has had ten attacks of unconsciousness with epileptiform seizures—three diurnal and seven nocturnal. No aura. She is dazed after consciousness returns and speech is thick but no residual paralyses have occurred. Recently she had two convulsions in one night. Incontinence of bladder and bowel in several attacks, but no tongue biting. Patient had in addition two attacks of momentary unconsciousness without convulsions. Disposition becoming irritable; memory impaired; outbursts of causeless laughter recently. Some vertigo at times preceding the attacks and also without relation to attacks. Constipation always. Never had juvenile convulsions.

Examination: P. 88; B. P. 150/60; W. 173. Ophthalmoscopic examination reveals marked retinal angiosclerosis. Heart enlarged to left about 3 cm. and downward to 6th interspace in anterior axillary line. Occasional extrasystyoles. Neurologic examination negative. Periphal arteries hard. Urine: acid, 1012, no sugar, a trace of albumin, many pus cells, a few hyaline casts.

Summary diagnosis: (1) Epilepsia tarda. (2) Arteriosclerosis. (3) Cardiac hypertrophy with extrasystoles.

Case II (Arteriosclerotic Type).—Mr. W. H., negro, age 55. 11/12/23—For the past year but never before patient has had about twelve generalized convulsions with unconsciousness and tongue biting and urinary incontinence. Attacks chiefly nocturnal. No aura. Nothing else of significance in history except occasional nocturia and bleeding hemorrhoids.

Examination: P. 60 to 70; B. P. 120/70. Well developed negro. Marked retinal angiosclerosis but no demonstrable hardening of the peripheral arteries. Heart negative except for a blowing systolic murmur at the mitral area. Neurologic examination negative. Urinalysis negative. Blood and

spinal fluid and Wassermann negative. Blood urea nitrogen, blood uric acid, blood sugar—all normal. Blood count moderate secondary anemia. Electrocardiogram shows sinus bradycardia.

Summary Diagnosis: (1) Epilepsia tarda. (2) Cerebral arteriosclerosis. (3) Secondary anemia from hemorrhoids. (4) Systolic cardiac murmur.

Case III (Arteriosclerotic Group).—Mrs. R. P., age 74. 4/20/27—For the past year patient has had nocturnal convulsions every few weeks with stertorous breathing, swallowing movements and bladder incontinence. False teeth are removed at night and tongue is not injured by the biting which occurs. No aura. Some mental irritability. Constipation for years. No juvenile convulsions. No epilepsy in family.

Examination: Wt. 138; P. 92; B. P. 164/90. Peripheral arteries hard. Well marked retinal angiosclerosis. Thyroidal adenoma. Heart enlarged with left border one inch beyond mid-clavicular line. No murmur. No arrhythmia. Urine: acid, 1015, albumin a trace, no sugar, a few hyaline and light granular casts.

Summary Diagnosis: (1) Epilepsia tarda. (2) Arteriosclerosis. (3) Cardiac hypertrophy.

Case IV (Hypertensive Type).—Mrs. D. C., age 48. 11/24/26—Patient has known that her blood pressure was too high for the past eight years. In 1918 began to have headaches, vertigo, tinnitus and shortly thereafter had her first convulsion. From 1918 to 1924 she had repeated attacks of unconsciousness with generalized convulsions lasting from fifteen to twenty minutes and followed by mental dullness. Aura of "something rising up from epigastrium." No tongue biting or incontinence. Attacks all diurnal. No petit mal. Has had no attacks for two years. No juvenile convulsions. Patient also complains of gaseous indigestion and crying spells and constipation. Menopause three years ago at forty-five.

Examination: Overweight (159); B. P. 240/140; P. 104. Heart enlarged 2 cm. to left of mid-clavicular line. Area of supracardiac dullness increased. Aortic second sound accentuated. Tenderness over the gall-bladder area. Reflexes normal. No demonstrable arteriosclerosis. Urine: acid, 1020, albumin trace, sugar negative, microscopy negative. Blood urea nitrogen and blood sugar normal. Phenolsulphonephthalein elimination 45% in two hours.

Summary Diagnosis: (1) Epilepsia tarda. (2) Hypertension. (3) Gall bladder disease. (4) Cardiac enlargement. *Course:* Patient has been symptomatically improved by low salt low protein diet together with biliary drainage, acidophilus milk, and the use of bromides and luminal and colonic irrigations. Last examined 1/17/27. Wt. 157; B. P. 212/118. No more convulsions.

Case V (Mixed Arteriosclerotic-Hypertensive Type).—Mr. E. H., age 59, 9/15/25. For five years has had dyspnea on exertion and edema of the feet. In September, 1923, had his first convulsion and had recurrent convulsions with unconsciousness about once a month for the next year—always nocturnal and associated with tongue biting and bladder incontinence at times. Previous history includes gonorrhea and inflammatory rheumatism. No convulsions have occurred during the past year since his doctor (R. D. Anderson, of Burlington, N. J.) began the use of luminal.

Examination: Overweight; P. 80; B. P. 180/100. Marked peripheral arteriosclerosis and retinal arteriosclerosis as well. Marked cardiac hyper-

trophy with engorged liver extending three inches below costal border and a blowing systolic mitral murmur. Some edema of legs and feet. Prostate markedly enlarged and urethral stricture reported by urologic examiner. Urine loaded with pus. Blood urea nitrogen 38—reduced to 18 by inlying catherer. Blood Wassermann negative.

Summary Diagnosis: (1) Epilepsia tarda, (2) Arteriosclerosis and hypertension. (3) Cardiac hyperthrophy with decompensation. (4) Prostatism. *Course:* The constant use of luminal in half-grain doses seems to have completely abolished convulsive seizures. He died 3/31/27 of cardiac decompensation and uremic (?) coma without convulsions or paralyses.

Case VI (Mixed Arteriosclerotic-Hypertensive Type).—Mr. M. H., age 56, 11/7/22. Patient has had attacks of vertigo for the past year with occasional headache and palpitation.

Examination: B. P. 196/100; P. 84; Wt. 196. Patches of leukoplakia inside cheeks. Faint systolic murmur at aortic area and slight left-sided cardiac enlargement. Moderate edema of shins. Peripheral arteries moderately sclerosed. Arcus senilis present. Urinalysis: 1028, albumin trace, sugar negative, microscopy negative. Blood Wassermann negative.

12/14/22—Fell down stairs in a "dizzy spell." No witness and no knowledge of convulsion. 1923—Had bronchopneumonia. Blood pressure tending higher. 3/24/26—While on ocean trip from Bermuda (3/14/26) had sudden vertigo and lapsed into unconsciousness. Eye witnesses state that he had a violent convulsion with bloody froth from mouth. Vomited on regaining consciousness.

Examination: B. P. 210/110; Wt. 184; P. 76. Urine as before except more casts. Blood urea nitrogen, uric acid, sugar, and creatinine normal. B. S. P. 35% elimination in two hours. Electrocardiogram shows "severe myocardial degeneration." Ophthalmoscopic examination (Dr. Fewell) "marked angiosclerosis. No hemorrhages." 7/16/26—Generalized convulsion with tongue biting followed by visual hallucinations which lasted several weeks. 9/4/26—Convulsion preceded by aura of vertigo and precordial distress. Occasional extrasystoles noted after this attack. 3/7/27—Convulsion with severe laceration of the tongue. Blood pressure in the attack was over 300 mm., pulse was 120 and gallop rhythm developed with a grating systolic murmur over the entire heart. Patient passed sixty ounces of urine in the three hours following this attack. No sphincteric incontinence at any time. 4/10/27—Convulsion as above. A good deal of anginoid discomfort.

Summary Diagnosis: (1) Epilepsia tarda. (2) Hypertension and arteriosclerosis. (3) Myocarditis.

Case VII (Mixed Hypertensive-Arteriosclerotic-Luetic). Mr. W. B. T., age 58. 2/2/24—For the past year patient has had recurrent generalized convulsions with unconsciousness, tongue biting and urinary incontinence. Most of the attacks are nocturnal and are frequently preceded by aura of precordial distress. Has been overweight for many years. Was first told he had high blood pressure two years ago. Chancre at twenty-one years of age. No juvenile convulsions. No epilepsy in family.

Examination: Wt. 202; B. P. 215/115; P. 80. Large and obese. Eye grounds show marked arteriosclerosis and small patch of choroiditis inside both discs. Neurologic examination negative except absent left knee jerk. Heart enlarged with left border at anterior axillary line. Rough systolic murmur at aortic area transmitted to neck. Urine: 1020, no sugar, albumin

a trace, a few granular casts. P. S. P. 50% in two hours. Blood Wassermann plus four.

Summary Diagnosis: (1) Epilepsia tarda. (2) Hypertension and arteriosclerosis. (3) Syphilitic aortitis and cardiac hypertrophy. *Course:* Patient improved under antisyphilitis treatment, dietary management and the use of luminal. Convulsions did not recur for full year when patient stopped treatment. Last heard from in March, 1927 (aet 61), he had suffered a right hemiplegia.

Case VIII (Endocrine Dysfunction Type: Diabetes Insipidus).—Mrs. R. S. Age 53. 2/22/27—Patient was well until menopause at forty-six when she had vertigo and flushes and has not felt well since. A year ago she was told for the first time that she had high blood pressure. During the past month she has had two attacks of unconsciousness with jerking of the head and face and limbs but no tongue biting or incontinence. Attacks preceded by aura of choking feeling in throat and burning feeling in epigastrium and followed by dazed mentality for several hours. No nocturnal attacks. No petit-mal. Ever since first attack has had very marked polydypsia and polyuria—passing five to six quarts of urine in twenty-four hours. Has become very nervous and memory is failing. No juvenile convulsions. Weighed 150 pounds at marriage and went up to 208 pounds a year ago. Comes of fat stock.

Examination: Wt. 197; P. 92; B. P. 170/80; "Full moon face." Lower eye lids puffy. Tonsils very large. Heart negative except for a soft systolic murmur at apex in recumbent posture. Abdomen adipose. No demonstrable arteriosclerosis. Neurologic examination, negative except knee jerks greatly diminished. Urine 1006, no sugar, no albumin. Blood Wassermann and Kahn tests negative. Blood sugar: .98% (fasting).

Summary Diagnosis: (1) Epilepsia tarda. (2) Diabetes insipidus. (3) Hypertension. (4) Heart murmur.

Case IX (Endocrine Dysfunction Type: Hypothyroidism. Arteriosclerosis).—Mrs. J. M., age 53. 12/20/21—Patient was well except for obesity and dyspnea on exertion until two months ago when she began to have convulsions of brief generalized type. Has had about fifteen such attacks in past two months. Following attacks she is confused and recently has been childish and forgetful. Has aura of precordial distress at times. In several of the attacks the tongue has been bitten slightly and the bladder has emptied incontinently. Always constipated.

Examination: B. P. 120/70; P. 100; Obese. Hair of scalp sparse and dry. Face and hands suggest myxedema. Ophthalmoscopic examination (Dr. Baer) "marked retinal angiosclerosis with a few recent hemorrhages around both discs." Heart enlarged 3 cm. to left mid-clavicular line. Sinus arrhythmia and tachycardia at times and at other times slow rate. Sounds muffled. Large umbilical hernia. Neurologic examination negative. Repeated urinalyses, blood counts, blood chemical examinations, blood Wassermann—all normal. Basal metabolism (during afebrile period when pulse rate was averaging about sixty-two) was minus 16%.

Summary Diagnosis: (1) Epilepsia tarda. (2) Arteriosclerosis. (3) Cardiac hypertrophy. (4) Hypothyroidism. *Course:* Treatment by rest in bed, low salt low caloric diet, and colonic irrigations together with bromides and thyroid extract was followed by a period of eleven months of marked improvement. The convulsions ceased and the mental condition

cleared up entirely. Thirteen months after onset the patient had hemiplegia and died.

Case X (Endocrine Dysfunction Type—Diabetes Mellitus with Hypertension and Arteriosclerosis).—Mr. W. P., age 50. 11/15/26—Well until four years ago when he had right renal colic. Three years ago right nephrectomy for nephrolithiasis. Felt well until May, 1926, when he had a convulsion which left him with some motor and visual aphasia but no other paralysis. Second convulsion today, 11/15/26, generalized with tongue biting and followed by a deep sleep lasting two hours.

Examination: Wt. 170; B. P. 250/140; P. 60. Eye-grounds show silver wire arteries indenting the somewhat dilated veins. No cranial nerve palsies. Heart slightly enlarged. Rough systolic murmur at aortic area and marked accentuation of second aortic sound. Reflexes normal. No edema. Blood urea nitrogen—28 mgm. per 100 cc., blood sugar 199 mgm. per 100 cc. Urine loaded with pus and containing 1% of sugar and a heavy trace of albumin. Specific gravity 1020. Urinary tract: X-ray shows several small calculi in left kidney. Blood Wassermann negative.

Summary Diagnosis: (1) Epilepsia tarda. (2) Hypertension and cardiac hypertrophy and aortitis and arteriosclerosis. (3) Diabetes mellitus. (4) Nephrolithiasis. *Course:* 4/4/27—Under diabetic management blood sugar is normal. Urine is free of sugar and no more convulsions have occurred but hypertension, aphasia and pyuria persist.

Case XI (Endocrine Dysfunction Type: Diabetes Mellitus, Arteriosclerosis).—Mrs. L. McL., age 59. 11/2/22—Diabetes was discovered at the age of seventeen. After one year of treatment patient considered herself cured and apparently remained well for the next forty years when loss of weight, polyuria and polydypsia recurred and sugar was again found in the urine (1920). Soon after this patient began to have attacks of unconsciousness with convulsions (aet. 57).

Examination: B. P. 100/70; P. 72; Wt. 95. Considerable emaciation. Marked peripheral arteriosclerosis. Heart enlarged with left border an inch beyond mid-clavicular line. Marked edema of legs. Neurologic evidence of tabes diabetica. Urinalyses: variable amounts of sugar. Occasional ketones. Fasting blood sugar varies from .295 to .500%. Blood urea nitrogen 19 mgm. Wassermann negative.

Summary Diagnosis: (1) Epilepsia tarda. (2) Diabetes Mellitus. (3) Arteriosclerosis. (4) Cardiac hypertrophy. *Course:* After the patient's regime of diet and insulin was properly regulated she had no more convulsions until 1926 when she broke diet. At present (4/7/27) she is quite well with urine free of sugar.

Case XII (Endocrine Dysfunction Type—Diabetes Mellitus with Hypertension and Arteriosclerosis).—Mrs. D. M., age 53. 10/3/23—Well until one year ago when pruritus vulvae and polyuria led to finding of sugar in urine. Had first convulsion nine months ago while cooking over hot stove. Second convulsion three weeks ago while ironing. Both preceded by vertigo and followed by heavy sleep for several hours. No tongue biting. No sphincteric incontinence. About ten days ago had a series of three brief convulsions without regaining consciousness between convulsions. No residual paralysis and no petit-mal attacks but some loss of memory recently. Menopause six years ago. Two brothers died of diabetes. No epilepsy in family.

Examination: B. P. 195/120; Wt. 175; Height 65 inches; P. 72. Obese. Eye-grounds show marked indentation of veins by silver wire type of arteries. Heart shows occasional extrasystole. Left border is 3 cm. to left of mid-clavicular line. Rough systolic murmur at aortic area. Urinalysis: Sugar 1.8% No ketones. Blood sugar, .245%. Blood urea nitrogen eighteen mgm. Wassermann negative.

Summary Diagnosis: (1) Epilepsia tarda. (2) Diabetes mellitus. (3) Hypertension. (4) Cerebral Arteriosclerosis. (5) Cardiac Hypertrophy. *Course:* 4/15/27—Patient has been uncoöperative as regards diet. Has had three convulsions in past two years. Following the last convulsion three months ago developed a right hemiplegia which has now almost disappeared.

Summary of the salient features of these twelve case-histories reveals some interesting facts. Five are men, seven are women. Nine are overweight. The average age at onset of convulsions is fifty-six years—with forty-one as the youngest and seventy-three as the oldest age at onset. Regarding the character of the seizures, all are of the recurrent, grand-mal type. In two patients, the attacks are exclusively nocturnal, in four exclusively diurnal. Two patients exhibit, in addition to major fits, petit-mal attacks. An aura, usually of precordial distress or vertigo, is noted by six patients. One case history reveals an episode of status epilepticus. Tongue biting is mentioned in five cases, sphincteric incontinence in six. The only classical feature lacking in these convulsions is the initial cry.

The grouping of our cases is as follows: three arteriosclerotic, one hypertensive, three mixed hypertensive-arteriosclerotic (one of which is syphilitic), and five belong to the endocrine dysfunction group. Of the latter, three are cases of diabetes mellitus, one of hypothyroidism, and one of diabetes insipidus. Every case in this endocrine dysfunction group has either hypertension or arteriosclerosis or both in addition. In no case is there any evidence of marked impairment of renal function—except in case five, which terminated in the uremia of prostatism five years after the initial convulsion.

The only underlying condition present in all cases is some circulatory abnormality. These abnormalities are divided as follows: (1) All twelve patients exhibit some cardiac disturbance, ten with definite hypertrophy and varying degrees of myocardial degeneration and two without demonstrable hypertrophy but with well marked systolic apical murmurs (in addition one of the latter shows sinus bradycardia in the electrocardiogram). (2) Ten of the twelve present definite evidence of arteriosclerosis as judged both by palpation and by ophthalmoscopic examination. (3) Seven are hypertensive. (4) Eleven patients present two or more of the foregoing factors combined. Only one patient (case 8) has neither

demonstrable cardiac hypertrophy nor demonstrable arteriosclerosis, but she has hypertension and diabetes insipidus.

Prognostic points in our series are as follows: Two of the twelve patients have died—case 5 in coma five years after initial convulsion and case 9 of apoplexy one year after onset. Eight patients are alive—averaging at present almost four years of life since onset of convulsions. Two patients have not been heard from. Of the eight known living patients, two have had strokes and are confirmed invalids, two others have such marked myocardial and hypertensive disease as to be totally incapacitated, while four are able to lead fairly normal lives. The longest duration of life after the initial convulsion is that of case 4 (of the hypertensive group). The patient is alive and well (except for a blood pressure of over 200) now nine years since her first fit and three years since her last one. The second best showing is made by one of the diabetic group (case 11) for whom insulin came just in time and who is now well seven years after convulsions began.

With the facts of these case histories in mind let us return to a brief discussion of our belief that moments of deranged cerebral circulation are responsible in part at least for the convulsions of epilepsia tarda. Of course this thesis in regard to epilepsy in general is not original with us. Sir William Gowers [6] has emphasized it. Russell in his Goulstonian Lecture in 1909 [7] maintained that "the fundamental factor underlying both the ordinary faint and the epileptic fit is cerebral anemia." Moon [8] presents a recent concise review of this hypothesis and reports a case of mitral stenosis with epilepsy at thirty-five. This report indicates the impossibility of sharply separating so-called idiopathic epilepsy from senile epilepsy.

It is well known that sudden disturbances of the cerebral circulation are sometimes followed by convulsions. They may occur, for example, during the rapid aspiration of pleural effusion, following profuse hemorrhage from any cause, and they have been produced in man and animals by compression or ligation of the carotid arteries. In three patients with senile epilepsy Naunyn [9] was able, by manual compression of the carotids, to reproduce typical grand-mal fits. He was also able to initiate fits in a few other non-epileptic but definitely arteriosclerotic individuals, whereas carotid compression failed to produce convulsions in a group of healthy adults. A recent significant and important study by Bordley and Baker [10] indicates that localized cerebral arteriosclerosis may be present without clinical evidence, and furthermore that such arteriosclerosis was found in all their cases of "essential hypertension." Just how the group of endocrine dysfunction cases of senile

epilepsy might fall in line with our circulatory hypothesis is a little difficult to state. Of course all of our cases had, in addition to diabetes mellitus or insipidus or hypothyroidism, some definitely organic cardiac or vascular defect. We feel that the endocrine dysfunction factor is to be viewed chiefly as a cause predisposing to organic circulatory disease. The possibility, however, of sudden circulatory changes of hormonal nature (comparable to the convulsions of insulin shock) cannot be excluded. We certainly do not agree with the prevailing French view [11] which would ascribe to acidosis the diabetic type of epilepsy. It is interesting to note in passing that the first allusion in American literature indicating a recognition of the diabetic type of senile epilepsy is that of Dr. Phillip S. Roy in a discussion of this subject in Washington, D. C., thirty years ago.[12]

Diagnosis of the several types of epilepsia tarda is by no means always easy. The physician who is called upon for an opinion either during or immediately following the initial convulsion certainly has many possibilities to consider. We may mention the more probable causes of generalized convulsions of adult life at this point: apoplexy, hysteria, general paresis, eclampsia, acute yellow atrophy, meningitis, encephalitis, brain tumor, Adams-Stokes disease, coronary artery occlusion, intoxication by alcohol, strychnin, belladonna, lead, etc., sudden anemia from hemorrhage, cranial trauma, brain abscess, the various types of senile epilepsy, and finally uremia. It is the group which comprises the senile epilepsies, apoplexy, and uremia that offers the greatest difficulties to the diagnostician.

When more than one convulsion has occurred and an interval of comparatively normal health has intervened the diagnosis is easier. Such a history points strongly to one of the forms of epilepsia tarda, the diagnosis of uremia which is usually made is seldom correct. The difference in prognostic significance is very great—a patient with true uremic convulsions is as a rule at death's door, a patient with epilepsia tarda may live for many years and may indeed be cured of his convulsions.

It is not sufficiently appreciated that generalized convulsions are rare in true uremia. It is significant, we think, that Strauss [13] noted no increase in the incoagulable nitrogen of the blood in cases of so-called uremia with convulsions. Agnew [14] states that "convulsions are probably not a part of pure nitrogen retention." In a more recent study of the syndrome of azotemia Feinblatt [15] found uremic convulsions surprisingly infrequent and when they did occur they were always terminal—in fact within an hour of death. We do not feel that the very rare condition of uremia without

azotemia [16] is deserving of mention in this discussion. It would almost seem that azotemia inhibits epileptiform seizures. It follows that the diagnosis of uremia in an elderly subject with an initial convulsion should not be made hastily. One of the types of epilepsia tarda must be borne in mind.

In the treatment of epilepsia tarda the associated and underlying pathologic processes must be regulated as far as possible. As in idiopathic epilepsy so here the emphasis must be placed upon a quiet even mode of life with all sources of irritation—both physical and mental—eliminated as far as possible. A bland diet of the low salt, low protein type and small meals seems to us to be the most suitable. Constipation must be rigidly combatted. Bromides or luminal are usually indicated. Iodides may be tried. Thyroid extract seems to have benefitted the convulsions in our case of hypothyroidism. Other endocrine substances are recommended but we have not been able to convince ourselves of their efficacy—always excepting insulin for the diabetic patients who need it. Digitalis and diuretics are sometimes indicated. In emergencies venesection has seemed helpful, as in one of our hypertensive cases.

The prognosis like the treatment varies with the underlying conditions. The cerebral arteriosclerotic "epileptic" may live for many years, although progressive mental deterioration is the rule. Sometimes paralyses follow the convulsions. Anglade [17] reports several interesting cases of this type which came to autopsy. One of the patients had his first convulsion at sixty-three and lived to seventy-one. According to Etienne and Richard [18] the endocrine dysfunction type (non-diabetic) may be cured by proper therapy. Our own patient of this group was "cured" of her convulsions but died a year later of apoplexy. The hypertensive epileptic is always in danger of cerebral or cardiac catastrophy or terminal uremia. Anginoid attacks are not infrequent. One of our patients in this group is alive nine years after her first convulsion. Theodore C. Janeway [19] states that in his series of 7,872 cases of hypertension "onset with convulsive seizure was a great rarity." In one case, however, "four years intervened between the initial uremic convulsion and death." This was doubtless a case of hypertentive epilepsy and not of uremia. The diabetic type of senile epilepsy is now perhaps the most hopeful of all—thanks to insulin.

Summary

1. Twelve cases of epilepsia tarda are reported and a classification is suggested.

2. A background of combined circulatory defects is demonstrable in all cases—indicating the probability that moments of deranged cerebral circulation constitute one exciting cause of the convulsions in these cases.

3. Differential diagnosis of the types of epilepsia tarda is presented with emphasis on their separation from uremia in which generalized convulsions are rare and only terminal.

4. Prognosis and treatment are briefly presented.

5. A selected bibliography is appended.

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TONSILLITIS ASSOCIATED WITH ACUTE ASEPTIC MENINGITIS*

CASE I.—Mr. I. B., a married man of 45 years, a native of New York City, had always enjoyed good health. On Tuesday, April 4, 1933, he awoke with a severe headache and a sore throat. The headache was obstinate, not yielding to codeine or other anodynes. Sinus roentgen-ray examination and blood Wasserman test were negative. The blood count was entirely normal, the fasting sugar 120 mg. per 100 c.c. of blood. The tenden reflexes were exaggerated on the right side and the Babinski reflex was present on that side. Eye-ground examination showed dilated vessels but no papilledema. Lumbar puncture revealed the following: Pressure 22 mm. of mercury, globulin increased, sugar 55.4 mg., Wasserman and colloidal gold tests negative. The cell count was surprising—there were 1125 cells to the cubic mm. The fluid was sterile on culture.

I had the opportunity of seeing Mr. B. with his physicians, Drs. Goodheart and Ginsburg, on April 9. The notes of the result of my examination are as follows:

The patient looks ill and is exceedingly apprehensive, perhaps because of the persistent headache, perhaps because of the many examinations and tests which the obscurity of his illness has rendered necessary. The headache is apparently very severe and he is inclined to dig his head into the pillow. The pupils are slightly unequal, markedly contracted but react to light; all ocular movements are normal. The tongue is covered with a thick white coating. Over the right tonsil a whitish exudate is visible like that of follicular tonsillitis; the left tonsil cannot be seen satisfactorily. The heart and lungs are normal. The liver is a little enlarged, the abdomen slightly distended, the suprapubic region dull on percussion; the spleen is not palpable. The knee jerk is normal, the Babinski reflex is absent, but there is a suggestion of an ankle clonus on both sides. While there is no real ataxia of the arms, the tips of the fingers are not easily brought together. The knee-heel test is normal. There is no rigidity of the neck, no Kernig sign. The eye-grounds are normal. The temperature is 102 to 104°; blood pressure 122 systolic, 70 diastolic; the pulse ranges from 70 to 90, respiration 20. The leukocytes in the blood are 16000 per cubic mm.

On questioning the patient I obtained information about an incident that may have had considerable bearing upon his case. On April 1, three days before the onset of his illness, he had been unexpectedly called to the home of an aged uncle. When he arrived he found his relative lying dead on the floor. It was the first death he had ever seen and the shock was, as he expressed it, terrible. It would not seem to be an unwarranted assump-

* Read before the Section on Medicine of the College of Physicians of Philadelphia, February 25, 1935; with additions.

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tion that his psychic trauma had something to do with the localization of the poison in the cerebral meninges.

I was of the opinion that the tonsillitis was the primary element in Mr. B.'s case and that with its subsidence the meningitic symptoms would also disappear. As a therapeutic measure I advised the application of leeches to the mastoid processes. Recovery was rapid, the patient leaving the hospital on April 14. On April 27 he came to see me in my office in Philadelphia. He felt fairly well but still had some ringing in the ears, a feeling of a "kink" in the back of the neck, and occasionally weak spells, relieved by lying down. He was nervous, irritable and easily upset. Physical examination revealed nothing of significance except a momentary ankle clonus on both sides but no Babinski reflex. I have heard from the patient since then. He is entirely well.

Case II.—The second case occurred at the Children's Hospital in the service of Dr. Joseph Stokes, through whose courtesy I am privileged to include it in this report. The patient was a boy of four years, of Italian parentage, who apparently as the result of some birth injury had had convulsions up to the age of three years. They then ceased and the child was apparently normal until one day in May, 1933, when he suddenly became feverish and had a convulsion. His breathing was of the Biot type; temperature 102. The limbs were alternately rigid and relaxed; the Babinski reflex was present on both sides, no Kernig sign; some rigidity of the neck. Examination of the throat showed a slight degree of tonsillitis. Spinal puncture yielded a somewhat opalescent fluid; pressure 18 mm. of mercury, globulin increased, sugar present, 500 cells to the cubic mm.; nearly all were lymphocytes. After the spinal puncture the child had no further convulsions. A second puncture showed 1000 cells, chiefly lymphocytes. There was no pellicle, and no organisms were found. Blood culture showed *Streptococcus viridans*; the Wassermann test was negative. The child's temperature became normal and the cell count in the spinal fluid was reduced to 10. A second blood culture again showed a profuse growth of *Streptococcus viridans*, but a third taken five days later was negative.

The diagnosis in this little boy was obscure but Dr. Stokes and his colleagues concluded that he had had a sterile meningitis, streptococcus tonsillitis, and *Streptococcus viridans* septicemia without endocarditis. The child made a satisfactory recovery.

I am prompted to report these two cases because they illustrate certain unusual complications of acute tonsillitis. Although I did not see the first patient in the beginning nor the second one at any time, I believe the conclusion is justified that the tonsillitis was the primary disease.

The promptness of the recovery of both patients is unusual and puts this type of meningitis in a class by itself.

The literature is very meager on the subject of tonsillitis and meningitis. Kroll [1] is the only author among the many I have consulted who speaks of tonsillitis (angina) as a possible cause of acute serious meningitis. Cases of septic meningitis following tonsillitis, usually of the quinsy type, are recorded. There are also

references in the literature to encephalitis complicating tonsillitis. Fanny Halpern reported six cases, all in the female sex, of pontine-cerebellar encephalitis in persons ranging from 11 to 60 years. Halpern was unable to determine whether the inflammation of the brain was due to organisms or toxins of the tonsillitis or to a lessening of resistance to the encephalitis virus produced by the tonsillar infection. It must be remembered that the differential diagnosis of meningitis and encephalitis is sometimes difficult.

That there was a definite meningeal involvement in both the cases here reported cannot be doubted in view of a spinal fluid cell count of 1000 in one and 1100 in the other. As the fluid was sterile, I was inclined to the opinion that a virus might have been responsible, although the action of a bacterial toxin could not be ruled out. The fact that the cases were "aseptic" brings them in line with a number of similar ones recorded within the last few years—those of Wallgren,[2] under the title of "Meningitis 'Aseptica' Acuta," of Viets and Watts,[3] as "Aseptic (Lymphocytic) Meningitis" and of Dickens,[4] under the same title. Dickens in his article asks himself the question whether he was dealing with "a new disease entity due to a filterable or nonfilterable virus." In 1934 Armstrong and Lillie[5] called attention to a virus they had encountered in monkeys that had shown definite signs and symptoms of meningitis; mice and guinea-pigs proved also to be susceptible to the virus. In May of this year Rivers and Scott[6] reported the isolation of a virus from two human cases of meningitis, and stated that the serum from these cases protected animals from the virus. Crossed serological tests indicated the identity of the two viruses, that of Armstrong and that of Rivers and Scott.*

Armstrong and Dickens†[7] in four human cases of "aseptic" meningitis found that the blood serum obtained in one case three years and eleven months, in one a year, in one three and a half years after the attack protected mice against the Armstrong virus. In the fourth case protective bodies were absent at the beginning of the illness, but appeared two months after the onset of the meningitis.

The clinical picture in these cases was similar to that of I. B. except that in the cases recorded by Dickens and Armstrong infections of the upper respiratory tract and not a well-defined tonsillitis preceded the onset of meningeal symptoms. The disease lasted from ten days to two weeks and left no residual features of any kind.

* The Armstrong-Rivers and Scott virus appears by serologic tests to be identical with a third virus, that of Traub, found in white mice.

† I want to express my thanks to Lieutenant Commander Dickens and to Dr. Charles Armstrong of the Public Health Service for letting me have a manuscript copy of their article.

In all these cases the cellular response of the spinal fluid was almost entirely lymphocytic. It is easy to see how such a cytologic finding might suggest the diagnosis of tuberculous meningitis. There is, however, no pellicle, and animal inoculation is negative. The sugar, chloride and urea content of the fluid is within normal range.

As far as our present knowledge goes the disease is self-limited and requires little treatment except lumbar puncture which is the best means of controlling the most distressing symptom, the headache. As an adjunct to or substitute for lumbar puncture, leeching from the mastoid processes may be tried.

It is desirable that those who hereafter see cases of aseptic meningitis * have laboratory tests made with the spinal fluid for the discovery of a possible virus, and with the blood serum which in the virus cases ought to protect mice against the virus.

Meningeal symptoms are not rare in the acute infections of childhood and also in pneumonia. These symptoms are often attributed to meningism, whatever that may mean. If lumbar puncture is done in such cases, it may reveal a pleocytosis suggestive of acute lymphocytic meningitis.†

In conclusion I should like to say that as far as tonsillitis is concerned, experience has long ago convinced me that it is a potentially serious disease and should be treated with more respect than is customary.

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* Armstrong and Dickens state that since in their opinion the affection is caused by a virus, "aseptic" is a misnomer and propose the term "acute lymphocytic choriomeningitis."

† Pleocytosis has been found in typhoid fever (Dr. James P. Leake—personal communication).

GLOSSOPHARYNGEAL NEURALGIA DUE TO AN IMPACTED WISDOM TOOTH *

In a recent article Hoover and Poppen [1] call renewed attention to tic douloureaux involving the glossopharyngeal nerve. They report two cases of their own and collect a number of others recorded in the literature. The pain is of the same nature as that of tic douloureaux except that it is located at the base of the tongue and in the back of the throat instead of in the face.

Medical treatment is not very effective—it consists chiefly of the inhalations of from 15 to 30 drops of trichlorethylene three or four times a day. Such treatment frequently stops the pain but does not in any sense bring about a cure. In a number of cases, including one of Hoover and Poppen's, surgical treatment has been employed. In their opinion intracranial section of the ninth nerve in the posterior fossa, a formidable operation, is the procedure of choice.

I want to call attention to a cause of glossopharyngeal neuralgia which should it exist renders such an operation entirely unnecessary, nothing more being required than the extraction of an impacted wisdom tooth.

The first case concerns a man about 50 years of age who began to have violent pains in the throat on eating and speaking. He was obliged to lecture frequently and sometimes while lecturing he would be seized with such a spasm of pain that he thought he would become delirious. The pain would not last long but while it lasted the patient had to hold on to something for fear of falling in a faint. The pain was felt in the back of the throat, in the tonsillar region, and at the base of the tongue—never in the teeth. Throat specialists told him he had gout and ordered salicylates and iodides, but the treatment had not the slightest effect. A dentist declared the teeth normal except for an impacted wisdom tooth. Thinking that this tooth might be responsible for the frightful neuralgia, I insisted that the tooth be removed. It was extracted with difficulty by the late Dr. Matthew Cryer, but from that time on the man has been entirely free from pain. The tooth itself was healthy.

The second patient was a man of 48 years who while in good health was suddenly seized with agonizing pain in the throat which unlike the pain in the first case was not paroxysmal but was more or less constant. For ten days he had hardly had any sleep despite a variety of strong

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sedatives. A dentist had declared his teeth to be normal. The case was so similar to the other that I suspected an impacted wisdom tooth. The roentgen-ray films showed such a tooth. It was extracted and the pain disappeared immediately and never returned. Neither of the two patients had any toothache or connected the pain with his teeth.

On the basis of these two impressive experiences I would advise search for an impacted wisdom tooth in cases of glossopharyngeal neuralgia and if one is found, that it be extracted, regardless of a dentist's opinion to the contrary, before resorting to more radical measures.

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ENDOCRINE DISEASES

A PECULIAR STATE OF ASTHENIA OF SHORT DURATION, ENDING IN RECOVERY [1]

About ten years ago I reported a strange case of myasthenia before the Philadelphia Neurological Society. As this report has never been published and as it is germane to my present subject, I shall reiterate the chief features of the case before speaking of the others that have come under my observation.

Case I.—The patient was a physician, aged 35, a native of Pennsylvania, engaged in an arduous country practice in the western part of the state. His family history and his personal history were good. For the last fifteen years he had used tobacco moderately and alcohol occasionally. He had had gonorrhea but never syphilis. About Christmas time he had a mild attack of influenza for which he stayed in bed less than two days. On the day he resumed work he was drenched by a rain and caught a cold, which was, however, not severe enough to interfere with his practice. Several days later, on January 10, he felt somewhat weak on arising from bed. During the day the weakness steadily increased and by evening he had to have assistance in getting into his phaeton. By night he could rise from a chair only with great difficulty, and on the following morning it required much effort to get out of bed. By January 13 he could not leave his bed without help. When in bed he could not put one foot over the other or flex the knees as long as the covers rested on the limbs. The weight of the bed-clothes was sufficient to neutralize what little power he had. If the arms were extended underneath the bed-covers he could not directly raise them but had to slide them up over the chest until they were clear of all weight. On one occasion a pillow toppled over on his face and it was only with supreme effort that he succeeded in tossing it off. One night he had turned with considerable difficulty on his side, but in a little while overbalanced himself and rolled over on his face. While in this position he almost smothered before he succeeded in regaining sufficient leverage to turn on his back. The patient did not think himself paralyzed but felt as though his muscular strength were utterly exhausted, as it might be from overfatigue. There was an entire absence of pain; appetite, digestion, the bladder and bowel functions were all normal. Mastication was somewhat difficult, but deglutition was not affected. Vision and hearing were not disturbed. As regards tactile sensibility, I am informed by Dr. J. M. Thorne, of McKeesport, who attended the patient, that it was normal. The knee-jerk was also normal. The mental processes were active, and, contrary to what might be expected, the patient was in a serene frame of mind, although he thought at different times that he was going to die.

[1] Read before the Section in Medicine of the College of Physicians, March 25, 1912.
Reprinted from the Journal of the American Medical Association, June 15, 1912, Vol. LVIII, pp. 1846-1847.

The temperature was persistently subnormal, not over 97; the pulse was as low as 45, and the respirations from 10 to 12. This low level of pulse, respiration and temperature was maintained for three or four days. Any physical effort was attended by profuse perspiration. At the end of ten days, when recovery from the general muscular weakness was almost complete, a left-sided facial palsy developed. It was unattended by pain and lasted ten days. When I saw him, which was two months after the beginning of his trouble, he still complained of being weak in the knees. I found nothing of moment on physical examination. The pupils were equal and reacted to light. There was no sway; the knee-jerk was exaggerated; there was no ankle-clonus and no Babinski reflex. The tactile and the thermic senses were undisturbed. The heart and lungs presented nothing abnormal. The blood-count showed 5,632,000 red cells, 10,500 white cells and 78 per cent. hemoglobin. No electric tests were made.

In the last note I had from him, dated April 2, he remarked that his strength had returned to him, but there was still a tendency to a feeling of nervousness after undue exertion or after holding his limbs in one position for any length of time.

To recapitulate: A man in good health, suffering only from a cold, is suddenly seized with profound weakness involving apparently all the voluntary muscles, causing no psychic, sensory or spincteric disturbance and being marked by bradycardia, subnormal temperature and bradypnea. A facial palsy ensued ten days after the onset of the myasthenia. Recovery was complete in about two months.

In endeavoring to explain this quite extraordinary case, which did not fit into the category of myasthenia gravis pseudoparalytica, periodic palsy or Landry's palsy, and which was evidently not hysteria, I took refuge in a theory that at that time seemed somewhat fanciful, namely, that the myasthenia was due to temporary functional insufficiency of the adrenals. This theory was in keeping with the facts of animal experimentation as they were available at that time and seemed to me to explain the muscular prostration and the hypothermia. The facial palsy could not be explained on the basis of this hypothesis and had to be considered an accidental complication. This view is the more plausible as the palsy appeared suddenly during convalescence.

From time to time this case recurred to my mind, especially in 1908, when Dr. Lavenson had his able article on suprarenal insufficiency in preparation and discussed it with me. But not until recently did I see any case that bore a resemblance to it.

Case II.—In February, 1912, a physician, 49 years old, consulted me on account of a feeling of great exhaustion which made every muscular act an effort. He dragged himself to his work with difficulty and was listless and depressed. There was no lack of control over the muscles, but they seemed to be fatigued before they were used. The pulse was small and feeble—98; the temperature, 96.1. The systolic pressure, which had been taken a few days before, had been found to be from 98 to 100. The urine

was normal. The patient could not account for his prostration. He had had no acute illness, no shock; digestion and bowels were normal. As far as he knew he was otherwise in good health. His only complaint was that for several years he had had occasional attacks of precordial pain of mild type, lasting half an hour or an hour and unaccompanied by a sense of anxiety—in short, not bearing the characters of an angina pectoris. The heart seemed to lack what I would call snap; the tones were soft but there were no murmurs. Finding no definite signs by which this condition could be explained, I decided that there must be some fault on the part of the organs of internal secretion, most probably the adrenal; and on the strength of this theory, which strongly appealed to the patient himself, I prescribed suprarenal extract. Recovery was prompt, whether *propter hoc* or merely *post hoc* I cannot say.

Case III.—H. L., aged 37, married, began in April, 1909, to have epileptiform convulsions. Though a history of syphilis was not obtainable, the convulsions ceased under antisyphilitic treatment, and three disfiguring excrescences of the skull promptly melted away. Since then the man has been well except for occasional headaches and attacks of indigestion brought on by imprudent eating. February 10, 1912, without ascertainable cause he felt chilly and had a little nausea. He rapidly became weak and found that even slight exertion exhausted him. His color was pale and sallow; temperature 96.1; pulse 48; the systolic pressure 92. Otherwise examination revealed nothing abnormal; the urine was negative. I ordered suprarenal extract, 5 grains three times a day, and advised the patient to go home. When I saw him again a few days later he felt well, though his pulse was still slow.

Case IV.—Another instance remains to be cited. During my second year in the medical school I had an experience that I remember with great vividness. I was seated one evening at my books, feeling as well as usual, when rather suddenly I found myself growing cold and weak, and had a sense as if my life-forces were ebbing away. I had no pain, only a sense of approaching dissolution. My temperature I found to be 96, and my pulse 46. One who knows the psychology of the medical student can imagine the workings of my mind. I do not recall whether I made any attempt at self-treatment, nor how long I was ill, if ill I was. But I remember distinctly that, contrary to my expectations, I survived. Since then I have not had a similar attack.

Leaving out for a moment the first case, the three others, including my own, have in common a sense of physical weakness amounting to actual prostration, a feeling of coldness, a subnormal temperature, and in two cases slow pulse and low blood-pressure. Recovery was prompt—in the two recent cases within three or four days.

How are we to explain this condition? To say that there was an infection brings the solution no nearer, for what infection is accompanied by persistently subnormal temperature, bradycardia and muscular exhaustion? It is true, during convalescence from typhoid fever, pneumonia, influenza, tonsillitis and perhaps malaria,

one sees at times subnormal temperature and bradycardia; but none of these diseases had preceded the asthenia in my cases. The first patient did have, two weeks before his myasthenic symptoms set in, a febrile attack of two days, but that there was any direct connection between this trivial attack and the other illness is unlikely.

It seems to me that these cases find their readiest explanation in the assumption of some disturbance in the functions of the organs of internal secretion, through which the sympathetic nervous system and the voluntary muscles suffered a change. The chief controller of these two systems, as far as we know at present, is the adrenal, or better the chromaffin system. The functions of this are manifold and complicated, but at this moment two particularly concern us, namely, the angiotonic and the antitoxic. Through the former, vascular tone and blood-pressure are maintained; through the latter, the fatigue products of muscular activity are neutralized. No definite clinical picture has as yet been established of mild temporary insufficiency of these functions. Treatises on diseases of the suprarenal gland hitherto have dealt only with such affections as are fatal in their consequences. By far the largest share of attention has been given to Addison's disease, which nearly all authorities attribute to destructive changes in the adrenal, although a few admit a merely functional disturbance of the gland or of the entire chromaffin system as a basis for the Addisonian symptom-complex.

In the more recent literature, however, in addition to Addison's disease, cases are recorded in which various acutely fatal conditions were at autopsy found associated with destructive changes—hemorrhagic, necrotic, inflammatory—of the adrenals. The latter conditions are distinguished from Addison's disease by the absence of pigmentation and by the shortness of their course. The cases may be classified[2] into several groups:

1. Those characterized by shock, gastro-intestinal symptoms, bradycardia, lumbar pain and death in a few days—a clinical picture somewhat resembling that of acute pancreatitis.

2. The asthenic type, in which the predominant feature is profound asthenia, ending in death within a few days.

3. Cases of sudden death, in which the autopsy shows as the only adequate morbid change a destructive lesion, usually hemorrhagic, of the suprarenal gland.

4. A nervous type, marked by convulsions, coma or delirium, with muscular twitchings.

[2] Lavenson: Arch. Int. Med., August, 1908, II, 70.

Another type of doubtful nature is one characterized by hemorrhage into the suprarenal glands with hemorrhagic eruptions in other abdominal viscera and the skin.

In some cases of so-called acute suprarenal insufficiency, as for instance the interesting one reported by Cooke,[3] the termination only is acute. With a progressively destructive lesion of the glands, tuberculosis for example, there exists no doubt for a long time an insufficiency of mild type which goes unrecognized. Finally, and with apparent suddenness, the function of the gland becomes wholly inadequate and an acute catastrophe ensues. We meet with an analagous condition in Bright's disease, in which a mild uremic state may for days and weeks precede the convulsive explosion.

In Biedl's exhaustive work on internal secretions,[4] I have not found any reference to transitory adrenal insufficiency. Sergent [5] and other French writers believe that such a condition may occur in the course of acute infectious diseases. It cannot be doubted that the glands of internal secretion are affected in acute disease, but the present methods of investigating their function do not give us an adequate insight into the subject. It seems to me highly probable that the postfebrile hypothermia, bradycardia and exhaustion which may follow even diseases of very short duration are in part due to disturbed function of the hormonogenic organs.

I believe that the cases I have reported, especially Cases II, III and IV, are best explained on the view that there was a functional insufficiency of the adrenals by which the body was temporarily deprived of its proper meed of adrenal secretion. Theoretically we might conceive, instead of a deficiency of the hypertensive epinephrin, an accumulation in the blood of hypotensive substances, the existence of which has been predicated by Abelous and Langlois, Pearce and others. But in doing so we increase rather than lessen our difficulties. It is much simpler to blame the adrenals, or perhaps the entire chromaffin system, the *fons et origo* of the substances maintaining the general vascular and muscular tone.

The symptoms of non-fatal hypoadrenalism may be described as those of mild shock—subnormal temperature, great muscular weakness, coldness of surface and low blood-pressure. The pulse is usually slow; the duration variable—from a few days to a few weeks. It is doubtful whether our present tests for epinephrin in the blood are delicate enough to determine the existence of such a state as I have described, but where laboratory facilities are at hand such tests

[3] Cooke: Observations on the Blood-Pressure-Raising Substances of the Adrenals in Acute Adrenal Insufficiency, Arch. Int. Med., January, 1912, IX, 108.
[4] Biedl: Innere Sekretion, 1911.
[5] Sergent: Rev. de méd. int. et de thérap., 1909, p. 807.

might readily be made. Rest and the administration of suprarenal extract—five grains two or three times a day—is the treatment that naturally suggests itself for temporary hypo-adrenalism.

It is more than likely that the first case, in which the myasthenia reached a grave degree, was also dependent on adrenal insufficiency. The "glandular" theory of myasthenia gravis has been advanced by several writers in recent years (Zudemans, Raymond and Massolongo); the tendency at present is to look on the condition as dependent on disturbances not only of the adrenal, but also of other glands of internal secretion. There is still, to be sure, much theory and little fact, but the hypothesis is attractive and may prove fertile.

PERSISTENCE OF THE THYROGLOSSAL DUCT[1]

The patient whom I have the honor of showing to you this evening is a Scotchman, aged 56, married, a mason by occupation. He came to the Dispensary of the University Hospital in the beginning of February of this year, complaining of peculiar pains radiating from the nuchal region to the front of the head. In the course of my examination I found a moist dimple in the median line of the neck, concerning which he gave the following history:

Thirty-eight years ago (he remembers the date exactly; it was two days before the wedding of the Prince of Wales, now the King of England), while playing with another boy, he struck the front of his neck against the other boy's knee. There was no bruise-mark; but on the same day a swelling developed, which opened and discharged a week later. Caustic was applied several times, but the opening never closed from that day to this.

There is more or less constant discharge of fluid, which is usually thin and whitish or milky; sometimes, however, it is thick. He has to wipe the area continually to remove the drop of fluid, which, as a rule, is the size of a pinhead; occasionally, especially when he catches cold, it becomes larger, and may then be as big as a pea. As I have said, the discharge continues all day long, but during the night a crust forms at the bottom of the cavity. The depression is funnel-shaped; 5 mm. transversely and 8 mm. vertically. It is situated in the median line of the neck, above the thyroid gland, and corresponds to the middle of the hyoid bone. The bottom of the cavity is red and moist, and is covered with a mucopurulent discharge, which on microscopic examination consists of fat-drops, a few granular cells, and some epidermal scales. There appears to be a single small opening, into which, however, I was unable to introduce a probe for any distance. The cavity is surrounded by a firm infiltration, measuring 15 mm. in all directions. At the bottom, the depression is attached to the deeper structures; it can be pulled sideways to a limited extent, but cannot be drawn forward, as the skin of the neck and chin can be normally. That the tissues of the depression are adherent to the hyoid bone, is most clearly realized when the patient swallows; the funnel is then seen to deepen markedly, and the surrounding structures are sucked in and drawn up with the hyoid bone, so that the integument below the chin forms a transverse fold over the top of the deepened funnel. During swallowing the depression is nearly 3 cm. in width. There is no pain, and no tenderness to ordinary pressure, but when I picked up the dense tissues around the depression with the forceps and tried to draw them forward, the patient experienced considerable pain. I applied some strychnin to the bottom of the cavity, thinking that the fistula might communicate with the mouth or the pharynx: but the patient did not taste the drug.

[1] Read before the University of Pennsylvania Medical Society, April 19, 1901. Reprinted from American Medicine, June, 1901.

The continued discharge, lasting incessantly for 38 years, suggests that we are dealing with a minute fistula, of the length of which we can form no definite idea. It seems, however, that it extends as far as the hyoid bone.

This is the second case of the kind that I have seen. A few years ago there was a student in one of my classes in the laboratory (he is now a practicing physician in Pittsburgh) who had a fistula similarly placed. It had been cauterized and incised without any benefit, as it would always recur. Eventually, it was, I think, removed. I have not heard whether there has been any return of the discharge.

There can be but little doubt that in our patient the traumatism produced by the blow against the neck was only an incidental cause of the fistula. We may confidently assume that a blind tract of congenital origin existed, the distal end of which was near the surface of the skin. The blow merely served to remove the slender partition-wall that separated this tract from the exterior.

The embryologic studies of His have shown that fistulas in the median line of the neck are usually the remains of the thyroglossal duct of the embryo. The formation of this duct, and the fistula to which it gives rise, can be better understood by a brief account of the development of the thyroid gland. In nearly all vertebrate animals this organ is formed from a central, unpaired rudiment or *Anlage*, and two lateral rudiments. The former appears first, and is an outgrowth from the endodermic epithelium of the ventral wall of the primitive pharynx, in the neighborhood of the visceral arches. It is surrounded by the ridges that are destined to form the base of the tongue, and in its descent remains for some time connected with the root of that organ by a canal, called the thyroglossal duct or canal of His. After its descent it unites with the lateral thyroid masses, which are primarily hollow outgrowths from the endodermic lining of the fourth visceral furrows. The thyroglossal duct begins to undergo atrophy at the fifth week, and by the eighth, is entirely obliterated, its upper extremity being, however, permanently indicated by the foramen cecum, on the dorsum of the tongue.

In some cases the primitive canal does not entirely disappear, and then various anomalies may result. Thus, the canal from the root of the tongue to the hyoid bone—the so-called ductus lingualis—may remain, and may reach a length of 2½ cm.; or there may be a persistence of the lower portion—the ductus thyroideus—which then extends as an epithelium-lined canal from the thyroid gland to the hyoid bone. In that case, the gland is usually possessed of a middle horn, from the apex of which the ductus thyroideus arises. This horn may not be situated in the median line,

but in every instance the upper extremity of the duct has a mesial position. In the case studied by His, the two ducts, although approaching closely to each other (within 5 mm.), were not united, the hyoepiglottic and thyrohyoid ligaments acting as a partition-wall. According to some authors, the thyroglossal duct bifurcates at its lower extremity; this explains the presence, in some cases of thyroglossal fistula, of a double opening on the front of the neck. This was true in two instances reported by Durham.

The thyroglossal fistulas are lined with ciliated columnar epithelium, which is replaced by squamous as the lingual portion of the duct is reached. The opening may be anywhere, from a little above the hyoid bone to the level of the sternum; but in every case the aperture is strictly in the median line. Fistulas opening laterally or fistulas with median apertures and lateral tracts, are probably to be considered as of branchial origin. They have recently been studied in an exhaustive manner by Coplin.

Thyroglossal fistulas move, as in our patient, with the hyoid bone on deglutition, having, therefore, the same characters in this respect as tumors of the thyroid gland. Sometimes the fistula is permeable to injections up to the foramen cecum; this, however, is rare in the adult, since, as already indicated, the continuity of the duct is interrupted at the thyrohyoid membrane. Thyroid-gland follicles, and even accessory thyroids, are often intimately connected with the duct. Accessory thyroid glands may, however, be found independently of a persistent canal; and may be situated above, in front of, behind, below, or even within the hyoid bone. Sometimes the upper portion of the thyroglossal duct persists and is transformed into a tumor composed of true thyroid tissue, springing from the base of the tongue. About two years ago, Dr. H. L. Williams showed me a section of a growth that had been removed from the root of the tongue. On examination I found it to be composed of typical thyroid follicles. Dr. Williams subsequently reported it in conjunction with another case of the same kind.

There is another possible source of cervical fistula, as pointed out by Durham: This is a persistence of the sinus praecervicalis—a cleft formed by the sinking in of the lowermost arches, and disappearing in later embryonal life by a coalescence of its ridges. Its persistence gives rise to fistulas lined with squamous epithelium. A distinction between these two forms of fistula, in the present stage of our knowledge, is to be considered as a refinement; although it is a point of importance that these latter fistulas sometimes communicate with the esophagus.

There are other interesting congenital anomalies associated

with vestigial remains of the thyroglossal duct, such as mucoid and dermoid cysts; but it is unnecessary to discuss them at this time.

Regarding the treatment of thyroglossal fistula, it is evident that only a complete extirpation of the canal with its epithelial lining can bring about a permanent cure.

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REPORT OF A CASE OF TUMOR OF THE HYPOPHYSIS WITHOUT ACROMEGALY [1]

The point of interest in the case we report, or rather the point we wish to bring up for discussion, is the presence of hypophysial disease without any symptoms of acromegaly. We believe, for reasons which will appear later, that acromegaly is due to disease of the hypophysis, and we purpose to use this case, which seemingly combats such an opinion, in an endeavor to explain the absence of acromegalic symptoms in some cases of disease of the hypophysis.

The patient, a white woman, 43 years old, was admitted to the Philadelphia Hospital on July 26th, 1897, on account of complete blindness. Her personal history was vague, and her heredity unknown. The only information that could be obtained from her was that she had been blind five years, and that her ovaries had been removed, by whom and for what reason she could not tell. Dr. Charles A. Oliver found the following ocular condition: O. D., iris dilated fully and irresponsive to light; pupil round; slight horizontal nystagmus; marked post-neuritic atrophy. O. S., iris fully dilated and irresponsive to light; disk still more atrophic from past inflammation than the right.

She was transferred to the nervous wards with a diagnosis of brain tumor. Physical examination revealed little. She was a thin, anemic, blue-lipped woman. Her gait was neither paralytic nor ataxic, but was a little stiff. Rigidity, not very marked, was observed in both legs, especially in the right. The station was good. The knee-jerks were increased, quick and spastic. On the right side ankle clonus was persistent and true; on the left it was abortive; that is, it ceased after three or four irregular contractions. The plantar jerk was present on both sides. Sensibility to touch and pain was normal on the legs, arms, and face. Her answers were so contradictory that it was impossible to determine the condition of the sense of smell. The heart and lungs were normal. Examination of the blood gave red corpuscles, 4,380,000; white corpuscles, 7,800; hemoglobin, 55 per cent. The eosinophiles were much increased. The urine did not contain albumin, sugar, or casts. The mental state of the patient was much more striking than the physical. At first she was simply dull and listless, disinclined to talk, sitting hour after hour with head bowed on the chest, moving only to go to her meals and to bed, answering in monosyllables all questions put to her—in short, seeming to be most content when undisturbed. This condition continued for several months, and then changed.

[1] Written in collaboration with Charles W. Burr, M.D.
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While still remaining ordinarily quiet and self-contained, she became at times most obscenely witty and cynically jocose. Questionable as it may seem to regard jocosity and obscenity as symptoms, they were in truth striking. Whether they were due to mere viciousness or to disease it is not possible to decide, but it is not impossible that they were due to disease, such symptoms having been noted in similar cases. During the last months of her life she became dull and stupid again, and suffered several attacks of coma, coming on suddenly and lasting several hours. She died in coma on the 19th of April, 1898.

The necropsy was made two days after death. The body was well developed and fairly muscular. Rigor mortis was very slight. Post-mortem lividity was marked. An old scar was present in the linea alba. The veins upon the chest were dilated. There was no enlargement of the extremities (hands or feet), or of the face, nor any deformity of the spinal column. There was an enormous deposit of preperitoneal fat five centimeters thick, and the omentum, mesentery, and mesocolon were also very thick with fat. The bladder was distended and projected five centimeters above the symphysis pubis. The liver was small and contracted, and failed to reach the costal margin by five centimeters. There were numerous adhesions in both iliac fossæ, and in the pelvis. The appendix was long, thin, and bound down at its tip to the pelvic wall. The right ovary could not be found. A part of the right Fallopian tube was present and adherent to a coil of small intestines that was prolapsed into the pelvis. On the left side the ovary could also not be found, and no part of the Fallopian tube remained. The round ligament was present. The uterus was adherent to the rectum on the left side. The diaphragm extended to the fourth interspace upon the left side, and to a corresponding point upon the right. There was quite a little bloody fluid in both pleural cavities. The lungs overlapped in front. A little of the thymus gland remained. There was a slight excess of clear fluid in the pericardial sac. The heart weighed 210 grams. The right auricle was slightly distended with liquid blood. The heart was small in proportion to the size of the body. The pulmonary valve was normal. The aorta was distinctly thickened. The interior showed "willow-tree" markings, beginning sclerosis, and some yellowish patches above the sinuses of Valsalva. The mitral valve was thickened, and showed a few yellowish patches. The heart muscle was dull brown, marked by whitish striæ. The cavity of the left ventricle was small, and its wall twenty centimeters thick. Both lungs were edematous, but otherwise normal. The spleen was small, but showed no evidence of disease. The kidneys were somewhat small, and the capsules stripped with difficulty. On section the substance was congested, dark, both pyramids and cortex being purplish red. The cortex was not diminished in thickness, its consistency was slightly increased, and the cut vessels gaped. The liver was small and hard. The calvarium was hard, ivory-like, and the diploe absent. In the middle line in front the calvarium was one-half centimeter thick. On the inner surface it was smooth, the grooves of the blood vessels were fairly well marked, and there were a few Pacchionian depressions. In front of the sella the bone was a little abraided, and the cavity itself was somewhat enlarged. The brain bulged considerably when the dura was removed. The whole interpeduncular space anterior to the mammillary bodies was occupied by a mass about as large as a lemon, on the under surface of which the hypophysis appeared. The tumor filled the space between the

tips of the temporosphenoidal lobes, and was adherent to the membranes over the base. Its anteroposterior diameter was six centimeters, its lateral five and a half, and its depth three centimeters. The hypophysis was one and a half centimeters transversely and one centimeter anteroposteriorly. The optic chiasm could not be discovered. Both third nerves were very much flattened. Anteriorly, the tumor extended a centimeter in front of the corpus callosum. On looking down upon the brain, the corpus callosum was seen to be much arched, with the convexity upward. The corpora striata on both sides, especially the left, bulged into the lateral ventricles. The tumor on section was grayish, not very hard, granular, and apparently not hemorrhagic.

The pathologic diagnosis was tumor of the base of the brain, probably originating in the infundibulum; absence of both ovaries, pelvic adhesions, beginning cirrhosis of the liver, slight interstitial nephritis, osteosclerosis of the skull, hyperplastic sclerosis of the cribriform plate of the ethmoid bone, and edema of the lungs.

Microscopic Examination.—Pieces of the tumor were fixed and hardened in alcohol, imbedded in celloidin, cut into thin sections, which were stained with hematoxylin, hematoxylin and eosin, carmine, and Van Gieson's stain. The tumor is a spindle-celled sarcoma, with a well marked tendency on the part of the cells to an alveolar arrangement. On the surface the tumor is covered by a thin capsule of fibrocellular tissue, which sends short trabeculæ into the growth. This capsule contains a few blood vessels and a number of mast cells, mostly of small size, scattered irregularly through it. The cells of the tumor are large spindle cells with large nuclei, and run in concentric groups, forming large bundles, or whorls, of considerable size. In the center of these the cells are very near together, on account of pressure, and the nuclei appear as if piled upon one another, so that a semblance of giant cells is produced, but no true giant cells are present. The alveolar arrangement referred to is not produced, except just near the surface, by a true stroma, but merely by a vertical grouping of the spindle cells.

Another section which had been carried through what was considered at the necropsy the remains of the hypophysis shows the structure of the latter organ distinctly. We find here small epithelial cells with darkly staining nuclei, closely aggregated, and here and there assuming a tubular arrangement. The tissue evidently represents the remains of the anterior lobe of the hypophysis. The connective tissue is slight in amount, but blood capillaries are abundant and well filled; colloid material is nowhere seen. Directly continuous with the glandular portion of the hypophysis is a small mass of lymphoid tissue, possibly a portion of the posterior lobe of the organ.

In one part of the section the hypophysis is sharply separated from the tumor by a broad band of fibrous tissue; elsewhere no sharp line of demarcation is observable, and in several places long, winding processes of hypophysial tissue are traceable into the new growth. The cells in these long processes show a well marked tubular disposition, are polyhedral, and are accompanied by connective tissue and blood vessels. The processes can be traced for a long distance and are finally lost in the tumor. The tumor is practically free from degeneration.

The nervous tissue included in the section is greatly degenerated; it is loose, alveolar, and resembles in its reticular character mucoid connective

tissue. The condition is well described as cribriform. The ganglion cells have lost their processes and stain indistinctly. There is no hyperplasia of the neuroglia, but in places the number of capillaries is distinctly increased.

To sum up: We have a woman whose sole subjective symptom is blindness, which came on several years before death, and who, under examination, is found to have post-neuritic atrophy in both eyes; who is usually dull and stupid, but at times very bright; who has persistent ankle clonus on one side, some rigidity in the legs and spastic knee-jerks; who has several times become comatose, and finally dies in coma.

The diagnosis of brain tumor with such a combination of symptoms is not difficult and is entirely justified. To locate the tumor is more difficult, and we found it impossible. Thus far in localization we could go; the tumor must be so situated as to encroach upon but not to destroy, nor seriously interfere with, both motor tracts, more especially the right. Had the case been seen earlier the type of hemianopsia characteristic of hypophysial disease might have been present, but when the patient came under observation it was too late. Had it been safe to depend on her statements as to the power of smell, much light might have been thrown upon the matter, but she was entirely unreliable. Post mortem there is found a tumor involving, but not destroying, the hypophysis.

The opinion that acromegaly is due to disease of the hypophysis has rapidly gained adherents, until now it is accepted by the majority of writers. This opinion has not been formed without careful thought and wide and exhaustive discussion of both sides of the question. It is based upon the following evidence: First, that from post-mortem examination.

In Hinsdale's [2] carefully prepared list, numbering fifty-seven cases, and including all admitted by every one to be instances of acromegaly, the hypophysis was diseased in all. In the cases reported by Sarbo, Friedreich and Arnold, and Bonardi, the hypophysis is said to have been normal, but there is some doubt about the correctness of the diagnosis. In William Hunter's [3] case, reported recently, there was vascular hypertrophy of the hypophysis with hemorrhages.

This fact, that in sixty-one cases, including even those in which there is some doubt about the diagnosis, fifty-eight showed disease of the hypophysis, proves that there must be some close relation between the two conditions. It cannot be mere accident. Were it true, as has been claimed, that disease of the hypophysis is merely

[2] Boylston Prize Essay, Medicine, June to September, 1898.
[3] Brit. Med. Jour., March 19, 1898.

a symptom of acromegaly, the lesion of the gland would always be the same, whereas it has been found to vary very much: in some cases being a so-called simple hypertrophy; in others a malignant growth.

Second, the evidence from the clinical history.

In a very large number of cases there are symptoms of tumor of the brain (headache, vertigo, optic neuritis), and in the cases which come early under medical observation, hemianopia of the type indicative of hypophysial disease is not infrequent. Furthermore, the visual symptoms increase with the increase of the bony symptoms, never beginning very late in the disease and often antedating by a considerable time the hypertrophy. The importance of this is that the visual symptoms serve in a rough way to measure the increase in the size of the hypophysis, and consequently the amount of disease.

Third, the argument from analogy with disease of the thyroid gland. The discovery of the functions of the ductless glands is of very recent date. Not so many years ago, had any one said that the thyroid gland stood in any relation to the nutrition of the body, he would not have found any hearers. Today every one admits that myxedema is caused by thyroidal disease. There is then in the known nature of things no reason why hypophysial disease may not cause acromegaly.

Against the view of the hypophysial origin of acromegaly there is the following evidence: First, there may be disease of the hypophysis without any signs of acromegaly. This is undeniably true. Many such cases have been reported. Weir Mitchell's classical case of aneurysm of an anomalous artery of the circle of Willis, often quoted in this connection, has in reality little bearing, for it was reported quite a long time ago, there is no description of the condition of the extremities, and when the brain was received by him it was not in condition for any minute study, The hypophysis is not described. In none of the reported cases known to us has it been shown that the glandular part of the organ was completely destroyed; in not a few no microscopic examination was made, and in others only sufficient to determine the nature of the growth. This is the value of the case that we report. It shows that though, to the naked eye, the gland may appear greatly diseased or indeed destroyed, still it may contain much healthy glandular tissue.

Though we are ignorant whether the hypophysis contains ordinarily more glandular tissue than is needed for the proper performance of its functions, yet by analogy it is highly probable that it does. In all other glands, secretory or excretory, there is

a surplus of tissue, or at least if a part be lost by accident or disease the remainder may do the same amount of work as was done by the entire organ. Nature is a spendthrift, and it is hardly fair to accuse her of niggardliness in the matter of one organ. The importance of a remnant of an organ is well shown in the thyroid. Operative myxedema does not follow the partial removal of the thyroid gland, even if the part left is very small, but does follow when the entire organ is removed. The same thing may be true of the hypophysis: namely, that a small amount of glandular tissue may do the work of the whole, or at least may be sufficient to inhibit excessive growth in the bony extremities. There may be, and probably are, other functions as yet undiscovered, requiring a greater amount of gland for their performance.

Second, the existence of acromegaly without visual symptoms. Dercum has reported two such cases, and there have been not a few others. If these cases come to necropsy and the hypophysis is found normal, their value will be greatly increased.

Third, there is not a single ductless gland in the body that has not been found diseased, and it would be as proper to say that disease of any one of them caused acromegaly as of any other. It is true that all or almost all have been found diseased, but not any one except the hypophysis in any large number of cases. We cannot say of any other one that it was pathologic in fifty-eight out of sixty-one necropsies. Furthermore, each of them is frequently diseased without any sign of acromegaly.

Fourth, the evidence from experimental destruction of the gland. The hypophysis has been destroyed without causing acromegaly (Marinesco, Varsale, Succhi). The acceptance of this evidence assumes the identity of function of the gland in man and dogs. This identity is assumed, not proven. We know little of the function of the gland in man, and less concerning it in other animals. The same evidence would prove that myxedema has no relation with the thyroid gland, for its removal in dogs causes entirely different, non-myxedemoid symptoms. Furthermore, acromegaly may be due to a perversion of function and not to its abolition.

Fifth, the failure of the therapeutic test. No patient has been cured by the use of hypophysial extract. This has manifestly little weight, and no one has laid great stress upon it.

Balancing all the evidence on both sides of the question, we feel justified in believing that acromegaly is caused by disease of the hypophysis, and that for its production the lesion must be complete, i. e., must affect the entire glandular structure.

INFECTIOUS DISEASES

IMMUNITY TO TUBERCULOSIS BY THE INJECTION OF EXTRACT OF HEART MUSCLE *

The article by Professor Elliott C. Prentiss in the issue of *Science* for July 31 prompts me to make a brief report of some experimental work undertaken a goodly number of years ago, but for various extraneous reasons never carried to completion. In my work as pathologist to the Philadelphia General Hospital and to the University Hospital, I was struck by the rarity, in fact, the virtual non-occurrence, of tuberculosis of the heart muscle. This seemed to me to have but one of two explanations: (a) that the activity of the intracardiac circulation was such that the tubercle bacillus had no chance to lodge; (b) that the immunity of the myocardium was due to a biologic property, to some antituberculous substance in the muscle. Assuming that the latter was the more probable reason, I undertook a series of experiments in which I made extracts of beef's heart and mixed the filtrate obtained with virulent tubercle bacilli and injected the suspension into guinea pigs. In this work I had the help of Dr. Karl F. Meyer, now of California. It seemed to me that the material had a distinct inhibitory influence. Unfortunately, Dr. Meyer left Philadelphia for his new field, while my own work in clinical medicine and teaching came to absorb nearly all my time. I have proposed a repetition of the experiments to several men whose facilities and opportunities for research of this character were greater than my own, but so far no one has begun to work actively upon the problem.

If the immunity of the heart muscle and of the skeletal muscles is, as I believe, biological rather than mechanical, then it may be possible to extract an active agent by suitable means. In my own experiments pieces of heart muscles were cut up into small fragments under aseptic conditions and the fragments put into a grinding machine with china balls. The juice was then pressed out under great pressure and finally filtered through a Berkefeld filter. The filtrate, a golden colored liquid, was then used for the experiments. It is highly probable that the procedure could now be greatly simplified.

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THE CELLULAR FACTOR IN INFECTIOUS DISEASES[1]

The prevailing conception of an infectious disease is that it is due to the poison of a parasitic micro-organism. This conception seems to me inadequate, for it leaves out of account another and to my mind very important source of toxemia, at least in some of the infections, namely, the proliferation and disintegration of myriads of new cells.

Practically all writers have hitherto attributed the constitutional symptoms of infectious diseases to bacterial poisons, either exotoxins, i. e., secretory products, as in diphtheria and tetanus, or endotoxins—poisons inherent in the bacterial bodies, as in typhoid fever and tuberculosis. And many of the local changes likewise, such as the degeneration of parenchymatous organs, are ascribed to the same cause. Take diphtheria, for example: the general symptoms—fever, prostration, albuminuria, delirium, anemia—are supposed effects of the toxins; so are the circulatory changes, the cardiovascular weakness. The swollen glands and the false membrane formation are attributed to the local action of the toxin.

With regard to typhoid fever, the views are very much the same. The so-called constitutional symptoms of the disease—fever, headache, prostration, delirium, carphologia, intestinal tympany, and albuminuria—are attributed to the presence in the blood of the endotoxins of the typhoid bacillus. These same poisons are held responsible for the intestinal lesions, the changes in the lymph glands, the bone marrow and spleen, and the parenchymatous degeneration of the heart, liver, kidney and voluntary muscles.

In tuberculosis the symptoms are ascribed either to the tubercle bacillus, that is, to its poison, or to a mixed infection of this micro-organism with pyogenic bacteria. In other words, our present conception of the infectious diseases emphasizes solely the toxemia produced by the causative parasite. Is that view adequate? Is it correct? Before answering these questions, permit me to go back a little in time. A decade and a half ago while actively engaged in

[1] Read before the College of Physicians of Philadelphia, with lantern demonstration, Dec. 2, 1914.

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pathologic work, I chanced to make an autopsy at the University Hospital in a case of general carcinomatosis, the symptoms of which had closely resembled an acute infectious disease, the last phase being a comatose state. At the autopsy the peritoneum was found everywhere dotted with small whitish nodules, indistinguishable on naked eye examination from miliary tubercles. The discovery, however, of a primary cancer in the rectum and the characteristic histology established the carcinomatous nature of the lesions.

About the same period I had under treatment a man with miliary tuberculosis in whom the disease was with difficulty distinguished from typhoid fever. He died at the end of an acute illness of three weeks' duration, the autopsy revealing everything densely peppered with equal-sized, firm, gray tubercles.

These two cases made a profound impression upon me—clinically so similar, etiologically so different, and the second so much like typhoid fever. I concluded that the three diseases must have something in common. The slightest acquaintance with pathology shows that the most striking thing they have in common is a tremendous cell proliferation. In a paper written at the time (in 1899) I made these cases the basis of an hypothesis which in its essential features is the same as that I wish to present here. Permit me to quote a few lines from this juvenile essay.[2]

> The death in miliary tuberculosis cannot be explained by the destruction of tissue or even by the invasion of a vital part by the tuberculous process. The reason always given is that it is due to toxemia, through poisoning with the products of the tubercle bacillus. I would not deny that the bacillary poisons play an important role, but attention, so far as I know, has not been called to the part taken by the myriads of new cells that are added to the body in the course of two or three weeks. When we reflect that every living cell forms metabolic products, that cell multiplication is probably always accompanied by the excretion of certain materials, we must conclude that during the formation of the countless host of tubercles, with their infinite number of cells, a large quantum of metabolic substances is thrown into the circulation for the system to deal with as best it can; and when, under the influence of the bacillus, some of the cells break down, more soluble matters are washed into the blood. It seems but reasonable to conclude that the body cannot rid itself of that enormous quantity of metabolic products, even if this material were normal in character, and if it is, as we may justly assume, not normal, then the result can only be a profound intoxication. Add to this "metabolic toxemia," as I would call it, the bacterial toxemia produced by the bacilli, and the cause of death becomes clear.

For the moment I will leave out of consideration the carcinoma case and will confine myself to a discussion of miliary tuberculosis and of typhoid fever.

[2] Riesman, D.: Philadelphia Med. Jour., Feb. 4, 1899.

A miliary tubercle consists of a vast aggregation of epithelioid cells, together with some giant cells and many lymphocytes—cells for the greater part if not altogether newly formed in response to the stimulus of the tuberculous poison. The number of cells in a good-sized tubercle is theoretically not beyond computation, but I know of no reliable estimate and for practical purposes the number is infinite. With regard to the tubercle bacilli, their number in a tubercle probably varies, but to all intents and purposes is also uncountable. When we consider the larger tuberculous areas, as in caseous pneumonia, both the cellular and the bacterial quantities must be expressed by the sign for infinity. I do not know how long it takes a tubercle to form, but it would seem that the cells multiply nearly as fast as the bacteria. In the course of two or three weeks there are thus added to the body in a case of miliary tuberculosis a quantity of new cells wholly beyond the power of the mind to conceive. These cells grow by utilizing the elements of the blood, chiefly the big protein molecule. In their period of active multiplication they take from the blood-stream what they need and cast back into it the unused remains. If the new cells are native to the place where they are formed then the cast-off products of their activity may be normal, though it is possible that they are formed in such quantity in a short time that the power of the system to deal with them is overtaxed. If we assume that since the cells are formed under pathologic conditions, they are not exactly like the old cells of their locality, then the possible harm done in their growth by abstraction and addition is even more readily conceived.

There is, however, another and probably more important factor to be taken into account in determining the fundamental causes of the symptoms of miliary tuberculosis. The newly formed cells soon die, by undergoing a peculiar change known as caseous degeneration. It is interesting to know how this is brought about. Some have ascribed it to the poison of the tubercle bacillus, others to starvation through inadequate circulation, and still others have held that the cells might be *ab initio* poorly endowed. The real explanation for the death of the cells is probably to be found in the newer theories of ferment action, especially in the theory of parenteral digestion advanced by Abderhalden. Abderhalden, as is well known, finds that if a foreign substance, let us say a foreign protein, which, were it introduced through the alimentary canal, would be digested there, is introduced under the skin or into the blood or anywhere except into the digestive tract, it excites at once the formation of ferments that break up the foreign protein into its so-called "building-stones." This dissolution of the protein by the appropriate

ferments is a true digestion and since it occurs outside of the alimentary canal it is called *parenteral digestion.* It is possible by physicochemical methods and by certain optical tests to demonstrate the presence of these proteoclastic ferments through their resultant products in the blood. The recent reports by Drs. Sailer, Schnabel and Williams have brought out the main points of the Abderhalden theory.

I have looked in vain in the English literature for a satisfactory rendition of the important terms created by Abderhalden to elucidate his theory, and have therefore endeavored to meet this lack by a series of new terms as shown in the following tabulation:

Abderhalden Term	Proposed Term
Körpereigen [3]	Idiosomatic
Körperfremd	Allosomatic
Bluteigen	Idiohematic
Blutfremd	Allohematic
Zelleigen	Idiocellular
Zellfremd	Allocellular
Arteigen	Idiogeneric
Artfremd	Allogeneric

A word about the derivation of these terms, in particular the prefixes, may not be amiss. "Idio" is derived from ἴδιος, own, proper, peculiar (οἱ ἴδιοι, friends). "Allo" comes from ἄλλος, other, foreign. Idiocellular and allocellular are, I confess, hybrids, but they are more euphonious, I think, than idiocytic and allocytic.

To return to the tubercle: As stated, the cells of the tubercle undergo a sort of digestion which in the ordinary case does not go on to complete solution of the tubercle. The failure of digestion to be complete, Jobling and Petersen [4] attribute to the presence of soaps which act as ferment-inhibiting substances. Under certain conditions not clearly understood—Jobling and Petersen believe that mixed infection is necessary—complete solution occurs with the disappearance of the tubercle. This is proved clinically by indubitable cases of cured miliary tuberculosis of the meninges and by the proved disappearance of even large tuberculous foci and masses in the lungs and peritoneum, In the removal of some of the products, phagocytes may be active; but the digestion itself is a chemical process.

We have then in tuberculosis myriads of cells undergoing parenteral digestion and in consequence throwing into the blood products that if not qualitatively are at least quantitatively abnormal. It is my belief, therefore, that in acute miliary tuberculosis and indeed

[3] Gavronsky and Lanchester (Defensive Ferments of the Animal Organism, New York, 1914) in their otherwise very satisfactory translation of Abderhalden's book, use the rather cumbersome terms "in harmony with the body" and "out of harmony with the body" for the words Körpereigen and Körperfremd.

[4] Jobling and Petersen: Jour. Exper. Med., 1914, xix, No. 4.

in all other forms of tuberculosis, a large share, not yet measurable, in the production of the symptoms must be given to the substances liberated by the living and dying pathologic cells.

I will now pass on to typhoid fever. I may say at once that, in general, what I have said of tuberculosis holds true of this disease. The typhoid bacillus enters the body through the intestinal canal, gets into the intestinal lymphoid tissue, into the lymph glands, the bone marrow and the spleen and provokes in all of these places, in an exceedingly short space of time, a truly colossal proliferation of cells. I exhibit here several specimens of intestines in which Peyer's patches reveal themselves as large fleshy masses. The normal spleen weighs about 200 grams, the typhoid spleen probably five or six times as much. Even if some of this additional weight is blood, because of active congestion, the greater part is constituted by new cells developed in the course of a week or ten days.

The lymph glands of the mesentery are normally scarcely appreciable to sight. In typhoid fever they may be as big as walnuts. When we contemplate it, is not this increase in cells staggering to the mind—an increase quite on a par with the stupendous multiplication of the bacteria. This extraordinary cell proliferation is achieved by complicated processes in which, as Reichert [5] has just shown, the cells convert the stereo-isomers of the blood into their own specific proteins. The conversion involves such tremendous cleavages and reconstructions that as mere manifestations of dynamic energy, they may be compared to the manifestations of radio-activity.

Adapting a further thought from Reichert, I might say that the typhoid bacillus, after entering the body, disturbs the physiochemical equilibrium and initiates a series of reactions that go from step to step until the end of the process, a physiochemical equilibrium which is either recovery or death, is reached. The beginning of the process—the first step—absolutely and inevitably determines the end, a sort of predestination not dreamt of in John Calvin's philosophy. All the changes from the liberation of the typhoid poison to complete autolysis of the newly formed cells are produced by the action of appropriately geared ferments. These changes are all connected and in their totality they constitute the disease typhoid fever. Viewed from this aspect, the symptoms of typhoid fever are a composite of the bacterial and the cellular toxemias and are not the result of the typhoid toxemia alone.

Naturally it is difficult at this time to say what part of the symptomatology of typhoid fever is bacteriotoxic and what part is cellulotoxic, nor have I any clear idea how the problem is to be

[5] Reichert: Science, Nov. 6, 1914.

solved. Perhaps the Abderhalden test, employing spleen, bone marrow and lymphoid tissue as substrate, may show corresponding ferments in the blood. While that demonstration would not *ipso facto* be proof of toxic action, it would open the way to further research.

Pneumonia is another disease in which the bacterial toxemia has been overemphasized to the exclusion of everything else. It seems to me not at all improbable that some of the general symptoms are due to the exudate, independently of the bacteria.

Friedrich Müller and later Flexner [6] showed that the resolution of the exudate—the autolysis—is a fermentative process. Why may not active substances be liberated in this process, inasmuch as autolysis is an ideal example of parenteral digestion? It seems to me quite probable that the crisis is due to this factor rather than to bacterial antibodies. A study of the amino-acids in the blood, and animal experimentation with extracts of pneumonic lung, may help to solve the problem.

If anyone sufficiently interested will think over the remaining bacterial diseases, other examples of cellular toxemia will suggest themselves. There are, for instance, the ordinary pyogenic infections in which leukocytic infiltrations occur outside of the blood vessels. These infiltrations undergo digestive autolysis, whereby active substances may be turned into the circulation. The so-called Fochier's abscess (*abscès de fixation*) illustrates this possibility in an empiric way. That leukocytes may be active in the body for which they are *körpereigen*—idiosomatic—is shown by the recent observations of Moreschi [7] and of Rotky.[8] Both found that the leukocytes in leukemia destroy the power of agglutinin formation in typhoid fever and other infections. The effect of the Roentgen ray on the spleen in leukemia and other diseases, an effect manifesting itself by fever, prostration and metabolic changes, is another evidence of the possibility of cells from the individual's own body, in other words, idiosomatic cells, developing toxic power. It may also not be irrelevant to mention that Krehl [9] attributes the fever frequently noticed in pernicious anemia to elements derived from the disintegrating red blood corpuscles.

The interesting observations of Flury [10] are also in line with my hypothesis. Flury believes that the symptoms of trichinosis are in part due to the trichinae acting mechanically and to a poisonous substance which they contain; in part, however, to the chemical

[6] Flexner: University of Penn. Med. Bull., July-August, 1903.
[7] Moreschi: Ztschr. f. Immunitätsf. u. exper. Therap., 1914, xxi, 410.
[8] Rotky: Zentralbl. f. inn. Med., Oct., 24, 1914, No. 43.
[9] Krehl: Pathologische Physiologie, Ed. 8, Leipzig, 1914, p. 145.
[10] Flury: Arch. f. exper. Path. u. Pharm., 1913, lxiii, 164.

products that arise from the degradation of the invaded and damaged muscle tissue of the host.

With regard to malignant disease, the case I mentioned earlier in my essay finds a fairly satisfactory explanation if we assume that the theory or hypothesis of "cellular toxemia" is correct and of general application.

I have no doubt that the thoughts here expressed have in some form occurred to other men; yet I have looked in vain in medical literature for any allusion to the cellular factor in disease, apart of course from any local effects. The splendid Traité de Pathologie by Bouchard and Roger is, as far as I have been able to determine, entirely silent on the subject. It is true reference is made to the action of the lymphatic glands in infectious diseases, but chiefly in their mechanical relations as filters, or as I would call them, barrier-forts, as distributors of infection and as sources of phagocytes, not at all to the possibility that the products of the lymphoid cells, living or dead, may contribute an active "something" to the circulation.

On the basis of the theory or hypothesis here advanced a new classification of bacterial infections suggests itself. We may make two great classes:

A. The productive infectious diseases, characterized by cellular proliferation.

B. The non-productive infectious diseases, not so characterized.

To the first class belong tuberculosis, typhoid fever, and pneumonia.

In pneumonia the cells of the exudate may not be all newly formed. They may have been called forth from the cell depots in the blood and elsewhere. They are, however, new in their pulmonary site and in the Abderhalden sense are out of place.

To the non-productive bacterial diseases belong diphtheria and tetanus.

A closer study of this classification reveals an extremely interesting point, namely, that the infections classed under A, that is, the productive infectious diseases, are all due to bacterial endotoxins, or, in the sense of Vaughan, to split proteins, while those in Class B, the non-productive infectious diseases, are due to the soluble toxins and not to poisons contained in the bacterial bodies. Whether this is a general biologic law, I do not know.

In conclusion, I beg to express the hope that men devoting themselves to research, if they find anything suggestive in the hypotheses advanced, will test them by the experimental method.

COCCIDIOIDAL GRANULOMA [1]

I. Review of the Clinical Data with Report of a Pennsylvania Case

Coccidioidal granuloma is a disease that must be differentiated from tuberculosis, blastomycosis and various lymphatic diseases. The diagnosis, in any case, must rest upon the isolation of the organism in culture and in tissue. The geographical distribution in this country is rather limited, the majority of cases having appeared in California. The present case is the first one to be reported in Pennsylvania.

Case Report

The patient, an American boy aged five years, who had lived in the east all his life with the exception of a two-months' visit to New Mexico, was placed under the care of one of us (D. R.) because of a long-continued low fever. Aside from hayfever and asthma affecting two members of the family, there were no other chronic familial diseases that would have a bearing on his illness.

The boy was perfectly healthy until the end of the fourth year when (in March, 1923) he had what was considered to be intestinal influenza. This was characterized by intermittent diarrhea, weakness, pain and fever. This illness lasted three months and was followed by a persistent night cough and slight fever. From that date on, the posterior cervical and right axillary lymph nodes were enlarged. In September, 1923, the cough become worse and the fever increased. At this time a diagnosis of pneumonia was made. After recovery from this acute illness, he had a bilateral otitis media necessitating puncture of both ear drums. The temperature then became normal and remained so until November, 1923, when he had a severe cold, possibly a bronchopneumonia, the acute symptoms lasting two weeks. The tonsils and adenoids were removed late in November, 1923. In spite of a gain of two or three pounds in weight and contrary to expectations, another febrile cold set in about

[1] Reprinted from the American Journal of the Medical Sciences, August, 1927, No. 2, vol. clxxiv, p. 151.
Written in collaboration with Florence E. Ahlfeldt, M.D.

Christmas and persisted up to the time the boy came under observation in January, 1924.

At this time the physical examination showed a large head, rather deep set eyes, with dark circles beneath. The tongue was slightly coated; the teeth in fair condition. There was no tenderness over the mastoid area. On the right side of the neck there was a mass of enlarged glands. Another gland, the size of a large walnut, was found at the inner end of the left clavicle, and above this a smaller gland. Posteriorly, one or two were found below the hairline on the left side, outside the border of the trapezius muscle. The right sternoclavicular joint was unduly prominent. The heart showed sinus arrhythmia. At the apex of the left lung the breath sounds were harsh but there were no rales. The spleen was not palpable. The liver extended from the fifth interspace to a little beyond the costal border. The knee jerks were present; there was no Babinski reflex; the plantar reflex was active.

Further Course. January 22, 1924: The patient is about the same. The temperature during the interval has ranged from 99° to 100.4° F., and was distinctly higher on rainy days. Cough occurs only at night. There has been one slight nosebleed. Some engorged veins are visible on the upper chest; the tactile fremitus is diminished over the left upper lobe. No particular change in respiratory sounds is noticeable but a few rales are heard at the left apex.

January 25: On this day a cervical gland was excised at the University Hospital by Dr. E. L. Eliason, and the specimen sent to Dr. Herbert Fox for diagnosis.

February 25: Since the previous examination the temperature has continued to be hectic, ranging from 102° to 103° F. in the afternoons and being normal or nearly so in the mornings. The cough has been more persistent and has become brassy. Wheezes are sometimes heard at night. The patient appears more tired. A fluctuating point has developed under the cervical scar. The mass of glands in the neck has grown to the size of half an apple. There is no undue venous engorgment. The breath sounds are a little rough. The liver and spleen are not enlarged.

March 8: The patient is distinctly worse and has pain in the left groin and the right chest. He is restless and not eating well. Two swellings have developed on the scalp. The glands in the neck do not appear so large but on percussion the mediastinal glands seem large. In the left pleural sac there is apparently an effusion.

April 8: The patient lies constantly on the left side; breathing is rapid. There is considerable abdominal pain and distention. An abscess on the top of the head is discharging a viscid light brown

material. The upper chest is dull on both sides. Posteriorly, over the middle of the left chest there is a large, soft, not tender, fluctuating swelling. The breath sounds over the left chest are bronchial; the tactile fremitus is greatly diminished.

April 13: The condition is no better. There is a great deal of abdominal distention.

April 17: After tapping the left chest the child seemed better for a day or two, then he became more distressed than before. The cough is hard and croupy. The left chest has filled again with fluid. Posteriorly there are three or four separate masses, the largest being the size of a hen's egg. All of these fluctuate. The abdomen is greatly distended, the liver large and depressed. Across the upper chest, extending from the sternum nearly to the shoulder on the left and not quite so far on the right, is an area of dullness over which the breath sounds are harsh but not bronchial. The reflexes are normal.

May 1: Dr. Eliason operated on the patient for multiple abscesses, one in the scalp, one in the neck beneath the scar of the cervical adenectomy, and one located on the left chest posteriorly. Local anesthesia was used. The same type of viscid "café-au-lait" pus was found.

May 2: The patient who had grown steadily weaker died today.

During the course of the illness arsenical remedies and iodids were administered with no relief. Alpine light was used by Dr. Percival Nicholson and was also without any alleviating effect.

Laboratory Findings. *Blood Count.* January 11, 1924: Hemoglobin, 82 per cent; red blood cells, 3,260,000; white blood cells, 9080; polymorphonuclears, 61; lymphocytes, 36; large mononuclears, 2; transitionals, 1. January 26: Hemoglobin, 70 per cent; red blood cells, 4,650,000; white blood cells, 22,800; polymorphonuclears, 70; lymphocytes, 7; large mononuclears, 6; transitionals, 3; eosinophils, 12; basophils, 2.

Coagulation Time. January 25, 1924; nine and five-tenths minutes.

Urinalysis. Occasionally there was a faint trace of albumin but no other abnormal finding.

Fractional Gastric Analysis. No lactic acid or occult blood was found.

Fasting.	Free HCl.	Total acid.
1	46	67
2	47	67
3	26	64
4	22	54
5	27	60

Roentgen ray, by Dr. Henry K. Pancoast.

January 18: "The lungs are negative. There is a very extensive glandular enlargement or neoplasm involving the mediastinal space."

February 26: "The mediastinal shadow has increased considerably since the previous examination."

Biopsy. Microscopic examination of a cervical gland was made by Dr. Herbert Fox. "Section of gland shows a chronic inflammatory process. It is tuberculous in the sense that there are areas of granulation tissue with many giant cells. Three structures resembling oïdiomyces were found in the giant cells. The histology is comparable to that described for blastomycosis or oïdiomycosis."

February 12: "Further study has revealed many of the forms described in the first report, including one showing internal sporulation but none showing budding or growth into mycelia."

Diagnosis. Coccidioidal granuloma.

Bacteriologic Report. Smears from the nodules on the scalp and from the chest fluid showed the typical organism and produced growth on culture.

Cultural Studies. Cultural studies of the organism as determined by growth on various media gave the following results:

Glucose agar, 2 per cent; acid, 1 per cent. A white fluffy growth is visible on the second day. Aërial hyphæ are produced, which give the surface the appearance of whiteness of dry snow. The hyphæ penetrate into the medium. About the fifth day the edge of the medium becomes discolored and of a brownish tinge.

Potato: There is abundant growth and a brownish discoloration at the edge of the medium on the fifth day.

Sugars: No fermentation.

Broth: Good growth. On the third day a membrane is formed over the top and flakes are seen in the broth.

Hanging drop: From the broth culture a hanging drop shows branching hyphæ, or mycelia, which eventually form an intricate meshwork. At the ends of the mycelia are seen club-shaped forms. No spores are seen nor is there any budding.

The Organism in Tissue. The form is distinctly spherical, 15 to 40 μ in diameter. It has a double-contoured membrane or capsule which contains granular, or vacuolated, or segmented protoplasm. Between the protoplasm and the capsule there is an area which does not take the stain. At times one sees the spherical bodies filled with spores. Budding has never been seen. The organism stains well with the following stains: Delafield's hematoxylin-eosin, methylene blue and eosin, Gram's and iron-hematoxylin.

Animal Experimentation. The disease was successfully reproduced in guinea pigs and rabbits by intravenous, intraperitoneal, and subcutaneous inoculations. Pin point nodules were found in the lungs, spleen, liver and testicles. The typical organisms were seen in the tissue sections and were recovered in cultures from various organs. Therefore, the bacteriologic and pathologic findings establish the diagnosis of coccidioidal granuloma.

Review of the Clinical Literature. We are able to find reports of 87 cases. It is a striking fact that the majority of the cases have occurred in inhabitants of California or in persons who had previously lived in that state, and especially in the San Joaquin Valley. Of a total of 78 cases, where the residence was stated, 70 occurred in California, and of these 19 were from the San Joaquin Valley and 51 from the remainder of the state.

The disease seems to affect chiefly the male sex, only 6 of the 87 cases occurring in the female sex. Race appears to play no part. As to the occupation we find that 19 were farm laborers, 5 were cattle men, and 5 railroad workers. Single cases have occurred in nearly all trades and professions. In respect to age we find that of 76 cases where the age was known, 41 were between twenty and forty years, and 8 were in children of less than ten years.

Clinical Types of Coccidioidal Granuloma. Clinically there are several types of the disease, yet the distinction is not clearly cut. One type tends to merge into another as the disease spreads throughout the body. Regardless of the type the general symptoms are loss of weight and strength, anorexia, hectic fever, sweating and a tendency to lymphatic involvement. If the lesion is localized and remains superficial the disease may run a very chronic course, even from ten to fourteen years. As soon, however, as the disease becomes systemic the course becomes more acute and is fatal in a few weeks or at the most months. The most common types found are those involving the respiratory tract, the osseous system or the skin. Aside from the general symptoms described, special symptoms pertaining to the particular tissue involved are observed. Skin lesions are often followed by local joint or bone lesions.

In the respiratory type the differential diagnosis must be made from pulmonary tuberculosis, pneumonia and empyema. The osseous type might easily be confused with bone tuberculosis, osteomyelitis, and arthritis. The skin lesions simulate lupus vulgaris, blastomycosis, actinomycosis, sporotrichosis and septicopyemia.

In rare instances the initial lesion is found in the central nervous system, the gastrointestinal tract or in the lymphatic system.

When the nervous system is involved the differential diagnosis must be made from tuberculous meningitis and epidemic meningitis. In the gastrointestinal type typhoid fever must be ruled out. The lymphatic type must be differentiated from lymphatic leukemia, Hodgkin's disease and lymphosarcoma. The final diagnosis rests entirely on the discovery of the organism both in culture and in tissue.

Differential Diagnosis. The points to be stressed in the differential diagnosis from blastomycosis are: In coccidioidal granuloma the skin lesions are generally secondary, while in blastomycosis they are generally primary. Blastomycosis tends to remain chronic and is considerably relieved by large doses of potassium iodid. Blastomycosis may sometimes become generalized and there are several instances reported in which the meninges were involved. Just as coccidioidal disease is most common in California, so blastomycosis occurs most frequently in and about Chicago. It is possible that a greater local interest in the disease accounts for this. Blastomycosis is apparently carried only by the blood stream while coccidioidal granuloma may spread both by the blood and the lymph channels. In blastomycosis budding is seen both in cultures and in the smears from the affected tissues.

Coccidioidal granuloma, blastomycosis, as well as the other fungoid diseases, should be thought of: (1) If the sputum in a case of chronic pulmonary disease does not show tubercle bacilli on repeated examinations; (2) if the patient has lived on the Pacific slope.

In all pulmonary cases not typically or definitely tuberculous, the sputum should be cultured on various media, especially glucose agar, for other organisms than the tubercle bacilli, for the coccidioides, the streptothrix and other fungi and yeasts.

Whenever the lymph nodes are enlarged in typical cases a gland should be removed for biopsy; part of it should be used for culture and part fixed for staining. With the free intercourse that obtains in this country among the citizens of all the states, it is improbable that blastomycosis is limited to the environs of Chicago and coccidioidal granuloma to the San Joaquin Valley of California.

Treatment. No drug that has been used thus far has been of any help. Roentgen ray exposure is thought to have relieved some of the bone lesions, especially if the treatment was applied after amputation. The only real cure occurred in cases in which the lesion had been entirely excised while it was local. No generalized case has ever recovered. Of the reported cases, 11 have been benefited by surgery.

Abstract of Cases from the Literature.

CASE I.—Wernicke (1892). The lesions consisted of nodules in the skin which disfigured the nose and the cheek. There were masses in the left groin, in the calf and the buttock. Wernicke described the organism he found in the granulation tissue and lying free "light yellow masses with a glistening shell." These bodies seemed to have granular or globoid interior but not a distinct nucleus. When fixed the interior was not filled out to the capsule. Some contained daughter cysts.

CASE II.—Gilchrist and Rixford (1896). A male, aged forty years, a manual laborer on trams and about docks in San Francisco and a native of Fayal in the Azores; he came to California in 1886. The skin lesions on the back of his neck and on his forehand first appeared in 1885. He came to the hospital in 1893 and at that time the lesions had extended to both upper eyelids, the nose, cheeks, lips, left ear and dorsum of the right hand at the base of the index finger. It is interesting to note that the mucous membrane of the mouth, nose and conjunctiva were more resistant. The disease entered the orbits without apparently affecting the conjunctiva. In February, 1894, the lymph glands of the neck began to swell and fluctuate. The temperature became intermittent. The patient developed a cough which became steadily worse. The left tibia became involved and the left testicle became abscessed. It was thought that the patient had contracted tuberculosis. The duration was nine years. Upon autopsy, lesions were found in the skin, lungs, diaphragm, peritoneum, spleen and lymph glands. Gilchrist described the organism and called it a protozoan. Cultures were not successful but some of the animal inoculations were.

CASE III.—Rixford and Thorne (1894). A male, Portuguese, aged thirty-three years, laborer and saloon keeper, who had lived in California for fourteen years, chiefly in the San Joaquin Valley. On June 1, 1894, the patient had hematemesis and complained of weakness. About five weeks later he observed blood in the urine and some reddish spots on his forehead, left arm and breast. The eruption was painful. The patient entered the hospital in August. The cervical and inguinal glands became involved. The duration was one month. There was no autopsy but the biopsy showed the characteristic organism. Animal inoculation was successful. There is no report in regard to the culture.

CASE IV.—Ophüls and Moffitt (1900). A male, aged nineteen years, farm laborer, born in the Azores, entered the hospital, January 26, 1900. The symptoms began in December, 1899, with a chill. A few days later the left pleura was tapped and one gallon of clear fluid was withdrawn. The temperature became irregular. The joints became involved. The cervical glands became enlarged and tender. The patient developed a cough with sanguinous sputum. He died, February, 1900 (two months' duration) with a diagnosis of septicopyemia. The autopsy showed lesions in the lungs, diaphragm, lymph glands, spleen, kidney, liver and bone. The characteristic microscopic and cultural findings were obtained.

CASE V.—Montgomery (1900). A male, German, aged twenty-one years, telegraph operator, came to California at the age of three years. The symptoms began with cough in July, 1898. He came to the hospital in April, 1899, with a diagnosis of pulmonary tuberculosis. The patient

had skin lesions, two on the scalp, eight on the face and two on the forearm. The cervical lymph glands became enlarged. He suffered from weakness, night sweats and loss of weight. The duration was ten months. Autopsy showed lesions in the lung, liver and in the skin. The characteristic microscopic and cultural findings were obtained. Animal inoculations were not successful.

Case VI.—Montgomery, Ryfkogel and Marrow (1903). A man, a native of Switzerland, aged fifty-four years, who worked on the ranches and as a miner, came to California at the age of seven years. In 1895 he noticed a gradual enlargement of his left hand and forearm. In 1896 the left leg and ankle began to swell. In 1899 an eruption appeared on his chest. In 1900 the eruption had spread to the left forearm, hand, neck and ears. His general health was good until December 15, 1901, when he became weak, had anorexia and pain in the temporal region. The duration was six years. Autopsy showed lesions in the lungs and in the skin. The characteristic microscopic and cultural findings were obtained. Animal inoculations were successful.

Case VII.—Gardner (1904). A man, aged thirty-two years, Swede, worked on a ranch at Newman, came to California in 1895. The symptoms began in 1900, when the patient sprained his right ankle. The foot became swollen and painful, and an abscess developed on the dorsum of the foot. The abscess was opened and considerable necrosed bone and pale granulation tissue was removed. The lymphatic glands in the right groin became enlarged. The foot was amputated and the inguinal glands were removed. The characteristic microscopic and cultural findings were obtained.

Case VIII.—Wolbach (1904). A female, age not stated, who had lived in Mexico and California. The patient complained of eczema with intense itching, frequent boils and chronic nasal catarrh. In 1903 she had two swellings on her head, forehead and mastoid process extending through the bone and stopping at the dura. The sores were curetted and cleaned. The characteristic microscopic and cultural findings were obtained.

Case IX.—Ophüls (1905). A man, German, age not stated; occupation not stated, was admitted to the hospital, May 8, 1900, in an unconscious condition. He was breathing stertorously. There was a slight paresis of the muscles of the right side of the face. The extremities were rigid. There was no other paralysis. The duration was five days. Autopsy showed that the pia mater at basis of the brain and in the sylvan fissure was diffusely infiltrated with pus and submiliary yellow nodules. There was a little turbid fluid in both ventricles. The characteristic microscopic and cultural findings were obtained.

Case X.—Ophüls (1905). A male, Japanese, age not stated, was employed by Santa Fé Railroad. He had a chronic ulcer of the right foot just below the ankle. The femoral and the inguinal lymph glands became involved. The diagnosis was made through biopsy.

Case XI.—Ophüls. (1905). A man, aged nineteen years, a canner, had been in San Joaquin Valley for twelve years and one month before he came to the hospital in September 23, 1901. Four weeks previous to his entering the hospital he had attacks of irregular fever with violent chills. The patient developed the symptoms of a severe, unusually chronic meningitis, and had much headache, marked rigidity of the neck, tenderness of the

cervical vertebra and constipation. The duration was three months. The autopsy showed lesions in the lung, kidney and adrenal; also basilar meningitis with many tubercles in the Sylvan fissures and very extensive chronic inflammation of the pia mater of the spinal cord. The characteristic microscopic findings were obtained. There was no report on the culture.

Case XII.—Ophüls (1905). A German, aged sixty-three years, worked as a baker and as a mill hand in Oakland and Sacramento. He came to the hospital with enlarged, suppurating cervical glands. In 1903 he developed a "cold" abscess in the left side of the chest. This abscess was opened and two ribs were resected in March, 1904. The wound never closed. The sinus was curetted and some of the diseased bone was removed. The characteristic microscopic and cultural findings were obtained.

Case XIII.—Ophüls (1905). A male, Chinese, age and occupation not given, who had lived in San Francisco. In June, 1905, the external condyle of the right humerus was resected on account of caries, which involved the elbow joint. The patient died in a short time. Autopsy was not permitted but the microscopic findings were characteristic.

Case XIV.—Brown (1907). A male, aged twenty-five years, Japanese, was a laborer of the South Pacific Company at Bakersfield. It was thought that he had beriberi. In November, 1905, he became ill with fever, cough and pain in the chest. Several of the joints were involved. The glands became affected. The patient died, January, 1906. Autopsy showed abscesses in various parts of the body, lesions in the lungs, spleen and mesenteric glands. The characteristic microscopic and cultural findings were obtained.

Case XV.—Brown (1907). A man, aged twenty-eight years, who irrigated ditches near Fresno, was admitted to the hospital with general malaise. He had an ulcer on the left wrist, several swellings in the neck and on the seventh, eighth and ninth ribs in left parasternal line. The disease was fatal. Autopsy showed the lungs studded with miliary tubercles. The characteristic microscopic and cultural findings were obtained.

Case XVI.—Brown (1907). A Japanese, aged twenty-eight years, worked for the Southern Pacific Railroad as a track worker. He complained of pain in the ankle joint with swelling and developed cervical adenitis. The characteristic microscopic and cultural findings were obtained.

Case XVII.—Brown (1907). A male, aged twenty-four years, Greek; occupation was not stated. He lived eighteen months in San Joaquin Valley. The symptoms began June, 1906, with pain in the left axilla. Postules then appeared on the forehead and scalp, and a cough developed. There were no cultural examinations, but the microscopic findings were characteristic.

Case XVIII.—Ryfkogel (1912). A Japanese, aged thirty years, a teamster in San Joaquin Valley. He was treated for typhoid fever in January, 1911. A swelling in the right heel and tenderness in the left shoulder and hip developed. The duration was three months. The characteristic microscopic and cultural findings were obtained.

Case XIX.—Carson and Cummins (1913). A male, American, aged twenty-four years, whose occupation was not stated, had lived in the San Joaquin Valley. The illness began with a "cold." His temperature and pulse were of typhoid character. He had severe general headache and

diarrhea. Autopsy revealed lesions in spleen, liver, kidney and lungs. The characteristic microscopic findings were obtained. The cultural findings are not reported.

Case XX.—Bowles (1912). A Japanese, aged thirty years, was a farmer and teamster and lived in San Joaquin Valley. He had been treated for typhoid fever. Tenderness in the right heel, in the shoulder and hip developed. The Roentgen ray showed necrosed bone, which was curetted. The microscopic and cultural findings were characteristic.

Case XXI.—Brown (1913). A male, aged two years; residence not stated. The symptoms resembled those of tuberculosis. The patient suffered from headache, vomiting, high temperature and double optic atrophy. The disease was fatal. The microscopic and cultural findings were characteristic.

Case XXII.—Brown (1913). A male, aged twenty years, Indian, was a laborer in a construction gang in San Joaquin Valley. He complained of cough and weakness. Five days after admission he died. Autopsy revealed miliary lesions in the lungs. The culture was not reported. The microscopic findings were characteristic.

Case XXIII.—Morris (1913). A male, aged thirty-seven years, American, occupation not stated, had lived in Brownwood, Texas. During the winter of 1911-1912 he suffered from a cough. In November, 1912, pain developed in several joints. In January, 1913, it was thought that he had a liver abscess. The weakness continued until he succumbed in May, 1913. The microscopic findings were characteristic.

Case XXIV.—Chipman (1913). A male, aged twenty-eight years, race not given, machinist, had lived two years in San Joaquin Valley. The lesion began as a pimple on the left side of the nose in August, 1912. The submaxillary lymph nodes were enlarged. The patient suffered from cough and loss of weight. The disease was fatal in three months. The diagnosis was made from the smears.

Case XXV.—Powers (1914). A man, aged forty-four years; race and occupation not stated. He traveled through the south and in Europe and as early as 1902 noticed nodules in his neck. He spent the winter of 1910 in California and at this time many nodules appeared on neck, chest and abdomen. He died from exhaustion, April, 1912. Autopsy showed miliary abscesses of the liver, spleen and kidney and caries of the thoracic vertebræ. The microscopic and cultural findings were characteristic.

Case XXVI.—Roblee (1914). A male, full-blooded Indian, aged eighteen years. The patient complained of a sensitive spot and swelling over the outer side of the head of the left tibia. In January, 1914, he developed an irregular temperature. A fluctuating mass developed in the right axilla. Many abscesses developed and the patient died a few months later. The characteristic findings were obtained.

Case XXVII.—Cooke (1915). A Portuguese, aged twenty-five years, a milker on a ranch near Newman, Calif. In March, 1912, he noticed a painful lump on his right wrist. The right knee became involved and other suppurating foci developed over the right shoulder, left arm, left ankle and beneath the scalp. The patient became considerably emaciated and weak and died March, 1914. The microscopic and cultural findings were characteristic.

Case XXVIII.—Cooke (1915). An Italian, aged twenty-nine years, occupation not stated, came from Bakersfield, Calif. The cervical glands

were greatly enlarged and masses developed on his forehead. The patient died on the fourth day after admission, from asphyxiation. Autopsy showed numerous abscesses filled with yellowish pus. The lungs were bound down by adhesions but there were no gross lesions. The cultural findings were characteristic.

Case XXIX.—Brown and Cummins (1915). A Mexican, aged twenty-nine years, a laborer in a railroad gang at Bakersfield, Calif., came to the hospital, July, 1913. Three weeks previous to his admission he noticed a nodule on the dorsum of his right great toe. He became emaciated, had a high irregular temperature, became stuporous and died. Autopsy showed lesions in the spleen, kidneys, lungs and a uniform thickening of the occipital dura mater. There was also necrosis of the temporal bone, sternum, third, fourth, and fifth lumbar vertebræ and the bones of the right toe. The microscopic and cultural findings were characteristic.

Case XXX.—Brown and Cummins (1915). A male, aged twenty-four years, race and occupation not given, had lived in San Joaquin Valley. He came to the hospital in August, 1912, with typhoid symptoms. He died March, 1913. Autopsy revealed apparently a disseminated miliary tuberculosis. Lesions were found in the spleen, lungs, liver, kidney, pancreas and adrenals. The microscopic and cultural findings were characteristic.

Case XXXI.—Brown and Cummins (1915). A male, aged twenty-seven years, race not given, a blacksmith helper in Kerto, Calif., came to the hospital in March, 1914. The symptoms began with lumbar pain. He lost 13 pounds in fifteen days, and died in three months. The diagnosis was based upon smears.

Case XXXII.—Dickson (1915). The age, sex, occupation and location were not given. The lesion was in the wrist and knee. The microscopic and cultural findings were characteristic.

Case XXXIII.—Dickson (1915). A male farm laborer, age not given, who had lived near Colussa, Calif., came to a physician, June, 1908, on account of an abscess between the thumb and index finger. An abscess developed on the side of the face. He developed a cough and died, November, 1910. The microscopic and cultural findings were characteristic.

Case XXXIV.—Dickson (1915). An Australian sailor, aged thirty-nine years, who had worked as a rope splicer in the oil fields of Kern County in the San Joaquin Valley, he was admitted to the hospital, February 14, 1909. He complained of pain in the chest, had a cough, sweats and lost twenty-two pounds in three weeks. He had pleural effusion, and 2000 cc. of pleural fluid were removed. The cervical glands became enlarged. He died, July, 1910. Autopsy showed lesions in the meninges, lungs, pleura, lymph nodes, liver, spleen, kidneys, ribs and sternum. The microscopic and cultural findings were characteristic.

Case XXXV.—Dickson (1915). A brakeman on the Southern Pacific Railroad in the San Joaquin Valley was admitted to the hospital, July, 1911, complaining of a stiff and painful elbow. The right elbow was completely ankylosed and there was marked atrophy of the muscles of the arm. The elbow was resected in August. The microscopic findings were characteristic.

Case XXXVI.—Dickson (1915). A Hindu, aged twenty-six years, occupation and location not stated. He had been treated for a tuberculous knee. His left elbow became stiff and swollen. He died, August, 1912. Autopsy revealed lesions in the lung, pleura, lymph nodes and synovial membrane

of the left elbow and lumbar vertebra. The microscopic and cultural findings were characteristic.

Case XXXVII.—Dickson (1915). A Mexican laborer practically moribund. He had been treated for disseminated miliary tuberculosis. The microscopic findings were characteristic.

Case XXXVIII.—Dickson (1915). A German, aged fifty-nine years, occupation not given, came to the hospital in July, 1913. He complained of "pain in the bowels" which came on four hours after eating. The diagnosis of duodenal ulcer was made. The characteristic miscroscopic findings were obtained.

Case XXXIX.—Dickson (1915). An American, aged sixty-five years, a housewife. She complained of pain in the left ankle, which had persisted for eight weeks. The diagnosis was based upon microscopic findings.

Case XL.—Dickson (1915). A Jamaican negro, sailor, aged twenty-one years, who had lived for four months in Coalinga, Calif. He came to the hospital, January, 1914, complaining of a sore foot. The foot was amputated May 2. During June and July a fluctuating mass appeared on the right side of the chest, on the side of the left leg and in the right arm. The patient left the hospital. The microscopic and cultural findings were characteristic.

Case XLI.—Lipsitz, Dawson and Fessenden (1916). A colored sleeping-car porter, aged twenty-eight years. He lived in Kentucky but traveled from St. Louis to Denver, never any further west. He came to the hospital in July, 1915. The illness began three weeks previous with coryza, hoarseness and cough. He lost 10 pounds in three weeks. On July 1 painful nodules developed in the calves of his legs. In ten days, 13 were palpable. The patient died August, 1915. The microscopic and cultural findings were characteristic.

Case XLII.—Cummins and Sanders (1916). A negro, aged forty-one years, a Pullman chef, who had made several runs over the San Joaquin Valley and always slept in his car, was admitted to the hospital in March, 1915. Two months prior he began to cough and had pain in the region of the left kidney. He lost 20 pounds in one month. Nodules developed in various places. Just before death muscular twitchings and convulsions occurred. Autopsy showed lesions in the occiput, left frontal region, spleen, lung, liver and lymph nodes. The microscopic and cultural findings were characteristic.

Case XLIII.—Cummins and Sanders (1916). A Mexican laborer, aged twenty-one years, who lived in San Joaquin Valley, was admitted to the hospital in February, 1916. He complained of cough, bloody sputum and a sore right ankle. He left the hospital. The diagnosis was based on smears.

Case XLIV.—Bowman (1919). A Mexican, aged twenty-five years, worked on a ranch in Bakersfield, Calif. He came to the hospital in February, 1916, with a diagnosis of monarticular rheumatism. He had pain and swelling of the left ankle. The bone was curetted and bloody grandular tissue was removed. The duration was two months. Autopsy showed sinuses leading to the ankle joints and extended upward in the legs along the tendons. Lesions were found in the lung and intestines. The microscopic and cultural findings were characteristic.

Case XLV.—Bowman (1919). A negro, aged eighty-three years, who worked about horses in Los Angeles. He entered the hospital in March, 1917, with a painful left ankle. On May 1, his leg was amputated at the

middle third. He was discharged June 4. The microscopic and cultural findings were characteristic.

Case XLVI.—Bowman (1919). A Mexican, aged fifty-four years, who worked on a ranch and cared for horses in Los Angeles. He came to the hospital in May, 1917, with the diagnosis of right psoas abscess and an infected left hand. The duration was one month. The microscopic and cultural findings were characteristic.

Case XLVII.—Bowman (1919). A male, aged twenty-eight years, Mexican ranch hand in Los Angeles for eight years, had spent three months in San Joaquin Valley. In January, 1917, the left index finger became swollen and very painful. Subcutaneous nodules appeared on the scalp and fingers. Many other joints became involved. The microscopic and cultural findings were characteristic.

Case XLVIII.—Bowman (1919). A Mexican, aged forty-eight years, worked in cotton in Los Angeles, spent six months in San Joaquin Valley. He came to the hospital in September, 1917, with the diagnosis of ulcer of the foot. He refused amputation. The microscopic and cultural findings were characteristic.

Case XLIX.—Bowman (1919). A male, aged fifty-four years, who worked with horses and cattle, lived in Visalia, Calif. He came to the hospital in May, 1918, with the diagnosis of "multiple abscesses." In September, 1917, he developed headache, cough, temperature of 105° F. and pustules appeared over the entire body. He lost 65 pounds in nine months. He died in November, 1918. Autopsy revealed lesions in the lung. The microscopic and cultural findings were characteristic.

Case L.—Helsley (1919). A negro, aged thirty-two years, a waiter for ten years in Sacramento and San Joaquin Valley. In March, 1917, he noticed a large tumor in the left lumbar region and swelling in the right supraclavicle region. The diagnosis was based upon biopsy.

Case LI.—Lynch (1920). A negress, aged forty-five years, who was born and who had lived on an island near Charleston, S. C. She was admitted to the hospital, December 10, 1918, in a delirious state. She had been treated for influenza. She died December 12, 1918, with a diagnosis of tuberculosis. Autopsy showed lesions in the lung. The microscopic and cultural findings were characteristic.

Case LII.—Burkhead (1922). The patient's age, sex, race, occupation and location are not reported. Subcutaneous nodules developed in the neck; the glands also became involved. The patient had a cough and eventually died. The diagnosis was made on the microscopic findings.

Case LIII.—Hirsch (1923). A negro, aged twenty-seven years, who worked on a Pullman which ran between Chicago and Los Angeles. His symptoms began in March, 1923, with cough, fever and pain in the chest. He developed several abscesses in the mediastinum. He died May, 1923. Autopsy showed miliary nodules in the lung, suprarenal and pancreas, and suppurative osteomyelitis. The microscopic and cultural findings were characteristic.

Case LIV.—Pruett and Wayson (1923). A male, aged fifty-six years, a merchant seaman. He was admitted to the hospital March, 1923, with a diagnosis of tuberculosis. He complained of a swollen knee. He improved with surgical treatment. The microscopic and cultural findings were characteristic.

CASE LV.—Taylor (1923). A negro laborer, aged forty-four years, who had spent eight years in Los Angeles. He came to the hospital in February, 1919, complaining of pain and swelling in the back. There was a bulging mass at the edge of the left quadratus lumborum muscle. The duration was five months. The microscopic and cultural findings were characteristic.

CASE LVI.—Taylor (1923). A Serbian laborer, aged thirty-seven years, who had lived in Los Angeles for nine months. He came to the hospital March, 1919, with multiple skin lesions. He had been in a sanatorium for tuberculosis. His joints became involved. He died May, 1919. Autopsy showed miliary lesions in the kidney, adrenals and lungs. The microscopic and cultural findings were characteristic.

CASE LVII.—Taylor (1923). A male Mexican child, aged three years, who had lived in California. The child was admitted to the hospital in March, 1919, with multiple abscesses and a swollen knee. He died May, 1923. Autopsy revealed fibrinous pleurisy, miliary granuloma of lungs and meninges. The microscopic and cultural findings were characteristic.

CASE LVIII.—Taylor (1923). A Mexican, aged seventeen years, occupation not given. He was admitted to the hospital May, 1919, with discharging sinuses under right and left sides of the mandible, right elbow, fifth finger, ankle and toes. The microscopic and cultural findings were characteristic.

CASE LIX.—Taylor (1923). A male, laborer, aged thirty-four years, who had lived in California for two years. He was admitted to the hospital November, 1919, with swelling of the left knee. His joints were painful and stiff. He developed multiple subcutaneous abscesses and died February, 1920. The microscopic and cultural findings were characteristic.

CASE LX.—Taylor (1923). A Mexican laborer. The Roentgen ray findings in right ankle are recorded.

CASE LXI.—Taylor (1923). A Russian laborer, aged thirty-seven years, who had lived in California for seven years. He was admitted to the hospital May, 1920; he had been treated for tuberculosis of the bones of the foot and ankle. In July his leg was amputated. The microscopic and cultural findings were characteristic.

CASE LXII.—Taylor (1923). A Mexican, aged twenty-five years, occupation not given, had lived in California for ten years. He was admitted to the hospital January, 1921, with fever and difficult breathing. He died February, 1921. Autopsy showed numerous and extensive subcutaneous abscesses, fibropurulent pleuritis and osteomyelitis. The microscopic and cultural findings were characteristic.

CASE LXIII.—Taylor (1923). A Mexican laborer, aged twenty-three years, who had lived in Los Angeles for one year. He was admitted to the hospital February, 1921, with diagnosis of monarticular arthritis. April, 1921, his left leg was amputated. The microscopic and cultural findings were characteristic.

CASE LXIV.—Taylor (1923). A negro cook, aged twenty years, who had lived in California for one year. He was admitted to the hospital in April, 1921, with a diagnosis of pulmonary tuberculosis. He had several abscesses and died in one month. Autopsy showed involvement of both lungs, spleen, liver and kidneys. The microscopic and cultural findings were characteristic.

Case LXV.—Taylor (1923). A Mexican child, aged nine years, who had lived in California for five years. He was admitted to the hospital April, 1920, with enlarged cervical and inguinal lymph glands. The duration was one month. The microscopic and cultural findings were characteristic.

Case LXVI.—Hammack and Lacey (1924). A negro gardener, aged eighty-three years, who had lived in California for twenty-five years. The location of the disease was in the left ankle. The leg was amputated, and the microscopic and cultural findings were characteristic.

Case LXVII.—Hammack and Lacey (1924). A male, Mexican, aged fifty-four years, who had spent one year in San Joaquin Valley, Calif. The location of the disease was in the right groin, vertebræ and left wrist. The duration was one year and the outcome was death.

Case LXVIII.—Hammack and Lacey (1924). An American, aged twenty-eight years, teamster, who had lived in California all his life. The location of the disease was in the fingers, knee joints and subcutaneous abscesses. The duration was eleven months and the outcome was death. The microscopic and cultural findings were characteristic.

Case LXIX.—Hammack and Lacey (1924). A Mexican, aged twenty-five years, farm and railroad laborer, who had been in California for six years. The lesions were located in the ankles, lungs, pericardium and subcutaneous abscesses. The duration was four months and the outcome was death. The microscopic and cultural findings were characteristic.

Case LXX.—Hammack and Lacey (1924). A Mexican, aged forty-eight years, farm laborer, who had lived in California for four years. The lesions were located in the right ankle. The duration was eight months. The outcome was unknown as the patient refused amputation. The microscopic and cultural findings were characteristic.

Case LXXI.—Hammack and Lacey (1924). A negro laborer, aged forty-four years, who had been in California for eight years. He suffered from abscesses in the lumbar region and in the lumbar vertebræ. The duration was five months and the outcome was death. The microscopic findings were characteristic.

Case LXXII.—Hammack and Lacey (1924). A Mexican boy, aged eight years, who had been in California all his life. The locations of the lesions were in the ankle, subcutaneous abscesses, lungs and brain. The duration was seven months. The microscopic and cultural findings were characteristic.

Case LXXIII.—Hammack and Lacey (1924). A Mexican boy, aged three years who had always lived in California. The lesions were located in the toes, elbow, ankle and cervical glands. The duration and outcome were unknown.

Case LXXIV.—Hammack and Lacey (1924). A male, Serbian, aged thirty-four years, oil worker, who had been in California for three years. The locations of the lesions were in the skin, subcutaneous abscesses, in the wrist, skull and in the kidney. The duration was four months and the outcome was death.

Case LXXV.—Hammack and Lacey (1924). A Mexican boy, aged nine years, who had been in California for five years. The location of the lesions was in the lymph glands, fingers, ilium, tibia and lung. The duration was four months and the outcome was death. The microscopic and cultural findings were characteristic.

Case LXXVI.—Hammack and Lacey (1924). An Armenian truck driver, aged twenty-seven years, who had been in California for seven years. Location of lesions in the ankle. The duration was five months before amputation. The microscopic and cultural findings were characteristic.

Case LXXVII.—Hammack and Lacey (1924). A Mexican, aged thirty-four years, painter, who had been in California for one year. The location of the lesions was in the ankle, knee, sacrum, sternum and subcutaneous abscesses. The duration was four months and the outcome was death. The microscopic and cultural findings were characteristic.

Case LXXVIII.—Hammack and Lacey (1924). A Mexican, aged twenty-five years, farm laborer, who had been in California for ten years. The location of the lesions was in the vertebræ, ribs, pleura and subcutaneous abscesses. The duration was six months and the outcome fatal. The microscopic and cultural findings were characteristic.

Case LXXIX.—Hammack and Lacey (1924). A negro, aged twenty-eight years, farm laborer, who had lived in California. The lesions were in the lungs, vertebræ, ribs and subcutaneous abscesses. The duration was one month and the outcome death. The microscopic and cultural findings were characteristic.

Case LXXX.—Hammack and Lacey (1924). A female, Mexican, aged thirty-four years, who had been in California two years. The disease was located in the ankle. The duration was two years; she refused amputation.

Case LXXXI.—Hammack and Lacey (1924). An American, aged sixty-one years, electrician, who had been in California for fifteen years. The disease was located in the ankle. The duration was sixteen months before amputation.

Case LXXXII.—Hammack and Lacey (1924). A Mexican girl, aged two years, who had been four months in California. The location of the disease was in the humerus. The limb was amputated.

Case LXXXIII.—Hammack and Lacey (1924). An American, aged thirty-nine years, clerk, who had never been in California but who had been in Arizona. The location of the disease was in the form of subcutaneous abscesses in the muscles of the neck.

Case LXXIV.—Hammack and Lacey (1924). An American woman, aged sixty-one years, who had been in California for thirty years. The location of the disease was in the head of the radius and vulva. The duration was one year.

Case LXXXV.—Hammack and Lacey (1924). A male, American, aged fifty-three years, who was a veterinarian and farm laborer, had been in California for fourteen years. The disease was in the form of subcutaneous abscesses in the wrist. The duration was four years. After being treated by drainage, the lesions healed and the patient is living.

Case LXXXVI.—Hammack and Lacey (1924). A female, American, aged twenty-three years, had lived in California all her life. Lesions were found in the lung, cervical glands and subcutaneous abscesses. The duration was twenty months. The patient has remained well for five years.

Case LXXXVII.—Hammack and Lacey (1924). A male, American, aged twenty-three years, without occupation, had been in California for two months. Lesions were found in the ankle. The duration was one month before amputation. Abscesses followed four months later. The patient has remained well for nine years.

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HYDROPHOBIA [1]

Report of Two Fatal Cases With Pathologic Studies in One

In recent years rabies in man has become a rare disease, owing to the improved methods of prophylactic treatment and to laws requiring the registration of all dogs and the quarantining of any suspicious animals. We have observed two cases, one of which developed in spite of the accepted prophylactic treatment. The other was that of a woman, aged 22, who was admitted to the Philadelphia General Hospital on April 5, 1931. The report of this case must of necessity be incomplete, because the patient was in the hospital only eighteen hours and was so desperately ill and so agitated that all efforts had to be centered on treatment. Furthermore, the family refused to permit an autopsy, and the coroner on whom the responsibility ultimately fell did not investigate the case. The history that we obtained is a digest of information received from the patient herself on admission, from her brother, her mother and the hospital in which she was first treated. Where there was disagreement, an attempt has been made to follow what in our judgment seemed the most reliable authority.

Report of Cases

Case I.—Mrs. C. P., a housewife, aged 22, was admitted to the Philadelphia General Hospital on April 5, 1931. The family history was negative, as was her past medical history. She was married at the age of 18, and had two children. She believed herself about two months pregnant. Her husband was living and well, but their married life had been stormy. He drank heavily, and on occasions her brothers had to protect her from his violence.

About two months before admission, on February 5, the patient was bitten by a dog. This dog, which had just been given to her husband as a pet, also bit him, and at least two or three other persons in the neighborhood. Because of this her husband returned it to the original owner, and it was subsequently killed in a dog fight. Mrs. P. was taken to a nearby

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hospital, where the wounds were described as "four small puncture wounds on the left wrist." They were treated with nitric acid, ammonia, iodine, alcohol and a dry dressing.

On Friday, April 3, she complained of pain in her left arm and in her back. On the following day she felt worse. Her husband went out for medicine and did not return. She went to her mother's home; she was much agitated, and said that she was leaving her husband. She complained of tightness in her chest, and declared that she could not swallow anything. She was taken to a hospital where she was told that she was all right. After she returned home, a doctor was called, who tried to give her some medicine. She choked on it, insisted that she could not swallow, and began to have "fits," characterized by screaming, gripping her chest and crying out that she could not breathe, and that air from an open door or window choked her. Her brother then took her to two other hospitals, at each of which a hypodermic injection of some sort was administered. Finally, two days after the onset of symptoms, she was sent to the Philadelphia General Hospital. When first seen she was sitting up in bed and looking around apprehensively. She complained of a tight feeling in her chest, inability to swallow and difficulty in breathing. An open door or window made a draught that choked her. She objected to examination, insisting that each touch "choked" her. A fairly complete physical examination was achieved, however, during the course of the day. The findings were negative, except for widely dilated pupils which failed to react to light or in accommodation, and a scanty, thin, white vaginal discharge. Her color was good, and despite her claims of difficult respiration, breathing was not noisy, and there was no cyanosis. The axillary temperature was 101.8 F., and the pulse rate, 120. During the morning she refused all medicines and complained that a proctoclysis choked her; she occasionally grasped the top of the bed and screamed loudly. The nurse was eventually able to soothe her, and even persuaded her to leave the door of her room ajar. She apparently drank water placed beside her when no one was looking. At noon she drank a cup of orange juice and ate small helpings of chicken, potatoes and rice pudding, but refused water. There was no excessive salivation.

In the afternoon she became more and more excited. She was worried if the door of her room was allowed to be open. When it was closed, she complained that there was a nurse just outside the door. She insisted that the windows were open when they were not. Eventually, she began to curse and spit at every one, to scream loudly and to void involuntarily. The pulse became rapid; the color became slightly bluish. She was put in restraint and ¼ grain (0.016 Gm.) of morphine sulphate and 1/150 grain (0.0003 Gm.) of hyoscine hydrobromide were given, after which she was transferred to the psychopathic department. In the evening she began to vomit a brown liquid. She also spat frothy white saliva, and the nurses reported that she was frothing at the mouth. She no longer screamed but lay talking and muttering to herself. At 10 P. M. the pulse became imperceptible; the color, pale and bluish; the axillary temperature was 103 F. At 11 P. M. the temperature was 106.4, and at 11.30 she died.

The diagnosis must obviously remain uncertain, although the case is entered on the hospital records as one of hydrophobia. So far, none of the other persons bitten by the dog has had any unfavorable symptoms. Since the patient's death, however, antirabic treatment has been instituted on all except her husband, who refused it.

Case II.—The second case was that of a boy, aged 14 years, who was admitted to the University Hospital on Nov. 5, 1930, with fever, nervousness, instability and salivation. He had been bitten by a stray dog on Oct. 11, 1930, twenty-five days prior to admission. The animal had a bloody mouth, as though it had been injured, and the boy was trying to aid it when he was bitten. The dog had disappeared and could not be located. The bite, which involved the left ear and cheek, was treated immediately in the Atlantic City Hospital, the wound being cauterized with phenol. Two days after the injury, the Pasteur prophylactic treatment was instituted, and a full course of treatment was given, which was completed a few days prior to admission. There were no untoward reactions. The local wounds had healed completely during that time. Throughout the week prior to admission the child had been more irritable than usual, and three days before he had complained of headache and had a coated tongue. He received a laxative, which he vomited. The next day he had a temperature of 101 F., and the headache was worse. He also complained of numbness and tingling in his left cheek and ear. These symptoms increased rapidly, and in addition, internal strabismus, diplopia and visual hallucinations appeared. The boy was restless and sleepless, and had difficulty in swallowing.

The past medical, family and social history was irrelevant.

When the boy was seen by one of us (D. R.), the most striking features were an intense restlessness, a flushed face and a continued flow of water from the mouth. The mouth seemed to be filled with saliva. Though the patient was conscious and could answer questions he seemed to have visual hallucinations with respect to surrounding objects. The temperature was 101 F., the pulse 120. The lungs showed many coarse rales. The skin over the trunk and extremities was markedly hyperesthetic, but there were no paralyses of the limbs and no spasticity. The knee jerk was exaggerated. The right eye showed an internal strabismus; the pupils were dilated. Examination of the blood showed hemoglobin, 90 per cent.; red blood cells, 4,750,000; white blood cells, 26,200, of which 80 per cent. were neutrophils, 10 per cent. lymphocytes and 10 per cent. monocytes.

Despite sedative treatment, the boy had several generalized convulsions. The temperature rose steadily to 107 F., and death occurred in a convulsion, six hours after admission.

The diagnosis was hydrophobia—acute encephalitis. The autopsy was performed shortly after death. The findings, except those in the brain and spinal cord, were insignificant.

Gross Morbid Anatomy.—The brain and spinal cord showed little in the gross specimens. The brain was markedly edematous everywhere. It had a blue cyanotic appearance, owing to congestion of all the superficial vessels. The substantia nigra appeared somewhat depigmented. The spinal cord showed nothing of importance grossly, except a pinkish appearance of the gray matter, owing to the great prominence of the vessels. It, too, was swollen and edematous.

Microscopic Changes.—In the gray substance of the base of the brain and in the gray matter of the spinal cord there was a marked inflammatory exudate, which was confined largely to the vessels, but which was spread diffusely throughout the tissues. The ganglion cells of the cortex showed marked changes.

The distribution of the lesions is a matter of great interest. The most pronounced reaction was found at the base of the brain. The cortex showed almost no evidence of inflammation, except for a mild meningeal

exudate in a few places. Of the basal ganglia, the thalamus showed some active perivascular inflammatory foci. These were situated just under the ventricular ependyma. The other basal ganglia were relatively little involved. In the mesencephalon the inflammatory reaction was most marked in the colliculi, around the aqueduct of Sylvius and in the reticular substance. The nucleus ruber was mildly infiltrated, and so, too, was the substantia nigra. The pes pedunculi showed some inflammatory foci. The greatest infiltration in the mesencephalon was in the periaqueductal gray matter, immediately around and below the iter. Infiltration tended to shade off gradually below this, though it was present everywhere in this section of the brain stem. The inflammatory reaction in the pons was practically confined to the tegmentum. The gray matter around the iter and fourth ventricle was markedly infiltrated with the reacting cells, but the basis pontis remained untouched. This was exceedingly striking. The entire tegmental gray matter was infiltrated and involved in the pathologic process. In the medulla the inflammation was found in the floor of the fourth ventricle and the entire reticular substance. Here, too, the inflammation was confined practically entirely to the gray matter. It stopped at the level of the inferior olives. The latter were mildly infiltrated. As one descended from the medulla into the spinal cord, it was found that the gray matter was involved almost exclusively. The white substance was infiltrated mildly here and there, but practically all the changes were in the gray substance. The cervical and lumbar cords were severely involved, while the thoracic region was less severely attacked. Within the gray substance the anterior horns were more markedly affected than the posterior horns. It is thus evident that the process was confined almost entirely to the gray matter of the base of the brain and the spinal cord.

The nature of the exudate is of as much interest as its distribution. In the areas where the exudate was most pronounced, there was marked perivascular infiltration. This involved the adventitial sheaths of the blood vessels as well as the perivascular spaces. In some vessels the amount of exudate was tremendous; in others it was less pronounced. In some vessels the exudate was composed exclusively of lymphocytes; in others it consisted of lymphocytes and large mononuclear elements. Plasma cells were rarely seen. Around the vessels, within the tissue substance, were large groups of cells of noninflammatory nature. They were composed of large oval, round or crescentic vacuolated nuclei and an abundant cytoplasm. They probably represented astrocytes among which were some fibroblastic elements. In some areas these cells constituted the major portion of the cellular reaction. They were spread throughout the involved areas, sometimes around vessels, but most often as a diffuse reaction within the tissue substance itself. They were particularly abundant in the spinal cord.

The meninges over the cortex, base of the brain and cord were mildly infiltrated here and there with lymphocytes. This meningeal infiltrate was, however, nowhere pronounced.

The cells of the cortex were almost universally degenerated. So, too, were the ganglion cells in the inflammatory areas and in the spinal cord. In the latter, the ganglion cells were virtually gone, but at a few levels groups of relatively intact ganglion cells could be found. The cells in the cortex were swollen, their processes tortuous and enlarged, the nucleus homogeneous, the nuclear membrane absent, giving a poor differentiation between nucleus and cytoplasm, the nucleolus vacuolated and the cytoplasm without Nissl bodies. This sort of ganglion cell change was found in all

the cortical layers and in all areas of the brain. There was no glial hyperplasia in the cortex.

The oligodendroglia was acutely swollen in the spinal cord. The astrocytes showed no changes in either the brain or the cord. Neurofibrillar stains showed an absence of neurofibrils within the anterior horn cells of the spinal cord.

An extremely careful search for Negri bodies failed to reveal these inclusions in the ganglion cells of the brain or spinal cord. However, four rabbits into which intracranial injections of an emulsion of the brain tissue had been made died on the tenth, eleventh and fifteenth days respectively, the symptoms being those of rabies; at autopsy, typical Negri bodies were found, thus confirming the diagnosis of rabies.

Pathology of Rabies

The pathologic changes in the nervous system in rabies are characterized by the presence of both inflammatory and degenerative products. Schaffer first called attention to these two processes in cases of lyssa. The inflammatory changes are characterized by a lymphocytic infiltration of the vascular adventitia in the early stages of the disease, followed by a filling of the perivascular lymph spaces with inflammatory cells, and eventual infiltration of the parenchyma. Lymphocytes constitute the majority of the exudative cells; plasma cells are less abundant; polymorphonuclear cells are rarely seen. The inflammation is accompanied by proliferative changes on the part of the neuroglia of both a diffuse and a focal nature. Babes described glial foci which he considered characteristic of rabies, but his descriptions have not been widely accepted. Achucarro has observed proliferative changes in the neuroglia, especially in the cornu ammonis. In addition, he found typical rod cells containing fat droplets in the cornu. Collado described hypertrophy of microglia cells in rabies. This has also been found by Loewenberg. In our own case, the glial reaction was intense throughout the entire involved area, varying in intensity apparently in direct proportion to the severity of the inflammation. Most of the neuroglial cells are astrocytes. In our case the oligodendroglia, especially in the spinal cord, reacted by an acute swelling. The microglia took no part in the process.

The degenerative changes found in the nerve cells of the cortex and elsewhere are not as a rule in proportion to the degree of the inflammatory changes. There may be pronounced evidences of inflammation and only mild degenerative changes in the nerve cells of the brain. The reverse is also found—the degeneration of the cells may be pronounced and universal and inflammatory evidences only slight. Klarfeld believes that there are two separate and distinct processes in rabies: inflammatory and degenerative. These

have apparently no clear relationship to each other. In one of his patients he found inflammatory changes limited to the pons and medulla and degenerative changes in the cerebrum and cerebellum. In another patient there were Babes' nodules and inflammation in the spinal cord, with no inflammation but active degeneration in the cerebrum and cerebellum. Spatz believes that the independent degenerative changes in the nerve cells may play an active role in the disease. The degeneration in the ganglion cells of the cortex is manifested by poor staining of the cell body, a loss of Nissl bodies, the formation of small bodies of chromatin in the nucleus, vacuolization, fatty degeneration, sclerosis and pigment atrophy. In our case the ganglion cells were swollen, the processes unduly visible, swollen and tortuous, the cytoplasm without Nissl bodies or with pulverized remains of these, the nucleus homogeneous and pale, the nucleolus often vacuolated and the cells containing fat. Cajal has described a simplification of the fibrillar network in the ganglion cells in rabies with some thickening of the neurofibrils, especially at the edge of the cells. This has been confirmed by Achucarro, who found these changes in the spinal ganglion cells. The change occurs late in the disease.

The independence of the inflammatory and degenerative processes is well illustrated in our case, in which there was marked inflammation at the base of the brain and in the spinal cord, and universal ganglion cell degeneration in the cortex, with practically no evidence of inflammation in this part of the brain. The independence of the two processes must not be overemphasized, however, because there were pronounced degenerative changes in the ganglion cells within the infiltrated areas of the brain. In the cortex, however, degeneration was pronounced, without the inflammation which was so marked at the base of the brain. There may, therefore, be two processes going on at the same time: inflammatory at the base of the brain and degenerative in the cortex. The degree of intensity of the degenerative process is not dependent in any way, apparently, on the inflammatory change. This point is well illustrated in two cases reported by Schükri and Spatz. In one case, there were inflammatory changes of a pronounced degree at the base of the brain, with only mild degenerative changes in the ganglion cells within the inflamed areas and practically no degeneration of the ganglion cells in the cortex. In their second case, there were likewise pronounced inflammatory changes at the base, with marked and universal degenerative changes in the nerve cells. The intensity of the inflammatory reaction was similar in the two cases, but the degeneration differed perceptibly in both.

Negri bodies are found in the dog's brain in rabies in the majority of instances. They have not been reported very often in man, though it seems to be accepted that they should be present as frequently in the human brain as in the dog's brain in hydrophobia. Viets reported a case in a human being with typical Negri body formation. A careful search in our case failed to reveal Negri bodies anywhere in the central nervous system. The two cases reported by Schükri and Spatz also showed no Negri bodies. Both of these cases, like ours, followed bites on the face, and were characterized by a very rapid clinical course. In the first case, which followed a wolf bite, death occurred twenty-nine days after the bite and in the second case, fifteen days after the bite. It is possible that the failure to find Negri bodies in the brains in cases of rabies may be related in some way to the acuteness of the disease. In both the cases of Schükri and Spatz and in our own case the course was extremely rapid, and it may be that Negri bodies had no time to form. Cases of rabies without the formation of Negri bodies have been reported by Maas, Abba and Borman, Leutz, J. Koch and Goldberg. Koch reported four such cases.

Distribution of Lesions and Nature of Rabies

Recent investigations, particularly those of Spatz, Schükri and Spatz, and Seifried and Spatz tend to classify rabies as an encephalitis and to group it with the encephalitides, which include epidemic encephalitis, poliomyelitis, Borna disease in horses, rabies, distemper and chicken plague.

Klarfeld first called attention to the similarity of the pathologic findings in lyssa and epidemic encephalitis. Later Schükri and Spatz studied two cases of rabies chiefly from the standpoint of the distribution of the lesions. They found marked involvement of the midbrain by the inflammatory process, particularly severe in the substantia nigra. The periaqueductal gray matter was rather severely involved, and the nucleus ruber was only mildly infiltrated. In the pons the inflammatory changes were most marked in the tegmentum—in the vicinity of the iter and fourth ventricle. More anteriorly there were isolated areas of infiltration in the floor of the third ventricle, but none in the cortex. The distribution of the inflammation in these two cases, particularly the marked involvement of the midbrain and substantia nigra, in addition to the similarity in the nature of the exudate, led Schükri and Spatz to conclude that rabies and epidemic encephalitis were closely allied and should be placed together in the group of encephalitides. Hassin

had previously shown that encephalitis and poliomyelitis are related, the only difference in the two diseases being that in epidemic encephalitis the pathologic changes tended to diminish spinalward, whereas in poliomyelitis they tended to diminish cerebralward. The intensity and distribution of changes in the two diseases may be so similar that they cannot be distinguished. The work of Schükri and Spatz has been confirmed in four cases of rabies by Loewenberg, except that in two of his cases he found marked meningeal infiltrations. More recently, Seifried and Spatz have demonstrated that Borna disease, which is an encephalitis occurring in horses, is similar in all respects to rabies and the other encephalitides, including epidemic encephalitis, rabies, poliomyelitis and other diseases.

According to Seifried and Spatz, the characteristics which distinguish these various encephalitides are: (1) absence of meningeal reaction; (2) predominant involvement of the gray matter; (3) a nonpurulent type of infection, the reaction consisting of lymphocytes, plasma cells and large mononuclear elements; (4) a glial proliferation of a diffuse and focal nature, and (5) a lack of hemorrhages and softenings. Differences between the various members of the group are those of degree; a local meningitis is more common in poliomyelitis than in the other diseases, and leukocytes play a more active role in poliomyelitis than in the other encephalitides.

The distribution of the pathologic changes and the inflammation is very much the same in epidemic encephalitis, poliomyelitis, rabies and Borna disease. The inflammatory exudate affects chiefly the gray matter at the base of the brain, involving particularly the colliculi, the periaqueductal gray matter, the substantia nigra and the tegmentum of the pons and medulla, especially the parts just under the fourth ventricle.

In the pons the basis escapes almost entirely. In the medulla the exudate is most active above the inferior olives. Spatz emphasizes the marked involvement of the substantia nigra in rabies, but in our case this nucleus was not particularly affected. In the hypothalamus the portions bordering on the ventricles are most involved. The tuber cinereum and infundibulum are special sites of election. In the forebrain the basal ganglions are most involved by the exudate, especially the caudate nucleus and parts of the thalamus. The changes in the cortex are mild.

In our case the involvement of the spinal cord was pronounced, more even than in poliomyelitis. While the various diseases which are grouped in this class of encephalitides show some differences in distribution, they tend to have characteristics in common which would seem to justify the classification proposed.

From a clinical standpoint the cases here reported bring out several important features: first, the necessity of thoroughly cauterizing the wound, preferably with fuming nitric acid instead of with phenol or other caustic substances. Animal experiments have shown that wounds promptly and thoroughly cauterized with nitric acid are seldom followed by rabies.[2]

The incubation period in the second case was about three weeks, which is considerably below the average of forty days. The shortest incubation period on record is twelve days; the longest, two years. The incubation period tends to be shorter in children than in adults and in cases in which the bite is about the head and face. Both of these factors bear on our case. Recently it has been recommended that more active treatment be given to patients who had bites about the face and head, so as to produce immunity more rapidly. Generally it is considered that at least fourteen days must elapse after completion of the treatment with vaccine before immunity is attained. Therefore, in any case in which the offending dog cannot be traced, thorough cauterization of the wound with fuming nitric acid should be done and antirabic treatment begun at once. If the wound is on the face, the routine treatment should be intensified. The danger of paralysis due to treatment is practically negligible, and of those in whom it develops, about 85 per cent. make a complete recovery.

[2] In the first case thorough cauterization did not protect the patient from the disease.

PSITTACOSIS, WITH THE REPORT OF A CASE [1]

Mr. W. D. C., age fifty years, a wholesale grocer, native of Pennsylvania, was first seen by one of us (D.) on January 15, 1930. He complained of fever, chills, and a broken back sensation, labored breathing, and severe frontal and occipital headache. His illness had begun on January 4th with a severe headache and backache and general body pains. He went to bed and called a physician who, when the patient told him that he had been suffering for some years from chronic appendicitis, agreed that that was the probable diagnosis of his present case. As the fever persisted the patient was transferred to a private room in the Atlantic City Hospital on January 16, 1930. The physical signs and the whole clinical picture of the case being peculiar, a more careful investigation of the history was made and this investigation to our surprise revealed the following interesting and suggestive facts: For a year and a half Mr. C. has had a parrot from the Isle of Pines. The parrot has always been well. Having a great fondness for parrots Mr. C. is a frequent visitor in a local pet shop. On December 1, 1929, he was called to see a sick parrot which later died. He did not actually touch this bird. Before Christmas the shop got a consignment of parrots from Panama. One of the birds was sick with diarrhea. The patient fed it boiled corn and it recovered. On December 23d while playing with this parrot it bit him, breaking the skin of the forefinger. He applied mercurochrome and continued to play with the parrot. The parrot at that time seemed in perfect health and was sold. We have been unable to trace its history further.

When seen on January 18th (D. R.) the parrot history was confirmed and the following notes made concerning the physical examination: The patient is a pale, fairly well nourished man, sitting propped up in bed and breathing with some difficulty. He is talkative, restless, and at intervals mildly delirious. Temperature 104 F., pulse 120, respiration 32. Just below the angle of the left scapula is a patch of dulness about the size of a silver dollar over which prolonged expiration, bronchophony and numerous fine, moist rales are audible. From this area downward to the base of the left chest, showers of crepitant rales can be heard during inspiration.

The right lung shows nothing abnormal. The abdomen is moderately distended, the spleen is not palpable; there are no rose spots. The reflexes are normal; carphologia and subsultus tendinum have been noted, but are not observed during the examination. The urine is normal; a small number of motile bacilli can be seen under the microscope.

Blood examination gave the following results: Red blood cells, 3,670,000; white blood cells, 12,100; hemoglobin, 9.66 mgm.

Differential count: Polymorphonuclears, 80 per cent.; small lymphocytes, 19 per cent.; eosinophils, 1 per cent.

[1] Read before the Section of Medicine, College of Physicians, April 28, 1930. Reprinted from the Medical Clinics of North America, Vol. 14, Number 4. Written in collaboration with Harold S. Davidson, M.D.

The Widal test with typhoid, paratyphoid A and B, and Bacillus abortus and B. tularensis was negative.

Blood culture both by aerobic and anaerobic methods was negative.

Sputum Culture.—This showed pneumococci, streptococci, and Micrococcus catarrhalis. The Bacillus psittacosis was not seen.

The agglutination test with the patient's blood serum and the Bacillus psittacosis was negative.

Course of the Disease.—The patient made a gradual but uninterrupted recovery; the pneumonia was slow to resolve. There was very little cough, never much sputum, only on a few occasions was there a little blood-tinged or rusty mucus. The dyspnea continued for some time. On February 20, 1930, the man was discharged from the hospital. He remained prostrated and weak, however, for some time after returning home.

The history of contact with sick parrots, the symptoms, the anomalous physical signs indicating an atypical pneumonia, justify, we believe, the diagnosis of psittacosis in this patient.

We have compared the features of our case with those now rather abundantly recorded in literature and find that they are in very close agreement. As there is at present no serologic or bacteriologic test of psittacosis the only criterion of the disease is a history of contact direct or indirect with sick parrots.

In a single case one may not always think of the true source of infection, but when there is a multiple outbreak of atypical pneumonia especially among persons associated in one domicile or one place of occupation, the possibility of such a disease as psittacosis should occur to the mind.

The history of psittacosis is full of human interest. It begins as far as our researches have gone in 1879, when Ritter of Uster, Switzerland,[2] observed an outbreak of a peculiar disease in seven persons who had worked in or visited the same room in which "exotic birds," to quote Ritter's phrase, had been kept as pets. Shortly before the outbreak a new bird had been received and also an empty cage. The disease had characteristics of both typhoid fever and pneumonia, so that Ritter applied the name of pneumotyphus to it. Of the seven persons attacked—and they were the only ones exposed during the period covered by the epidemic—three died.

The most serious outbreak and the one that established the nosologic position of the disease occurred in Paris in 1892.

Two French merchants, DuBois and Marion,[3] bought one thousand parrots and other tropical birds in Buenos Aires. On the homeward voyage a large number of birds died and were thrown into the ocean. When DuBois and Marion debarked at Havre only a few hundred parrots survived.

[2] Deutsch. Arch. f. klin. Med., 1880, 25.
[3] Gastou, Le Bulletin médicale, 6, 1892, p. 700.

DuBois, who had been taken ill on board, remained a few days at Havre to convalesce, charging Marion with the care of the birds. Marion took them to his brother's house in the Rue Dutot in Paris. Within a few days Marion developed pneumonia, soon afterwards his brother, who died, then their parents, also a married couple that cared for the birds, and another couple often invited to the house; likewise three butcher boys and a number of others who either had visited the house or had bought parrots. Including Marion, the parrot importer, twenty-four persons developed the mysterious disease, of whom three died.

DuBois having had a disagreement with his partner removed his share of the parrots to the granary of a man named Liénard. That act started a second epidemic center with 18 cases and six fatalities. Thus, as the result of the importation of the South American parrots forty-two persons fell ill, of whom nine died, a mortality of over 21 per cent.

The symptoms of the disease in the main resembled typhoid fever, but there were no typhoid lesions, the most constant morbid change found being a bronchopneumonia. Dujardin-Beaumetz, who was appointed to study the epidemic, declared it an atypical infectious pneumonia related to influenza, and as he was a man of immense authority his opinion carried great weight. Peter,[4] however, expressed the view that the disease was a typhoid-like affection transmitted from parrots to man. This view soon received strong support through the discovery by Nocard of a special bacillus in the bone marrow of the wings of parrots that had died of psittacosis, a name proposed by Morange. Aside from a dubious report of an Italian epidemic,[5] the Nocard bacillus has not been found in human cases except once. In the epidemic described by Gilbert and Fournier[6] five persons were attacked after contact with parrots; two died. Two other contemporary cases were reported by Delawney and Descazalo.[7] It was from one of these that Gilbert and Fournier isolated a bacillus resembling that of Nocard.

The most serious American epidemic known to us is that which occurred in Wilkes-Barre, Pa., in 1917. For the main historical facts of this epidemic we are indebted to Dr. Stanley Freeman, of Wilkes-Barre, who was one of the first to suggest the correct diagnosis. Some data have also been culled from an elaborate monograph on the Wilkes-Barre outbreak prepared by the late

[4] Le Bulletin médicale, 6, 1892, p. 714.
[5] Palamidessi, Il Policlinico, 1895.
[6] Gilbert and Fournier, La Presse méd., January 13, 1897, p. 25.
[7] Gaz. des Hôp., August 13 and 15, 1896.

Andrew Todd McClintock (Pleomorphism in Bacterial Protoplasm; A Study in Psittacosis, privately printed, 1925).

A department store at the Christmas season purchased for display and sale a large number of Central American parrots. The weather was uncommonly cold and many of the parrots fell ill in the store and in the homes of the purchasers. Soon a number of persons in the store, the advertising man and the man who burned the dead parrots in the cellar of the store, and the girls stationed near the window in which the parrots were displayed became ill. Before long men and women in the city and in the nearby towns who had purchased parrots also became ill. It seemed that everyone who had bought a parrot which afterward sickened presented symptoms of disease. The incubation period was from seven to ten days. Until the connection with the parrot disease was fully appreciated, the cases were diagnosed just as they had been in the Paris epidemic of 1892 as influenza, or as typhoid or as paratyphoid fever. A great deal of confusion was caused in the lay mind by the similarity of the words—parrot fever and paratyphoid fever. Perhaps because of the war the Federal Government made no investigation while that conducted by the State Government was very superficial. The state investigators accepted in the main the diagnosis of influenza. The study of the late A. T. McClintock already referred to was largely bacteriologic in nature, but despite most painstaking efforts McClintock did not find a definite etiologic factor, which is not surprising in view of the negative results obtained by later investigators working with improved methods.

In the Wilkes-Barre epidemic there were 140 cases directly traceable to parrots, with a mortality of 11 per cent.

Clinically three distinct types could be distinguished:

1. The influenza type—without definite lung involvement and without intestinal symptoms. The minority presented this type.

2. The typhoid type with spots but with negative Widal for typhoid and for paratyphoid A and B. In this group, in which the majority of cases fell, the symptoms resembled very much those of the second or third week of typhoid fever. One of these was seen in consultation by one of us (D. R.).

3. The pneumonic type—the signs were atypical and seemed to change from place to place and from day to day. A few of the patients had bloody sputum.

The leukocyte count was low in practically all of the cases, in many less than 5000. In no instance could any transmission from one human being to another be determined.

Among the physicians connected with the local epidemic the belief prevailed that some poison was eliminated in the excreta of the birds, that it dried on their wings, and that through flapping it was transported through the air. That would account very well for the illness of the girls near the window where the parrots were displayed, since they claimed not to have come in direct contact with the birds.

At the present time psittacosis presents itself as a rather widespread epidemic. One of its first appearances was in Berlin; it was traced to the importation of South American parrots. Some time before a shipment of parrots was brought from Brazil to Cordoba in the Argentine. Soon afterward there was an outbreak of psittacosis in Cordoba which rapidly spread to neighboring towns. By December 5, 1929, according to the League of Nations reports, several hundred persons had been attacked in Brazil. In Berlin the disease appeared close on the heels of the arrival of a shipment of the South American parrots. Twenty persons became ill, of whom three died. A small epidemic of eight cases occurred at Altona near Hamburg; the infection was traced to four birds (Günther, Klin. Woch., February 1, 1930, p. 203).

In this country cases have recently been reported from widely scattered localities, Annapolis, Boston, Hollywood, Washington.[8]

The Washington outbreak is perhaps the most interesting so far recorded and from the careful studies made is destined to become a landmark in our knowledge of the disease. Dr. McCoy, Director of the Hygiene Laboratory, was kind enough to supply us with some details of this outbreak.

There were 11 cases, a trifle over 20 per cent. of the personnel in the building in which the psittacosis work was being carried on. A striking feature of the outbreak was the fact that nine of the eleven persons attacked had nothing whatever to do with the work of investigation, merely being employed in the same building. Not one of them had been in the room in which the work was being conducted.

Clinical Features.—The disease resembles influenzal pneumonia and is usually in the beginning mistaken for that disease. There are, however, certain features that differentiate it from this affection. In the first place the respiration rate is not materially accelerated—not to the degree one finds in influenzal pneumonia.

[8] A case of psittacosis was reported by Dr. Sailer (Medical Clinics of North America, January, 1929) that had evidently occurred some time in 1928, the year not being given. The patient, a woman forty-seven years of age, had received an African parrot which seemed to have a cold. She nursed it, allowing it to eat from her mouth and to kiss her. The New York Zoological Society, to which the husband reported the parrot's symptoms, expressed the opinion that the bird had psittacosis. The exposure as well as the symptoms and course of the disease in the woman justified Dr. Sailer's conclusion that she was suffering from psittacosis.

Secondly, there is rarely any cyanosis, as a rule the countenance, as in our patient, is pale. Third, the cough is slight and may be absent; fourth, sputum is scant, often there is none. Finally, leukopenia is more common than leukocytosis.

The pulmonary lesions are usually present before any symptoms of lung involvement appear. The physicians of the United States Navy Hospital in Washington who had charge of the cases from the Hygienic Laboratory were able to demonstrate by means of the X-ray the appearance of pulmonary lesions within forty-eight hours from the onset of general symptoms and long before pulmonary symptoms appeared.

Nervous symptoms are often well marked—insomnia, headache, and delirium; the last closely resembling that of the typhoid state. At times there is great thirst. There are no noteworthy gastro-intestinal disturbances. Splenic enlargement is rarely observed; rose spots have been described.

The period of incubation is from nine to fourteen days; the febrile period lasts from fourteen to thirty-six days. In unfavorable cases the patient falls into a profound stupor and succumbs either in a typical typhoid state or by reason of increasing pulmonary involvement.

The mortality varies—it was 11 per cent. in the Wilkes-Barre epidemic, 21 per cent. in Paris in 1892. Heymann [9] collected 164 cases with 54 deaths, nearly 33 per cent.

Etiology.—The disease is transmitted from sick parrots to man nearly always by direct contact, although such contact is not absolutely necessary. That convection is possible by indirect contact is shown in the Paris epidemic, in the one in Wilkes-Barre, and most unequivocally in the outbreak in the Hygienic Laboratory in Washington. The contagion clings to objects with which parrots have been in contact. It appears to be transportable through the air as is the virus of smallpox.

The disease can be carried by well parrots that have been in contact with sick ones. In all probability the former carry some of the infective discharges on their feathers.

While transmission from parrot to man is well established, interhuman transference of the disease has been denied. Günther's observations in the Altona epidemic, however, establish quite definitely the possibility of such transmission.

While the disease is very contagious it happens, as in all communicable diseases, that not everyone exposed takes the disease.

One source of infection is found in the pernicious habit of parrot lovers of allowing the parrots to pick food from their mouths

[9] Klin. Woch., February 1, 1930, p. 193.

and of caressing the parrots and carrying them under their clothes. With the publicity that parrot fever has received that source should be entirely abolished.

The nature of the infective agent is not known. The Nocard bacillus is definitely eliminated as the cause. Whatever part it may play in the disease of parrots, as the cause of human psittacosis it has been ruled out of court. We have referred to the infrequency with which it has been demonstrated in human cases.

Krumwiede, McGrath, and Oldenbusch [10] produced psittacosis in parrots with the filtrate of material obtained from the organs of a parrot dead of the disease. The materials from the inoculated parrot filtered in the same way again produced the disease in another parrot. The sputum and blood from one of the human cases were fed to a parrot and the disease picture produced resembled that in the parrot which presumably had infected the human case.

The organs of the inoculated parrot were used to infect another parrot after the material had been filtered through a Berkefeld filter. The disease was again produced. These observations indicate that from the original parrot and also from the human contact case a filtrable virus had been obtained, and that this virus is the primary etiologic agent of the disease.

Bedson, Weston and Simpin [11] also have demonstrated the presence of a filtrable virus in material obtained from diseased parrots. They do not report experiments with human material. Levinthal of Berlin has likewise obtained evidence of a filtrable virus and does not believe that the Nocard bacillus has anything to do with the disease.

While the demonstration of a filtrable virus is a great advance in our knowledge of the disease, it throws a damper on any hope of finding a method of cure.

However, it is conceivable that some means may be found of vaccinating against the disease when an epidemic outbreak occurs.

The possibility of insect carriers suggests itself but as the disease is most frequent in the winter months the mosquito at least may plead not guilty.

Treatment.—Up to the present time the treatment of psittacosis has been purely symptomatic; although a trial has been made of the serum of convalescent patients, it is too early for any definite statements to be made. Whether vaccination against the disease when it assumes endemic forms will ever be possible is in the lap of the gods. Isolation and careful destruction of all fomites are

[10] Science, March 7, 1930.
[11] Lancet, February 1, 1930

essential measures to prevent the spread of the disease. It is unnecessary even during an epidemic outbreak to kill healthy parrots. Diseased parrots, however, should be destroyed, of course without unnecessary cruelty. It is also important hereafter to supervise the importation of parrots and other tropical birds. That applies not only to supervision at the time of landing, but supervision and care during transport. Through the help of the League of Nations it should be possible to obtain information of outbreaks of psittacosis among birds and human beings in the tropics before the exportation of parrots is attempted. By these measures epidemics can be prevented and a not unimportant industry, giving pleasure and profit, can be conserved.[12]

[12] As an index of the proportions of the parrot trade we may quote some figures from an article by Heymann (Klin. Woch., February 1, 1930). There are imported into Hamburg annually about 18,500 parrots through regular and irregular channels. Berlin disposes annually of from 40,000 to 50,000 parrots. To these figures must be added a considerable number of parrots raised in Germany. One Berlin dealer in the year 1928 sold not fewer than 11,000 and in 1929 about 8000.

UNCLASSIFIED CONDITIONS

CERVICAL RIB [1]

On examining Mrs. R. F., a patient with tuberculosis of the lungs, I found on each side of the neck, in the supraclavicular triangle, a bony mass that, as it could be traced back to the seventh cervical vertebra, I took to be a cervical rib. A radiographic examination, kindly made for me by Dr. Pfahler, confirmed this view.

The two ribs were not of the same size. The right, decidedly larger than the left, passed forward in a curved direction from the vertebra, and ended with a sharp, slightly incurvated edge at a point corresponding with the middle of the clavicle. It caused a distinct prominence in the supraclavicular triangle, and had considerable vertical extent. The skin over it was freely movable and not discolored. Two parallel veins, one running in front of the mass and the other close to the edge, joined at the lower border to form the external jugular vein. The subclavian artery passed over the rib and could be compressed against it. Such pressure, however, gave rise to severe pain, radiating down to the middle of the upper arm. During the pressure the pulse at the wrist became very small; but the pain interdicted my making sufficient pressure to cause complete obliteration of the pulse.

The supernumerary rib on the left side, as already stated, was much smaller than that on the right, and presented itself merely as a bony knob, causing a scarcely visible prominence. The jugular vein was just in front of it; and immediately below it a large artery coursed across the neck, probably the transversalis colli.

There was no spontaneous pain on either side, and no difference between the pulses.

The patient, who was sent to me by Dr. Stem, of Berlin, N. J., was a married woman, aged sixty-five years, a native of Philadelphia. She was extremely emaciated and had distinct signs of consolidation at the apex of the right lung; tubercle bacilli were present in the sputum. The supernumerary ribs had never given her any trouble, and she was not aware of their existence.

[1] Paper read and patient exhibited before the Section in Medicine of the College of Physicians of Philadelphia, April 13, 1903.

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The tuberculous disease made rapid progress, and the patient died of exhaustion within a few months. An autopsy was not obtained.

The existence of supernumerary ribs has interested anatomists for centuries, and many of the earlier writers devoted considerable space to the subject. Galen mentions it, and Vesalius's monumental work contains a longer account than, for example, does Gray's *Anatomy*. Most of the earlier writers discuss the subject in connection with the Biblical story of the creation of Eve from one of the ribs of Adam. "Because Adam lacked a rib on one side," naively remarks Vesalius, "it does not follow, of necessity, that a rib must be deficient in all other men." Schenck v. Graefenburg, who observed a supernumerary rib in the cadaver of a woman that he had dissected, states that an excess in the usual number is more common than a deficiency, and reiterates Vesalius' argument with regard to Adam and Eve. Morgagni cites a paragraph of Kerkring's, in which it is stated that supernumerary ribs are rare, but not so rare as is a number less than normal. Riolan says that he has seen skeletons with thirteen ribs on each side.

None of the older writers notes whether the supernumerary rib seen by him was found in the neck or in the lumbar region. The first to describe a strictly cervical rib was Hunauld, in 1740. Another French anatomist, Bertin, in 1754, reported a case with fifteen ribs on each side. Gruber, the first to study the subject thoroughly, interprets Bertin's case to have been one of triply-split cervical rib. Boehmer, in 1751, published a case in which an accessory rib articulated with the last cervical vertebra. Another case was described by Meckel, in 1815. This author, however, states that supernumerary ribs more commonly spring from below the twelfth dorsal vertebra than from above the first. Hodgson, in 1815, and Astley Cooper, in 1818, reported cases that were probably cervical ribs; although the former thought that he was dealing with an exostosis. These two appear to have been the earliest cases with clinical symptoms to be reported.

The first and most thorough study of cervical rib was made by Gruber, of St. Petersburg, in 1849, since which date many writers have dealt with the subject, the most recent article being that of Dr. Pancoast, of Philadelphia.

In the lower vertebrates—the fishes, the reptiles, and some amphibia—ribs spring from the entire length of the spinal column. In the mammals, only those springing from the thoracic vertebræ attain full development; while in the neck and in the lumbar region the rib "Anlage" remains rudimentary or entirely disappears. In

the case of the cervical vertebræ the rudiment of the rib is represented by the anterior root of the transverse process, which unites with the posterior root to form the lateral process, leaving a circular foramen for the passage of the vertebral artery and vein. If the rudiment reaches a greater development than normal it becomes either a complete or an incomplete cervical rib. Planet considers the presence of cervical rib to be a form of atavism, inasmuch as all vertebrates originally had as many ribs as vertebræ.

We may divide cervical ribs into the following varieties:

1. True ribs, starting at the seventh cervical vertebra and passing forward to the manubrium sterni without interruption; these are rare.

2. Ribs reaching the manubrium, but, before doing so, having their cartilage united for a greater or less distance with the first rib.

3. Ribs the body of which passes forward for a variable distance, and either ends free or unites by a ligament with the cartilage of the first rib.

4. Ribs represented by a short process not extending much beyond the transverse process of the cervical vertebra, but having a head, neck, and tubercle, and articulating with the body and with the anterior surface of the tip of the transverse process.

5. Ribs represented by their two extremities only,—the sternal and the vertebral,—the intervening gap being filled by a fibrous band; sometimes the band is absent. Such cases are reported by Leboucq and Albrecht.

When a cervical rib is present the transverse process of the seventh cervical vertebra is usually devoid of a vertebral foramen, the vertebra thus approaching in type the vertebræ of the thorax. Cervical ribs are commonly symmetric, but not necessarily equal in size. The rib usually springs from the seventh cervical vertebra; but in Stifler's case it arose from the sixth. In the case reported by Struthers and in that reported by Ehrich there were two cervical ribs on one side. In Ehrich's case the two ribs enclosed the subclavian artery in such a manner that at the inspiratory lifting of the thorax the pulse became completely obliterated. If the rib is of any considerable length the subclavian artery runs over it and occupies an abnormally high position in the neck. This is one of the suggestive signs of cervical rib. According to Turner, the artery reaches the highest elevation when associated with a cervical rib that does not bound much more than the posterior half of its own side of the thoracic inlet. Halbertsma states that if the cervical rib is 5.6 cm. or more in length, the subclavian artery passes over it;

if it is only 5.1 cm. or less, the artery passes over the first dorsal rib. If the rib passes far enough forward, the space between it and the first thoracic rib is filled with a set of intercostal muscles supplied by nerves. In one of Turner's cases the nerve for this interspace came from the first dorsal and the eighth cervical. The general anatomic features have been well studied by this author, to whose several papers I would refer. The vertebral artery in a case of cervical rib usually enters through the foramen in the sixth cervical vertebra, instead of in the seventh.

As a rule, when a cervical rib exists there is also the usual complement of thoracic ribs—viz., twelve; in some cases, however, only eleven of the latter have been found.

For a long time cervical rib possessed only an anatomic interest, being either one of the dissecting-room anomalies or a symptomless condition accidentally discovered during life; but that cervical rib may produce disorders of even considerable gravity is attested by the large number of cases scattered through medical literature. In a fairly thorough, but probably still incomplete search, I have found forty-six cases in which the condition gave rise to marked disturbance, sometimes so severe as to render an operation necessary. This was so in twenty-two out of the forty-six cases.

The clinical picture in the ordinary cases is about as follows: Either suddenly or gradually, pain develops at the base of the neck and radiates to the shoulder, the back, and the pectoral region; sometimes up the neck, and even to the ear. The pain may be present constantly, or only when the head or the arm is moved. It is usually paroxysmal and worse at night, preventing sleep. Associated with the pain are sensory disturbances—paræsthesias, such as numbness, tingling, formication, and sensitiveness to cold. There may be inability to perform fine movements, and muscular weakness approaching paralysis. Atrophy frequently takes place. Circulatory disturbances of varying intensity are likewise present: the arm may be cyanosed and cold; the pulse feeble or absent. Examination of the neck shows obliteration of the normal concavity, and at the base of the neck, in the supraclavicular triangle, a rounded prominence covered with unaltered skin. Along the anterior margin of this prominence a pulsating vessel—the subclavian artery—may be seen. Pressure upon the prominence may cause pain to radiate into the chest and the arm, following the distribution of the brachial plexus. In very mild cases the patient may complain of nothing save pain from the pressure of a tight collar.

Analyzing the symptoms, we shall find it of advantage to classify them in two groups: A, local; and B, functional—the latter being subdivided into 1, circulatory; and 2, nervous.

A. LOCAL SYMPTOMS.

These are: *a.* A prominence above the clavicle or an absence of the normal depression at the outer border of the sternocleidomastoid muscle.

b. A visible or palpable superficial pulsation, high in the supraclavicular region.

c. The presence of a smooth bony mass in the supraclavicular fossa, which may be followed backward to the spine, and which anteriorly either ends free under the skin or unites with the first rib.

B. FUNCTIONAL SYMPTOMS.

1. *Circulatory.*

These are: *a.* Thrombosis of the subclavian artery and its branches, with resulting inequality of the pulses or total absence of the pulse on the affected side.

b. Lowering of the temperature and pallor or cyanosis, and sometimes redness of the arm and hand.

c. Coldness and "dead fingers."

d. Œdema of the arm and hand.

e. Aneurysm of the subclavian artery, as in the cases of Poland, Adams, and Braun.

f. A systolic bruit over the rib, as in the cases reported by Ehrich and by Stifler.

2. *Nervous.*

a. Pain in the distribution of the brachial plexus, usually starting at about the middle of the clavicle and radiating down the shoulder to the arm, forearm, hand, and fingers, into the pectoral region, and at times into the neck. In some cases the pain is increased by extending the head or by moving the arm. The pain may attain intolerable severity and become a true brachial neuralgia.

b. Hyperæsthesia or paræsthesia, such as numbness, formication, or a cold feeling, with awkwardness in using the hand; also disturbance in the muscular and stereognostic senses.

c. Weakness and paresis or paralysis; sometimes ataxia and contracture.

d. Atrophy and other trophic changes, such as gangrene, as in Coote's case. Differences in the dermal temperature of the two arms have been noted; and in one of Hirsch's cases there was increased sweating on the affected side.

In some cases in which nervous symptoms were marked, operation showed flattening of the nerves of the brachial plexus against the cervical rib.

Bernhardt, Ranzi, Kuester, and Tillmanns have reported cases in which there was dysphagia. This could hardly have been due to pressure upon any nerve or upon the œsophagus. When not attributable to some complicating organic disease, the symptom is usually of hysteric origin.

Palpitation and dyspnœa are frequently present; and in several cases there has been hoarseness. In the case of Borchardt the hoarseness was found to depend upon a paralysis of the right recurrent laryngeal nerve, but the existence of other nervous symptoms that had no connection with the cervical rib made a diagnosis of bulbospinal gliosis possible; and, naturally, removing the rib did not relieve these symptoms. In a case reported by Ranzi, and in one reported by Spisharny, there was scoliosis, which those authors bring into relation with the cervical rib.

Although cervical rib is a congenital condition, the symptoms do not, as a rule, develop early in life—usually not before the twentieth year. Lloyd's and Planet's patients, however, were twelve years old; one of Ehrich's, and one of Ranzi's, seventeen; and Williams' and Pancoast's, fifteen. The late development is probably, in part at least, to be explained on the ground that the cumulative muscular strain during the early years of active work brings about the symptoms. Scheller and de Quervain have called attention to the fact that the existence of cervical rib may unfit men for military duty. The pressure of the strap that supports the knapsack gives rise to pronounced nervous and circulatory disturbances. The latter author therefore advocates examining all recruits for cervical rib, and rejecting those that present this condition.

It is probable that the functional disturbances are commonly initiated by some overlooked trauma. As a rule, the first symptom to call attention to the existence of the rib is a slight pain in the region of the supraclavicular triangle.

Regarding the sex in the cases in which cervical rib has produced symptoms, it is given in 44; 29 of these were in women and 15 in men—a proportion of nearly two to one. In 41 cases the side affected is specified. It was the left in 26, and the right in 15.

If these figures can be taken as representative, they indicate

that the mere using of the arm is not a factor in the production of the symptoms; otherwise the preponderance would be on the right side and in the male sex.

Diagnosis. The diagnosis may be easily made. The presence of a visible and palpable prominence above the clavicle, together with marked pulsation, should suggest cervical rib. In cases of brachial neuralgia, and when other disturbances, such as those that I have mentioned, exist, it is always well to examine for the anomaly. The *x*-ray is of value and has been used in a considerable number of cases with satisfactory results. In several instances recorded in the literature a diagnosis of osteoma has been made, although the description of the local and functional conditions given by their reporters is strongly suggestive of cervical rib.

The high position of the subclavian artery, only noticeable when the rib is long enough to allow the artery to pass over it, has at times led to a diagnosis of aneurysm. On careful examination, however, it will be found that the apparent aneurysmal tumor consists largely of a deep-seated bony mass, overlain by an artery of normal caliber; but aneurysm sometimes develops as the result of a weakening of the vessel through impact or pressure against the rib. At times the tumor simulates a large lymph gland, as in Huntemüller's case, which is one of the earliest in which a diagnosis of cervical rib was made during life.

In a rather large proportion of cases tuberculosis of the lung existed. Whether this was more than accidental is difficult to determine.

Treatment. If symptoms are present the treatment consists primarily in removing ascertainable external causes and in subduing any inflammation that may exist. This has succeeded in several cases, as in those of Astley Cooper, Hodgson, and others. Often, however, resection of the unnecessary rib is indicated. In the cases in which this was done, twenty-two in number, the results were generally excellent. The nervous and circulatory symptoms usually disappeared promptly, even aneurysms of the subclavian artery afterward becoming rapidly cured. In some cases the circulatory changes and the atrophy remained (Ranzi's, Tillmanns', and Kammerer's), the pulse not returning on account of extensive arterial thrombosis. No improvement whatever followed in two of Borchardt's cases and in one of Israel's. In the latter the operation not only failed to relieve the symptoms, but was followed by a serratus magnus palsy; and in one of Borchardt's cases the entire arm became paralyzed after the operation. In several cases the pleura was opened during the operation, with a resulting pneumo-

thorax. In none of these cases, however, did this give rise to serious disturbance, the air being quickly absorbed. In Tillmanns' case, although the pleura was opened, no pneumothorax ensued; this was owing to the existence of pleural adhesions at the point of perforation.

CONCLUSIONS.

1. Cervical rib may exist without producing symptoms.
2. When present, the symptoms are local and functional.
3. The local symptoms are a hard prominence above the clavicle and a visible pulsation high in the supraclavicular fossa.
4. The functional symptoms are circulatory and nervous.
5. The principal circulatory symptoms are feebleness or absence of the pulse, coldness of the extremity, at times cyanosis, and edema.
6. The principal nervous symptoms are pain in the distribution of the brachial plexus, together with paresthesias, such as numbness and formication, and awkwardness in the use of the hand; in some cases weakness and atrophy.
7. In cases of brachial neuralgia the possibility of the presence of a cervical rib should be considered.
8. The treatment, except in the mildest cases, is excision of the rib. This was done in twenty-two out of forty-six cases, and in the majority with success.

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TRIGGER-FINGER (DIGITUS RECELLENS), ASSOCIATED WITH ACROPARESTHESIA *

Trigger-finger is a rare and annoying affection, characterized by a sudden locking of the finger when it is flexed or extended to a certain point. The finger thus locked cannot be further flexed or extended without a powerful voluntary effort, and frequently not without the aid of the other hand. The forcible overcoming of the resistance is usually attended by a distinct, audible snap. The condition, first described by Notta,[1] in 1850, is known in English literature by various names—as trigger-finger, a term first applied to it by William Anderson;[2] as jerk-finger (Turby [3]); as lock-finger (Agnew [4]); and as snap or spring-finger. The Germans designate it as *schnellender* or *federnder Finger*; the French as *doigt à ressort*, and the Italians as *dito a scatto*. The literature of the subject is quite extensive, Carlier [5] having been able to collect, in 1889, 105 cases; to these Necker,[6] in 1893, added 16 cases, including one of his own; Abbe [7] described five cases in 1894; Büdinger,[8] one case, in 1896, his paper containing a large number of literary references. One of the latest writers dealing with the subject is Turby,[9] who reports two cases.

Trigger-finger is considerably more frequent in the female than in the male sex, and usually involves but one finger, the middle finger being the seat in over one-third of all cases. Thumb, ring-finger, index, and little finger are affected in frequency in the order in which they are named. In my own case, described below, the little finger was affected. The right hand is involved twice as often as the left. A condition completely analogous has also been observed in the toes, and is even said to occur in the wrist and hip; in one of Turby's cases the knee seemed also to lock.

With regard to age, the disease is commonest in middle life, but it may occur at any time, and may even be congenital. The etiology is obscure—rheumatism and gout are given as the cause in not quite half the cases—52 in 121 cases, investigated by Necker; traumatism was accused in 13, and overuse from occupation in 47. In two cases the condition was congenital; in seven instances no definite cause was ascertainable. Schmit [10] pointed out the inter-

* Reprinted from the Philadelphia Polyclinic, Vol. VII, No. 13, March 26, 1898.

esting fact that the disease was common in seamstresses, embroiderers, knitters, and mattress-makers, and he attributed it to functional overuse of the fingers. As the middle finger and thumb are the parts chiefly employed in these occupations, they would naturally be those most often affected, which is, indeed, the case. Several instances have been observed among soldiers, in whom the disease was ascribed to certain routine manipulations of the musket, *e. g.*, carrying the musket over the shoulder.

Musicians are also liable to the affection from overuse of the fingers; in a flute-player, observed by Schmit, the left middle finger, and in a pianist, the left ring-finger was subject to locking. In a few instances, the disease seemed to be a neurosis, and to such Carlier applies the term "idiopathic."

Various theories have been advanced to explain the pathology of the affection; they are historically and critically considered by Necker, and I need scarcely repeat them here. Loose cartilages seem to have nothing to do with the production of the condition. The best explanation, according to Necker, is that of Berger, who, on the strength of the anatomic studies of Hyrtl,[11] and the experimental investigations of Menzel,[12] comes to the conclusion that trigger-finger is dependent "on a combination of thickening of the tendon of the flexor or extensor of the finger, and a physiologic or pathologic narrowing of the part of the pathway [the synovial sheath] traversed by the tendon during motion." A total of 11 cases has been examined at necropsy and at operation. Büdinger has analyzed these with the following results: (1) *Changes in the tendon*—duplication; diffuse thickening; pediculated tumor of deep flexor; folding of tendon; hyperplasia of connective tissue of tendon; remains of a tumor; (2) *Changes in the sheath*—transverse band; fibromatous nodule [Agnew, it is interesting to note, believed fibromatous thickening of the synovial fringes to be the cause]; villous hypertrophy; diffuse thickening, the result of tenosynovitis. Büdinger's own case at operation showed a thickening of the synovial sheath; during flexion the sheath became folded like an accordion, and the tendon was caught by the crests of these folds; (3) *Negative results*—after operation in three cases—Carlier, in two of these thought the condition, as already mentioned, dependent on a nervous cause. As will be seen below, the affection in my case was probably nervous in origin.

My own case is as follows:

M. W., a widow, 49 years of age, born in Philadelphia; occupation, chamber-work. The family history is negative. She herself had "typhoid pneumonia" several years ago. She has had seven miscarriages and bore

three living children, one of which lived only two weeks. Her husband died of heart-disease.

Seven years ago she had an attack of numbness of the right arm and a feeling in hand and elbow of "pins and needles." Under the use of electricity the trouble disappeared. Four years later it returned, and the same treatment was again successful. The *present attack* began three weeks before she presented herself at the nervous clinic of the Northern Dispensary. There was a feeling of numbness and formication in the right hand, just as on previous occasions. But there was now an additional and peculiar symptom—a locking of the little finger of the right hand in the flexed position.

The trouble was located in the first phalangeal joint of the little finger; when the fingers were flexed they could all be readily extended except the little finger—extension here was only possible by the aid of the other hand, and was accompanied by a distinct snapping sound. When I myself forcibly extended the finger, the sound and the peculiar jerk produced suggested the opening of a pen-knife. This comparison has also been made by König.[13] The locking was not constant; at times she could flex and extend the finger without difficulty. There seemed also to be a slight tendency to locking in the ring-finger of the right hand—this may have been in part only apparent, since when the little finger is completely flexed the ring-finger is always, from an interlacing of the tendons, in a partly flexed position.

When the locked ring-finger was forcibly extended a pain shot up to the elbow, but it was only momentary.

The numbness and formication were worst in the mornings and during the night, and prevented sleep; the patient found some relief by placing the hand in a basin of water before retiring. On arising in the morning the right hand usually was slightly swollen. The feeling of formication extended from the wrist to the tips of the fingers. Tactile sensation was not disturbed; there was no tenderness or swelling of the affected joint, but there was a little pain at a point in the palm corresponding to the base of the little finger. No loose body or nodular prominence could be felt in the neighborhood of the affected joint. Above the olecranon there was a tender spot; there was no pain along the course of the nerves, nor were they tender to pressure. Pretty severe squeezing of the entire hand did not cause any pain. There was no excessive sweating of the hand. Slight numbness existed in the left hand.

The patient was well-nourished and rotund, but pale and quite anemic; she was constipated, and her appetite was deficient.

A skiagraph of the patient's right hand was made at the Polyclinic Hospital, but it was not successful.

The treatment first instituted consisted in regulation of the bowels and the administration, in view of a possible specific taint, suggested by the repeated miscarriages, of potassium iodid. No relief followed, and faradism was employed, likewise without success. As the patient complained chiefly of the formication and numbness, I ordered fluid extract of ergot, which, since its advocacy by Dr. Sinkler, I have used with gratifying success in a number of cases of paresthesia. Improvement followed, and soon the sensory

disturbance and the locking of the finger disappeared. I saw the patient last on November 8, 1897. She reported herself as entirely well so far as the right hand was concerned, but had slight fugitive, probably rheumatic, pains in various parts of the body.

Interesting in this case was the existence of the pronounced acroparesthesia. Such sensory disturbances have been described as accompanying trigger-finger, but in the present instance the condition seemed to have attained an unusual degree of intensity. It is not my purpose in this paper to discuss the subject of acroparesthesia, but it will have been noted that the symptoms detailed, the nocturnal exacerbation, etc., were typical of the disease as described by Schultze, Frankl-Hochwart, and others.

The prognosis of trigger-finger is on the whole good, and a considerable number of recoveries is on record. The treatment generally advised is the application of iodin, electricity, massage, passive motion, and fixation of the finger by means of a splint. Inveterate cases have been treated by operation, which usually consists in removing whatever obstacle to free movement exists. If an underlying cause, like rheumatism or gout, is ascertainable, proper general treatment is of course to be instituted. In cases accompanied by pronounced paresthetic phenomena, the use of ergot may be tried.

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"SPELTER CHILLS" [1]

In recent years the results obtained from the study of occupational diseases have been most gratifying. Such a study not only often aids in arriving at an otherwise difficult diagnosis, but as a part of industrial hygiene it has become of great importance in the prevention of those ills that are the result of occupation.

With this in mind a systematic study of occupational diseases is being made in the medical division of the Philadelphia General Hospital, and the affection about to be described is one of a number of interesting conditions revealed by this study.

"Spelter chills" is the name given to a condition heretofore but briefly described under such varying terms as brass-founders' ague, brass chills, zinc chills, smelter shakes, das Giesfieber or Staubfieber and fièvre des fondeurs. We believe the condition results from the inhalation and ingestion of the fumes and flakes of zinc oxide arising from the melting and volatilizing of spelter, which is the commercial name for zinc in its impure state. Spelter chills we found to be the name popularly employed among the local workmen.

The chills occur in brass foundries, in zinc smelters, and in places where zinc is poured. The majority of instances are found in places where yellow brass is manufactured, a process in which a large percentage of zinc is used. The chills do not occur in those engaged in processes in which the zinc is not volatilized. Lehman produced it artificially in a workman by burning zinc. Some investigators have suspected copper as the cause of the chills. This seems unlikely in view of the fact that in the manufacture of red brass, which contains a large percentage of copper and a small percentage of zinc, the chills occur less frequently than in the manufacture of yellow brass, which contains a greater percentage of zinc than of copper. In brass workers employed in finishing or polishing of brass, though they inhale quantities of copper-laden dust, as is shown by the excretion of copper in the perspiration imparting a greenish tinge to the skin, hair and underclothes, the chills never

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Written in collaboration with Russell S. Boles, M.D.

occur. Lead as a contributory cause may be considered a negligible factor.

A brief description of the process which exposes the workers to this ailment may be of interest: Zinc is obtained from its ores, zinc sulphide or zinc blende and zinc carbonate or calamine. Brass is ordinarily of two varieties, red and yellow. The red brass, the better quality, is made up of from two to four parts copper and one part zinc. The yellow brass is made up, roughly, of two parts copper and three parts zinc. The relative proportions of zinc and copper thus determine the quality of the brass.

Brass is manufactured by either the direct or the indirect process, the latter being the safer, though the former is probably in more common use. In the direct process the metals are all fused together at the same time. In the indirect they are fused one after another, the order depending upon the relative fusibility and volatility. The metals are melted in a large crucible, which is first heated to avoid breaking. Into the crucible is put, first, a mixture of scrap brass or grain copper; rarely are the pure copper and zinc directly mixed in their definite proportions. After the material is melted down the proper amount of copper or zinc is added to secure the desired composition. It requires 2000° F. to melt copper and 770° F. to melt zinc. Hence the necessity of adding the zinc last. Zinc is readily volatile above 770° F., and for this reason must be well submerged beneath the surface of the melted copper. The mixture is then poured into molds. Though the process up to this point exposes the workmen in some degree to the metallic fumes the pouring is probably the source of greatest danger. As the metal is being poured the atmosphere becomes laden with intensely irritating whitish fumes and fine flaky deposits of zinc oxide or "zinc snow," as it is called. Sir Thomas Oliver gives the following analysis of this "zinc snow":

Moisture	9.64
Organic matter	39.42
Silicious residue	9.14
Oxide of zinc	28.82
Oxide of iron	2.78
Copper	1.71
Other matter	8.49
	100.00

Another analysis gives 44.9 per cent. zinc.

It is this volatilized zinc or "spelter" impregnating the atmosphere breathed by the workmen that we think is the cause of the "spelter chills." As to their ultimate cause we are not prepared to

speak. Lehman believes the symptoms are due to an auto-intoxication from absorption of dead epithelial cells lining the respiratory tract, the cells being destroyed by the inhalation of zinc oxide fumes. Rambouse says that neither pure copper nor pure zinc gives rise to poisoning, yet the pouring of brass, an alloy of zinc and copper, sets up a peculiar train of symptoms. The question of infection seems doubtful. It is probably an acute intoxication.

Thackrah in England, in 1830, recognized a definite train of symptoms arising from the inhalation of volatilized zinc, but makes no reference to the chills. Greenow in England, in 1845, described a condition "similar to an intermittent fever of an irregular type." Blaudet and Greenhow were also aware of a form of poisoning observed in brass pourers. The chills themselves seem to have been first observed by Schwitzer, in Germany, in 1862. The observations of Siegel made in Wurttemberg in 1905 are, however, the most valuable on the subject. Rarely has the condition claimed the attention of American writers, a few reports of individual cases only having been made in Chicago, in 1904, by Drs. Ungre and Savin and by Dr. S. R. Pietrowiecz. Dr. Kober comments on it in his report to the House Commission. Dr. Hayhurst in his "Report on the Investigation of the Brass Manufacturing Industry in Chicago" contributes the most elaborate American report.

Conditions Predisposing to Chills.—Respiratory and circulatory disturbances favor a more sudden and severe onset of the chills. Minors and women and those unaccustomed to the work are more susceptible than others. Alcoholism, anemia, malnutrition, and impaired renal function likewise constitute predisposing causes.

Characteristic of the chills is their tendency to attack the workmen every Monday. This may perhaps be due to the free indulgence in alcohol over the week end. The chills occur most frequently in winter, this undoubtedly being due to the greater accumulation of the fumes in the workshop owing to the windows not being open. Their frequency is further increased on damp, cloudy days on account of the heavy atmospheric conditions and consequent difficulty in clearing the room of the fumes.

Description of the Attack.—The chill may begin while the man is at his work in the latter part of the afternoon and after the second pouring, but more often it begins soon after leaving the shop or in the early evening. (This we think is due to a diminished activity of the sweat glands after leaving the overheated shop.) Free perspiration, by favoring an excretion of zinc, not only aids in aborting the chill but noticeably diminishes the intensity and

duration of an attack. For this reason the men resort to hot drinks, the most efficacious, one of our patients told us, being hot milk with red pepper. For the same reason the men wrap themselves in blankets.

The first thing complained of is a creepy, chilly sensation up and down the spine which gradually extends throughout the entire body. It may continue as a mere chilliness, but more often develops into a genuine rigor which lasts for from one-half hour to an hour or even from two to three hours. At its height, cramps and pains in the limbs are apt to occur; abdominal pain is infrequent, except as it may follow the ingestion of cold drinks. The pulse is increased in frequency and there is a slight elevation of temperature. Preceding the chill there is a dry, scratchy sensation in the throat, a sticking, pricking feeling in the tongue, oppression in the chest, and an irritating cough, usually unproductive. Actual dyspnea is rare. There is a feeling of prostration and of nausea which frequently eventuates in severe vomiting. Diarrhea is common; indeed, the men at all times have a tendency to diarrhea, constipation being rare among brass molders. As the attack subsides the patient, quite exhausted, breaks out into copious perspiration and soon falls into a deep sleep. A temporary loathing for food and an unpleasant metallic taste in the mouth are present on awakening and last a little while.

One of us exposed himself for two afternoons to the fumes and flakes of zinc oxide during the melting and pouring process. In a few minutes the above-mentioned irritative condition in the throat and chest, with coughing, was experienced. Headache also developed, and later a slight diarrhea. No chilliness, however, was felt.

The attacks do not often incapacitate the workers. For this reason, and also because the men accept the "chills" as a matter of course and of no moment, the physician rarely has the opportunity of witnessing an attack. Great numbers of these workmen, it is reported, visit the out-patient department of the Birmingham Hospitals, but always for respiratory and digestive disturbances.

It is doubtful if single attacks of this affection are of any importance, but repeated again and again, as they usually are, sometimes for many years, they undoubtedly produce far-reaching effects in the human economy.

Among the chronic manifestations of the intoxication, those pertaining to the pulmonary system are the most serious. Brass-founders are especially subject to bronchitis and phthisis, and frequently succumb to pneumonia. A very high death-rate from lung diseases is recorded among the Berlin founders.

A tendency to arthritic attacks with acute and chronic joint manifestations we feel has been somewhat overlooked. One of our patients at present is convalescing from a severe attack of acute inflammatory arthritis complicated with an acute endocarditis and pneumonia. Another suffers with chronic arthritis deformans, and still others have repeatedly complained of mild though definite joint symptoms. Gastro-intestinal disturbances are common; among the more ordinary are attacks of anorexia, headache, apathy, epigastric distress after eating, nausea, and diarrhea. Jaundice sometimes occurs. We have knowledge of an especially interesting case of jaundice which we feel was directly due to zinc intoxication. Unfortunately, we were not able to study it. Among his coworkers the man was known as "yellow-brass Rudy." He was especially subject to the chills, and became markedly jaundiced within a few hours after pouring yellow brass. He could pour red brass without much disturbance, but would not accept, if he could help it, a position where he had to handle yellow brass.

Among the other ill-effects of this vocation we noted a state of malnutrition, a pasty, sallow complexion, and a slight secondary anemia. (The blood cells showed no "stippling.") A well-developed pyorrhea alveolaris was present in all the cases. We detected no changes in the central nervous system, though tabetic symptoms are said to occur. Chronic renal disease should be looked for. Kober found that zinc workers may excrete zinc for months in the urine, though often without signs of poisoning, and Weyl mentions a case showing albumin and a trace of zinc in the urine after a chill. No albumin could be demonstrated during the time the patient was free of the chills. Siegel found a trace of zinc, but makes no mention of albumin in the urine after a chill. Goodman demonstrated the presence of copper, but not of zinc, in the urine and sweat of a brass-worker. The man was probably a finisher and not a molder. As mentioned before, brass-finishers and polishers frequently show visible evidence of copper excretion in the sweat (i. e., greenish tint to skin and hair, staining of underwear, and aggravated itching of the skin). These symptoms are all due in a large measure to uncleanliness, and frequent bathing and the free use of talcum powder tend to prevent their occurrence. The men are not particularly unhealthy.

As the result of examinations kindly made for us by Drs. John Marshall and Wertheim, we are able to report that analyses of the urine from a number of cases revealed no zinc or copper.

It seems that no great tolerance for zinc is ever acquired. Men who have been in the trade for twenty-five years and more fre-

quently suffer from the chills. Certain individuals are more susceptible than others, developing a well-marked chill almost every night and a particularly severe one on Monday nights. None of the subjects experience the chills when not engaged in their work. About 75 per cent. of the men exposed develop the chills. The general mortality rate among these workers is higher than that among other workmen. One authority says it is two and a half times that of farmers. Sir Thomas Oliver notes that "only ten brass-workers were found living out of 1200 casters in Birmingham who were past sixty years of age, and that a superannuation insurance for brass-founders to begin at fifty-five years of age had only three applicants in a period of some ten years." Hayhurst noted that from 1761 foundry men the oldest at the trade was seventy-three years of age, that only 17 were past fifty, that 60 were past forty-five, and 180 past forty years of age.

General Conclusions

Spelter chills lie in the field of preventive medicine. To eliminate them the following precautions should be observed on the part of the employer:

Guard against inhalation and ingestion of metallic vapors by providing the working rooms with an efficient system of ventilation practical for all seasons of the year.

Keep the furnace room apart from the others and provide proper ventilation about the furnaces.

Employ an improved technic for pouring when such is at fault—perhaps some automatic device.

Provide for the removal of all metallic dust and deposits about the foundry by a systematic and thorough cleansing, at regular intervals, of the floor, walls, ceiling, rafters, etc.

Employ strong, healthy men to do the work demanded in brass foundries, zinc smelters, and in any allied trades in which zinc is poured.

Do not employ minors or women.

Do not demand of the workmen an amount of labor that is fatiguing.

Provide proper washing and toilet facilities, and advise the men as to the necessity of their proper use.

Allow the men reasonable time for washing before their eating period and a suitable place for eating.

Caution them to change their clothes before leaving the shop. Advise them not to wear mustaches and to employ respirators when necessary. Caution them against sudden changes in temperature.

A study of industrial diseases is of great importance and should form part of the curriculum of medical schools. With the help of the State, which is now assured in Pennsylvania and in several other commonwealths, it will be possible to inaugurate methods of prevention that will greatly lessen disease and increase the efficiency of the workers.

SUBPECTORAL ABSCESS *

With Report of Two Cases

Subpectoral abscess is rare and little referred to by writers, but an experience with two cases has convinced me that it is a serious and important condition. I have looked over many textbooks, especially textbooks of surgery, and find it mentioned in only a few. A good account is given by Ashhurst (*Surgery—Principles and Practice*, 1914, p. 730), and there is also a short but clear paragraph in Brewer's *Textbook of Surgery* (1909).

The first symptom of subpectoral abscess is usually a sudden, intense, agonizing pain in the infraclavicular region, increased by breathing and especially by motion of the arm. The temperature is high from the beginning—fever may even precede the onset of the pain—and prostration is marked. There is nothing to indicate the exact nature of the trouble, and the physician will think that the case is one of brachial neuritis, pneumonia, or pleurisy. On examination there is tenderness in the pectoral region in the second or third intercostal spaces. As time progresses the pain does not abate much, but rather increases, although tenderness to touch may not be marked. Palpation gives a sense of very deep fluctuation, which is so elusive that when different men examine the patient simultaneously they are apt to disagree about it. Coincident with the appearance of this deep-seated fluctuation, the whole pectoral region becomes brawny and tense from the clavicle downward and outward toward the axillary fold. There was no enlargement, as I recall it, of the axillary glands in either of my cases. The fever is irregular and tends to be high throughout. The pulse is rapid, the face flushed. Delirium is present, chiefly nocturnal, sometimes diurnal, and the urine shows a high degree of toxic albuminuria. The leukocytes are considerably increased, especially the polymorphonuclear cells. In one of my cases a small pneumonic patch became evident near the angle of the scapula toward the end of the first week.

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Regarding the etiology, there may be, as in some cases of delayed tetanus, no evidence of any portal of entry. In my first case it was only after careful inquiry that the fact was revealed that the patient had had a source of infection prior to the onset of the trouble. In the second, no cause could be discovered. Ashhurst believes that some cases are due to a slight trauma of the pectoral region with the production of a hematoma which subsequently becomes infected through the blood stream. Where the infection has a peripheral origin, it travels up the lymphatics to the glands of the pectoral region. It is said that infection from the thumb or index finger or the radial aspect of the forearm may pass directly to the pectoral nodes along the lymphatics accompanying the cephalic vein; in my case the infection took place in the ring finger, nevertheless it reached the pectoral glands direct, thus circumventing all the intervening lymph nodes.

There are two sets of lymph glands in the pectoral region—one, the anteropectoral group situated over the second and third intercostal spaces beneath the lower border of the pectoralis major muscle and anterior to the long thoracic artery. The other is the inferopectoral group, composed of two or three small nodes situated either upon or posterior to the long thoracic artery over the fourth or fifth intercostal space or even higher.

The streptococcus is the organism usually found in subpectoral abscess, which explains the alarming character of the constitutional symptoms.

Case I.—Dr. X., seen through the courtesy of Dr. L. J. Hammond, while operating, on February 18, 1914, on a case of septic peritonitis, pricked or scratched himself through the rubber glove in the left ring finger. On the following day there was a fine line of suppuration without pain or discomfort. He slit open this area and disinfected it with iodine and acetone. It healed so promptly that he gave it no further thought. On Saturday evening, February 21st, while examining candidates for internship, he felt himself getting very warm and found his temperature to be 103° F. After leaving the hospital, he ate a hearty supper, then took some salicylate of soda, and arose next morning with a normal temperature and feeling quite well. In the evening he was called out, and just as he was in the act of putting on his coat, a sharp shooting pain struck him in the left pectoral region below the clavicle, and radiated into the shoulder. The pain was very severe and by the time he came home he could scarcely lift the arm from the side. During the night the temperature rose to 104° F. By morning he could not abduct the arm and any attempt at coughing or sneezing was agony to him. He was profoundly depressed, sleepless, and exceedingly irritable. When I saw him I found the left pectoral region of an almost boardlike hardness, scarcely tender to touch, and not very hot. The whole upper left chest wall was involved, the swelling extending outward toward the shoulder and the axilla, in particular filling out the

hollow normally present below the acromial end of the clavicle. At first a small incision was made by Doctor Hammond, but it was evidently not deep enough, for no pus appeared, so a few days later, on March 7th, he made a second and deeper incision along the border of the pectoralis major, and through this considerable pus escaped. The patient's mind at once became clearer, but the high temperature persisted, though he felt well in every way, except that he was still troubled by persistent insomnia. The albumin disappeared from the urine. Upon the establishment of free drainage by means of a large rubber tube, the temperature gradually subsided; yet the patient remained extremely weak for a long time.

Two blood counts were kindly made by Dr. W. C. Albright—one on February 26th and one on March 2d: 1.—Leukocytes, 16,350. Differential count: Polymorphonuclears, 87 per cent.; transitionals, 1; large lymphocytes, 3; small lymphocytes, 8, and large mononuclears, 1 per cent. 2.—Leukocytes, 15,200. Differential count: Polymorphonuclears, 93 per cent.; large lymphocytes, 2; small lymphocytes, 4, and mononuclears, 1 per cent. Blood culture was sterile, but the pus from the abscess yielded the streptococcus in pure culture.

Case II.—Mrs. B. Z., married, a native of Russia, aged forty years, was seen in consultation with Doctor Tonsky, on April 12, 1914. She had been perfectly well until three days before, when she was suddenly seized with intense pain in the right shoulder and back of head. Several severe chills occurred on the same day and were followed by profuse sweating. Her temperature in the beginning was 102° F. When I saw her it had reached 104° F. She looked very ill and was greatly prostrated. By a coincidence, which had served to confuse the diagnosis, her husband was lying in the same room with a severe acute attack of articular rheumatism. I found a diffuse fullness in the right pectoral region, which as in the first case was especially noticeable in the hollow in front of the shoulder. The swelling was very tender, but there was no local heat. Movement of the arm greatly increased the pain. I at once suspected subpectoral abscess, and with her physician's consent had the patient taken to the Polyclinic Hospital, where on April 18th, Doctor Jopson made an incision in the right pectoralis major. After splitting the fascia below the pectoralis minor, pus was reached and evacuated.

The blood examination made soon after admission gave the following result: Erythrocytes, 5,400,000; hemoglobin, 90 per cent.; leukocytes, 15,000; polymorphonuclears, 81 per cent.; transitionals, 3; lymphocytes, 4; large mononuclears, 12 per cent.; eosinophiles, 0; mast cells, 0; myelocytes, 0. Four days later, the leukocytes were 11,400. Blood culture remained sterile; the Wassermann reaction was negative. From the pus the streptococcus was isolated in pure culture.

Remarks

The constitutional symptoms of subpectoral abscess from the very beginning are out of proportion to the local manifestations. This is due to the fact that the streptococcus is the causative organism and that the free lymph circulation of the thorax permits of easy dissemination of the infection. In the first patient we several times despaired of a favorable outcome.

In the treatment of subpectoral abscess the question arises whether it is better to wait for definite localization of the pus or to make an incision as soon as the diagnosis is established. The question can no doubt be settled best by surgeons, but I cannot refrain from saying that I believe it is wiser *not* to wait, but to make at once a free incision. The general medical treatment scarcely requires discussion, nor need I say anything about the use of vaccines. This latter question is sure to come up in every protracted case and has to be considered upon the general principles of vaccine therapy.

BERIBERI FOLLOWING DRASTIC VOLUNTARY DIETARY RESTRICTION [1]

Beriberi is looked on as a tropical or exotic disease, but the conditions that are alleged to give rise to it may conceivably occur elsewhere. A few instances have been encountered in badly run prisons and insane asylums, but sporadic cases are on the whole sufficiently rare, in this locality at least, to justify us in placing two on record.

Beriberi is a vitamin B deficiency disease characterized by cardiovascular changes, edema and polyneuritis. Historically it is a very ancient malady. It appears in Chinese writings of the Sui and Tang dynasties at the beginning of the seventh century. A description dating back to 610 A. D. is clear enough to indicate that a moist and a dry form of the disease were then recognized just as is the case today. Under the name of kakke the malady makes its appearance in Japanese literature in the ninth century. The first indubitable descriptions are, however, not found before the seventeenth century. An early account by a European was written by Malcolmson in 1835. About the middle of the nineteenth century the publications multiplied rapidly, largely by reason of work by Europeans studying the problem in Asia, both on the mainland and in Japan and on the islands of the Straits and in the Philippines. The disease was a great scourge in the armies during the Sino-Japanese War (1894-1895), occurring in 17.56 per cent of the troops, and in the Russo-Japanese War (1904-1905), in 16 per cent. One fourth of all hospitalized soldiers had the disease.

Early writers believed that beriberi was caused by an infective agent, but in 1895 Eijkman [2] made experiments that not only resulted in clearing up the cause of beriberi but threw a flood of light on the whole subject of deficiency diseases. He fed hens nothing but polished rice and produced polyneuritis, exhaustion and death, while a diet of rice and barley or of only half polished rice

[1] Read before the Section in General Medicine of the College of Physicians, Feb. 26, 1934. Reprinted from the Journal of the American Medical Association, June 16, 1934, Vol. 102.
Written in collaboration with Harold S. Davidson, M.D.

[2] Eijkman, C.: Virchows Arch. f. path. Anat. **148**: 523, 1897.

prevented the disease. Between 1900 and 1910 proof was definitely brought forth that beriberi was a nutritional disease. Fraser and Stanton in 1910-1911 showed that beriberi could be prevented among the natives of the Malay peninsula by a diet of parboiled rice and that it could be prevented under the same condition even when the men also received polished rice. Similar experiments were made by Chamberlain, Vedder and their associates in the Philippine Islands. A little later Takaki [3] succeeded in conquering beriberi in the Japanese navy by a change of ration.

The accessory food factor that is responsible for beriberi is the soluble antineuritic or B vitamin, which in nature is usually associated with a closely related substance called the antipellagra vitamin (B_2 or G). These water-soluble vitamins are contained in vegatables, fruits, milk, yeast, kidney, liver, brain and whole grain. Recent studies seem to indicate the possible existence of seven components in the B complex.[4]

Clinically, beriberi presents itself in two fairly distinct forms: one in which polyneuritis predominates, the other in which edema is the outstanding feature. In the former a differential diagnosis between beriberi and polyneuritis from other causes is sometimes required. The senior author many years ago called attention to the similarity between alcoholic multiple neuritis and the deficiency diseases. It is well known that steady drinkers in whom alcoholic multiple neuritis later develops rarely partake of an adequate amount or of a proper kind of food.

Edematous cases of beriberi can be distinguished by the fact that pressure on the calf muscles produces severe pain; it has also been noticed that beriberi patients have difficulty in rising from a squatting position. If the diagnosis proves doubtful, the therapeutic test may decide. Under the specific therapy, the administration of foods that contain vitamin B, beriberi patients promptly recover.

Nutritional or war edema is allied to beriberi in that it is also a deficiency disease. It results from living on a diet containing too little protein and an excess of fluid and salt. Polyneuritis is not common in war edema. Some cases of war edema are probably due to an acute glomerulonephritis.

Patients with beriberi, as in our own first case, usually complain of dyspepsia. They seldom have spontaneous pain but they lose all appetite, acquire a loathing for food and have a sense of fulness in the stomach which in the more severe cases may pass into nausea

[3] Takaki, cited by Sherman, H. C., and Smith, S. L.: The Vitamins, ed. 2, New York, Chemical Catalog Company, Inc., 1933.

[4] Kruse H. D., and McCollum, E. V.: Review of the Recent Studies on the Antineuritic Vitamin, J. A. M. A. **98**: 2001 (June 18) 1932.

and vomiting. The first characteristic symptom as a rule seems to be weakness in the legs; later a moderate edema, paralysis of the legs and general nervous disturbances such as irritability, headache and dizziness are added. Changes in the skin in the form of hemorrhagic exudates often appear. Fever is usually absent unless complications ensue. Palpitation on exertion and shortness of breath are present and become more marked as the disease progresses. The heart is usually enlarged, especially toward the right, but the edema is out of all proportion to the clinical evidence of cardiac changes during life. With respect to the changes in the heart, the recent studies of Wenckebach [5] are interesting. He found the right heart extraordinarily over-filled, the muscle being stretched and flattened out. These pathologic changes throw light on the sudden deaths that are so common in beriberi. The vascular symptoms often closely resemble those of aortic insufficiency.

E. W., our first patient, a white man, aged 76, married, retired from business, complained of greatly swollen, painful legs, and digestive disturbances. His father, mother, two brothers and three sisters had all died of old age. The patient had typhoid in infancy. When he was 23 he had a "heat stroke"; at that time he was given so many different kinds of medicine that ever since he has had stomach trouble for which he has seen many specialists in this and foreign countries. Gradually he eliminated one article of food after another, since nearly everything gave him a feeling of distress in the stomach, with belching of large amounts of gas.

About a year and a half before coming under observation he became so ill that he discontinued all foods, except milk, of which he took about 3 quarts a day. As this caused diarrhea, he was forced to cut down the amount by one half. He grew progressively weaker and in August 1933 his legs began to swell. The swelling became more and more pronounced and eventually involved the face and hands. He was dizzy and extremely irritable and so weak that he had to be lifted from his bed to a chair. The greatly swollen legs were intensely painful and he screamed when they were touched. Eventually he became utterly helpless and could no longer leave the bed but lay with his swollen legs drawn up and supported by pillows under the knees. With difficulty he was induced to take a little milk but would take nothing else in the way of food. Somewhat later pruritus ani became very annoying, and he at last consented to see a physician. A skin specialist treated him without any relief. It was at this time that he was first seen by one of us (D.) and a week later by the other (R.). There were large ecchymotic spots on the legs and buttocks. The heart was enlarged to the right; the hands, face and legs were edematous; the calf muscles were extremely tender to touch. The man was visibly emaciated, extremely pale, mentally confused and very uncooperative. A diagnosis of beriberi was made. Only the persuasion of both of us finally broke the man's resistance against going to the hospital.

The blood count on admission showed less than 7.5 Gm. of hemoglobin, 2,150,000 red blood cells, 8,800 white blood cells with 82 per cent poly-

[5] Wenckebach, K. F.: Riddle of Beriberi-Heart, Libman Anniv. Vols. 3: 1199, 1932.

morphonuclears and 18 per cent small lymphocytes, with a marked shift to the left. The urine was concentrated, the color of dark straw, with a specific gravity of 1.017 acid, with no albumin or casts, and from 25 to 30 leukocytes per low power field.

Two blood transfusions of 250 cc. each on succeeding days were given. Because of the patient's unwillingness to cooperate and to take food, a Jutte tube was introduced through the nostril into the stomach and through it large quantities of vitamin B exract, orange juice, beef juice, egg, tomato juice and cod liver oil were administered for four days. The first day his intake was 134 ounces and the output 39 ounces. Large doses of iron and ammonium citrate were also given through the tube. On the fourth day he removed the tube himself and said he would eat whatever we gave him if he was permitted to go home. He ate puréed vegetables, raw liver pulp, cooked fruit and fruit juices and took the iron without any distress. He was allowed to go home. The blood count on discharge, October 18, showed: hemoglobin, 8.9 Gm.; red blood cells, 2,840,000; white blood cells, 3,630; polymorphonuclears, 61 per cent, and small lymphocytes, 39 per cent, with a marked shift to the left.

At home he continued to eat ravenously. A general diet was ordered, the vitamin B extract and iron and ammonium citrate being continued. The swelling subsided within two weeks and he was then allowed to get out of bed. Though he was still very weak, the pain in the calves of the legs had almost entirely disappeared and the ecchymotic spots were fading. He had no more indigestion. One month later, November 7, his blood count showed: hemoglobin, 9.5 Gm., or 61 per cent; red blood cells, 3,500,000; white blood cells, 4,300; polymorphonuclears, 56 per cent; small lymphocytes, 43 per cent, and eosinophils 10 per cent, with a marked shift to the left. He now walks outdoors unaided, is in a cheerful frame of mind and is interested in everything, for the first time in two years. He eats with relish all varieties of food without the slightest discomfort; he sleeps well and feels better than he has in years.

About a year ago Brauchle [6] reported an interesting case which is almost a replica of the foregoing. The patient, Dr. Brauchle's own mother, aged 60, began to have pain in the left hip. After about a year other symptoms were added, such as fatigue and tension in the muscles of the legs. These complaints were at first attributed to the menopause but treatment of every sort not only was of no avail but seemed to intensify the trouble. The woman had been largely a vegetarian all her life. After a year, fever and edema appeared; the patient's weight increased from 144 to 160 pounds (65.3 to 72.6 Kg.). Eventually the muscles became to weak that motion was virtually impossible and the only parts that could be moved were the mouth and eyes. One consultant attributed the symptoms to myositis; another attributed them to periarteritis nodosa but remarked casually that there was some resemblance to beriberi. It is interesting that the patient's mother had died at the age of 65 with practically identical symptoms. When the patient

[6] Brauchle, Alfred: Med. Welt 7: 34 (March 11) 1933.

was almost moribund Dr. Bircher-Benner was called in and declared at once that the disease was the wet form of beriberi. He placed the patient on a diet of raw fruit, "musli," nuts and raw vegetables; bread, milk and cooked vegetables were totally forbidden. Under this treatment the edema rapidly disappeared. Her weight dropped from 160 to 120 pounds (72.6 to 54.4 Kg.); motion returned in the muscles and at the end of three years, the raw fruit being continued, the patient was able to walk any distance and to make long journeys. Dr. Brauchle and all who had seen the patient declared that her recovery was a miracle. In our case the recovery was no less striking.

An unusually interesting case is reported from the Philadelphia General Hospital by Kepler:[7]

A Negro woman, aged 28, had always been in good health. In August 1918 she had a miscarriage followed by severe vaginal bleeding. A friend recommended raw starch as a cure. Acting on this advice and later influenced by a superstition among Negroes that raw starch has cosmetic value and tends to make the skin white, she gradually ate more and more. At the end of two years this habit had increased to such an extent that she was consuming from 1 to 2 pounds daily of one of the box brands of gloss starch. Her husband had only one of his daily meals at home, and rather than cook for herself she obtained most of her nourishment from the starch. The cooked meal at night consisted of the usual staple articles of diet found on a workman's table. Under this regimen she lost her appetite and as a result she practically subsisted on laundry starch, which, so far as its vitamin content is concerned, is certainly the equivalent of decorticated rice. The hold that this habit had obtained on her can be realized from the fact that on several occasions after admission to the hospital she asked the nurses to smuggle starch to her. At the end of a little less than three years she began to have symptoms of polyneuritis, with a trifling edema of the buttocks. The heart was enlarged to the right and to the left and, despite the fact that there was no aortic diastolic murmur, the vascular signs were those of pronounced aortic sufficiency. As the patient also had nephritis, the primary treatment was directed toward that disease. After about ten days a diagnosis of beriberi was made and autolyzed yeast was given. A marked improvement followed. The urine became normal, various heart murmurs that had been present gradually vanished, and the pulsation of the peripheral arteries disappeared and the heart became normal in size.

A case of beriberi is reported by Swineford:[8]

A woman, aged 47, single, a native of Virginia, had a severe attack of typhoid and since then had never been entirely free from indigestion. To combat the abdominal pains she gradually reduced her diet to toast, soup, an occasional egg, corn meal, oatmeal and a rare helping of fish or chicken. She practically eliminated fruits, fresh milk, meat, peas, beets, potatoes and other vegetables from her diet. Gradually signs of polyneuritis developed; the legs became drawn up and the muscles of the calves and thigh exceed-

[7] Kepler, E. J.: Beriberi from a Diet of Raw Starch, J. A. M. A. **85**: 409 (Aug. 8) 1925.
[8] Swineford, Oscar: Virginia M. J. **56**: 814 (March) 1930.

ingly tender; even the bones were painful on light tapping. Alcohol could be ruled out as a cause of the symptoms. Under a high vitamin B diet the patient improved but did not fully recover.

Farnell and Yacovlev [9] call attention to the difficulty of distinguishing at times between pellagra and beriberi.

Wohl [10] reports a beriberi-like state in a diabetic woman, aged 32, whose diet had been improperly balanced. In considering cases of this type the thought comes to mind that perhaps the neuritis of diabetes has in it a deficiency factor.

A case of self-imposed avitaminosis partaking of the character both of scurvy and of beriberi has been reported by Bullowa.[11] A man, aged 55, Irish, a hotel porter in New York, had "taken a dislike" for meat and had lived for four and a half months on tea and bread. The result was a symptom complex suggesting both the lack of the antiscorbutic and the antiberiberi vitamins.

One of us (R.) has for several years been of the belief that some of the cardiac "breaks" seen in the poor patients entering the Philadelphia General Hospital since the depression are in part due to food privation and can be corrected only by proper nutrition. It is important to inquire in much greater detail than is the usual custom into the dietetic habits of patients. One may then perhaps learn that many common diseases, infectious and others, arise largely on the basis of faulty practices in eating.

Our second case was diagnosed as beriberi by one of us (R.) through consultation with the patient's physician, who described the results of his examinations:

A young woman, much overweight, in an effort to reduce her avoirdupois had adopted a meager and monotonous diet. After a few weeks she became short of breath and had palpitation and edema of the legs. These symptoms induced the belief among her medical attendants that she was suffering from heart disease. She had no rheumatic history, never had been ill with anything that could have given her heart disease and, prior to her voluntary dietary restriction, had been athletic and in the best of health. To my mind there was in this patient no primary cardiac trouble. The symptoms were those of a deficiency disease; in other words, it was the picture of the wet form of beriberi. Under a sensible dietetic regimen and that alone, the young woman made a prompt recovery.

As long as fashion decrees the sylphlike figure, sporadic cases of beriberi are likely to occur. They may show only an incomplete picture of the disease but if the true cause of the symptoms is not

[9] Farnell, F. J., and Yacovlev, P. J.: Ann. Clin. Med. 4: 541 (Jan.) 1926.

[10] Wohl, M. G.: Avitaminosis in the Course of Diabetes, J. A. M. A. 87: 901 (Sept. 18) 1926.

[11] Bullowa, J. G. M.: M. Clin. North America 10: 959 (Jan.) 1927.

recognized, the trouble may be ascribed to primary myocardial disease with inevitable failure of treatment.

The period of vitamin shortage that an individual may safely endure is variable, being influenced by several factors.[12] It is quite possible, although by no means proved, that the edema of wet beriberi is due to a shortage of protein. This would suggest a multiple deficiency in this type of the disease.

Of the sources of vitamin B for clinical use, yeast and wheat germ are the best. Liver, kidney and brain are richer than muscle in vitamin B. The whole grains, because of their content of germ, contain appreciable amounts in contrast to the highly milled products such as white flour and degerminated corn meal. Among the fruits and vegetables, tomatoes, raw cabbage, fresh spinach and legumes have been found to contain more than orange or lemon juice, onions, cauliflower or lettuce. The vitamin in the egg is located in the yolk. Milk, although a good source of the pellagra preventive substance, does not contain a large amount of vitamin B.

[12] Cowgill, G. B.: Vitamin B, in Relation to the Clinic, J. A. M. A. 98: 2282 (June 25) 1932.

DIAGNOSIS

DISEASES OF THE CHEST AND OF THE ABDOMEN [1]

Their Mimicry of Each Other

The practice of medicine would be far easier if diseases kept to textbook standards. If the symptoms of pneumonia were always the same, if appendicitis never changed its physiognomy, what a strain would be taken from the mind of the conscientious doctor. Unfortunately one of the first lessons the young practitioner learns is that things are not what they seem. Marion Sims knew only the textbook pictures of disease, so when he was confronted with his first case in his South Carolina home, he was nonplussed, and though he searched his books, he was unable to find light. You know what happened. When the same experience repeated itself, he threw his shingle in a well and left the town. Unfortunately, the end results are but rarely as triumphant as in the case of Marion Sims.

Our classifications of diseases are after all artificial which is the reason why they have undergone so many changes as is admirably brought out in Knud Faber's *Nosography*.

After this preamble, I pass now to the subject of my essay. I wish to point out some of the common vagaries of diseases that perplex us in our daily work. It would be an impossible task to take all—a textbook could be written on atypical diseases—I shall speak of those in the chest and in the abdomen that give the impression on superficial examination that they had arisen in the other cavity.

The first that comes to mind is pneumonia. One day I was asked to see a boy of ten in consultation; he had been taken ill with abdominal pain and vomiting. The family physician had diagnosed appendicitis and advised immediate transfer to a hospital. The anxious mother wanted an additional opinion. As the doctor related the symptoms, they clearly pointed to the abdomen. When I came to examine the patient I was struck by the playing of the alæ nasi, the rather slight tenderness of the abdomen, and the ill-defined

[1] Read before the Section on Medicine of The Medical Society of the State of Pennsylvania, Philadelphia Session, October 5, 1933.
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rigidity. There was a little impairment on percussion over one apex and suppressed breathing in the same area—sufficient for a tentative diagnosis of pneumonia. In a day or two, the pneumonic process became clear; empyema followed with complete recovery after operation. The case illustrates a very common happening in children. One might ask what about the leukocyte count; it is of course increased both in pneumonia and in appendicitis and if around 20,000 gives no help; however, if much higher, 30,000 or more, with polymorphonuclears of 90 per cent. or more, the thought of pneumonia should be at once entertained. Children do not always cough; they rarely expectorate, so no help is gotten from the sputum—but the playing of the alæ nasi and the expiratory grunt are seldom absent. In a few very difficult cases, a small herpes vesicle or crust on the lip or nose may give the clue—it is, as you know, a frequent symptom in pneumonia.

In adults, pneumonia does not set in very often with abdominal symptoms, but I have seen a number of cases. The most remarkable one, already reported elsewhere, is as follows: I was at a banquet—about ten o'clock I was called to a hospital to see a man with appendicitis who was about to be taken to the operating room. As the patient was an important citizen, a specialist in anesthesia had been called to give the ether. This very careful man was not pleased with the patient's pulse and asked that some one be called to examine the heart and determine whether ether anesthesia was safe. When I reached the hospital, surgeons, internes, and nurses were all scrubbed up; the stretcher was at the door; the family were there waiting for the result of the operation. Getting a hurried history from the patient, I was, I must admit, impressed with its versimilitude to that of appendicitis. But on examination of the chest, I found a definite pneumonic consolidation below the angle of one scapula, with unmistakable bronchial breathing. The situation was embarrassing in the extreme and with all the tact I could command I informed the family that an operation was not necessary. Doctors and nurses were sent to bed. By the following day the diagnosis was no longer in doubt. Often, how often no one knows, operations are performed in such cases. Children thus operated upon under a mistaken diagnosis may recover despite the trauma added to the pneumonia, but adults rarely do. Hence the importance of examining the chest in every patient who falls acutely ill with what appears to be appendicitis.

In rare instances pneumonia may simulate a gallstone attack, especially if jaundice is present.

I am inclined to think that some of the ether pneumonias,

so-called, are in reality unrecognized preëxisting pneumonias that were masked by abdominal symptoms.

What I have said about pneumonia is equally true of acute pleurisy—perhaps it is the pleurisy in pneumonia that gives rise to the referred pain. There are pleurisies that as far as one can tell are not part of a pneumonic process. One must, therefore, look for them in all cases of acute febrile abdominal manifestations.

How are we to explain the presence of pain in the abdomen? In some instances there may be a double infection, i. e., pneumonia and appendicitis, but this is not often the case. There have been too many laparotomies in which nothing was found in the abdomen. Actual pain reference to a remote region is a definite observational fact about the cause of which we know little. The work of Capps has shown experimentally the possibility of such distal pain reference. If by some obscure spinal nerve reflex the vessels in a distant part were made to contract spastically, it might explain the referred pain, for spastic constriction of arteries is a painful phenomenon. The subject is one that requires much more research than it has received.

The simulation of gastro-intestinal conditions by disease of the heart has become a truism in medicine, one, however, often forgotten. Elsewhere I have called attention to these simulations under the phrase "Gastric Masquerades."

1. Ordinary myocardial failure may in the early stages give the picture of dyspepsia, especially of the flatulent type. This is particularly true in the presence of a unilateral, usually right-sided, hydrothorax. I remember the case of a locomotive engineer who was referred to me with the diagnosis of chronic indigestion. He had no subjective symptoms suggesting heart disease—what shortness of breath he had was attributed by him to "gas on the stomach." This gastric emphasis had influenced the doctor's opinion. I found fluid in the right chest caused without doubt by a failing myocardium. Tapping of the chest completely banished the dyspeptic symptoms.

2. In advanced congestive failure the gastric symptoms—distention, loss of appetite, nausea, and vomiting—have in several instances led to a diagnosis of malignant disease. This has occurred more often in cases of mitral stenosis with decompensation than in other diseases of the heart, the reason probably being the elusiveness of the mitral stenotic murmur and without murmur many physicians are unwilling to diagnose heart disease. This often leads to serious error. In mitral stenosis I have occasionally found that the brunt of the hepatic congestion has fallen on the left lobe of the liver, which then forms a tumorlike mass in the epigastrium that may easily be mistaken for a new growth. In one case the

patient had been already referred to a surgeon for operation with a diagnosis of cancer of the stomach.

I might say a word about the recognition of mitral stenosis—even when a murmur is absent, there is nearly always a "presystolic element," a loud, snappy first sound. If the patient is examined in two positions or after a little exercise, the murmur will rarely escape detection.

3. Coronary artery disease contains within itself two main possibilities of error in interpreting the symptoms as of subdiaphragmatic origin.

a. In the early stages the patient may have no pain, only a sense of oppression in the lower sternal and epigastric region which is relieved by standing still and eructating a little gas. Many cases of this type are diagnosed as examples of gastric neurosis or dyspepsia and remain so labeled until an acute coronary occlusion points its threatening finger to the real seat of the disease. How can one guard against this tragic error into which most of us fall at some time in our lives? If a middle-aged adult who has always enjoyed good health begins to complain of some gastric disorder for which no apparent cause is in evidence, he is most probably suffering either from an incipient new growth or from cardiac disease. There are of course other possibilities such as cirrhosis of the liver, pernicious anemia, etc., but they are more remote.

b. Acute coronary occlusion so often simulates an abdominal catastrophe that only the most watchful care will enable us to escape errors. The particular conditions that are simulated are: Perforated peptic ulcer, gallstone colic, acute pancreatitis, mesenteric thrombosis. I shall not go into the differential diagnosis, all I need to say is that in every case of acute upper abdominal pain attended by shock, the physician should look not only for a cause in the abdomen but also for the signs of coronary thrombosis.

Cases of angina abdominis are so rare that I shall do no more than mention them.

Sudden rupture of an aneurysm may closely simulate an acute abdominal crisis. In a case of rupture of a dissecting aneurysm of the aorta, the primary picture was that of a gallstone attack, later of an acute coronary closure. The pain was virtually uncontrollable; it abated a trifle when the patient got on all fours on the floor.

Though simulation of abdominal disease by disease in the chest is common, the simulation of thoracic disease by trouble below the diaphragm is not common, if we exclude those functional digestive disturbances that by causing palpitation and hypochondriac pain lead the patient to imagine he has heart disease. Gaseous distention

of the stomach or colon by incidental pressure against the diaphragm seems capable of disturbing the heart's action. Correction of the diet and habits of eating, attention to the bowels, and a simple alkaline bromide mixture, and much psychotherapy usually cure these cardiophobias. A subdiaphragmatic abscess, rarely an hepatic abscess, may resemble empyema. A careful history, the roentgen ray and judicious exploratory puncture usually clear up the diagnostic difficulty.

I have referred to the great similarity under certain conditions between angina pectoris or coronary seizures and gallbladder attacks. That fact imposes upon us the necessity of careful study in equivocal cases of disease in middle-aged persons, especially in men of action. What at first sight looks like angina pectoris might be a gallbladder attack and vice versa, as pointed out above. If there is the slightest doubt whether the case is one of gallstone or coronary disease, then the most painstaking study is required before the patient is subjected to a gallbladder operation. Gallbladder trouble and myocardial disease, it should be remembered, may occur together; in such cases, as I pointed out many years ago, removal of the gallbladder may bring about a complete disappearance of all cardiac symptoms.

In a few instances I have seen puerperal septicemia diagnosed as bronchopneumonia. This seems strange but the following observations will explain the matter. The abdomen in these patients was greatly distended by tympany and on account of the consequent pushing up of the diaphragm, there was much shortness of breath; and as nearly always in case of grave illness some rales could be heard over the base of the chest. These features had led to a diagnosis of bronchopneumonia. To my surprise the obstetrician could in several instances not find any local evidence of septic infection and had welcomed the diagnosis of bronchopneumonia. There is a peculiar mental state in most cases of puerperal septicemia that is not ordinarily found in primary pneumonia, a clarity, almost a superclarity, of mind,[2] and an unawareness of the gravity of the condition which together with the history of recent confinement has helped me to a correct diagnosis confirmed in two instances at necropsy.

A condition not strictly thoracic, one rather without a definite local habitation, is diabetic acidosis which may closely resemble appendicitis. Fever, abdominal pain, and leukocytosis are often present and I know of one case already on the operating table—the

[2] This peculiar mental state has its best literary representation in a character in Schnitzler's play *Dr. Bernhardi.*

surgeon had diagnosed acute appendicitis—when the urine report stayed the surgeon's knife. Insulin promptly cleared up all the symptoms. Dr. Priscilla White has met cases in which diabetic acidosis produced the deceptive picture of pneumonia. Diabetic acidosis may give rise to pain in the precordial region and cause the suspicion of angina pectoris or coronary occlusion to be entertained, as pointed out by R. M. Lymburner (Proc. of Staff Meetings of the Mayo Clinic, 8: No. 16, 1933). The fact that angina pectoris and coronary disease are frequent in diabetes may make the interpretation of the symptoms in a given case difficult. Electrocardiographic studies and the results of insulin treatment may help to clarify the obscurity of the picture. Anginal attacks have been observed after the use of insulin. Just how they are brought about is a moot question.

In one or two cases of acute tonsillitis under my observation, abdominal symptoms of the appendicitis type were present.[3] If the appendix is indeed the abdominal tonsil, then such vagaries can perhaps be understood. Inspection of the throat in a child or young adult will do no harm—it certainly helped in my cases.

Two other conditions deserve to be mentioned even though they do not entirely fit into the general picture I want to draw. One is the gastric crisis of tabes—which may throw even the most wary clinician off his guard. I have seen the following diagnoses made: Gallstone colic, perforated peptic ulcer, intestinal obstruction, hysterical vomiting. There is but one rule for avoiding such mistakes—in all cases not typical of the conditions just mentioned, the physician should test the knee jerks and the pupils. With regard to the pupils I have had one fact borne in upon me—that the pupils are likely to be pinpoint and will not respond to the light reflex because morphine has so often been given. A Wassermann test, especially on the spinal fluid, will naturally be most helpful. The fact remains that even in the best hospitals patients whose real trouble is tabetic crisis are operated upon for one or another acute abdominal disease.

The other condition that I want to refer to briefly is migraine. More than once have I seen patients whose case was diagnosed as peptic ulcer, gastritis, or some other subdiaphragmatic process, although the real essence was migraine. In some cases of this strange malady the headache and ocular symptoms are less conspicuous than the abdominal symptoms. A history of familial attacks, a longer duration than in the usual abdominal troubles, the

[3] I might briefly refer to a simulation of meningitis by tonsillitis. Although not strictly germane, it is interesting enough to deserve a brief record here. A man, age 45, was seized with intense headache and insomnia. His physicians suspected meningitis—lumbar puncture showed an increase in cells but no organisms. The case proved to be one of follicular tonsillitis with aseptic meningitis.

attacks often beginning at puberty, are data that will help in solving the problem.

Every practitioner of large experience can find cases among his records or in his memory that illustrate my thesis and others of the same genre that I have omitted to mention. Eternal vigilance is the price of correct diagnosis.

MEDICAL DIAGNOSIS IN RELATION TO SURGERY [1]

The domain of surgery has been so widened in our own time that there is scarcely a medical condition that may not in some of its phases become a surgical one. By the very vastness of his field has the surgeon been forced to specialize and to devote himself exclusively to the eye, the ear, the nose and throat, the genito-urinary tract, or the female genital organs. The advantages of such a distributive process are many—and are too well known to be reiterated here. But there are some incidental disadvantages. At first sight these might seem to have nothing to do with my present theme. There is, however, a very logical connection. We find that the laity no longer consult their family physician for their well-defined regional complaints—they go directly to the ophthalmologist, otologist, laryngologist, etc., who if he finds an operative condition proceeds in the majority of cases to deal with it surgically. Not all will deem it necessary or important to have a medical examination made, a neglect that may jeopardize the patient's life.

Medical diagnosis to my mind involves not only the recognition of the existence of a surgical condition but also a careful study of the patient as a surgical risk. No surgical operation requiring anesthesia should be done without the approval of a medical man, based upon a thorough examination of the patient. Such an examination involves a study of the heart, the blood pressure, the temperature, the lungs, the kidneys, the blood, and the psychic and nervous systems. The results of his findings, in so far as they may affect the operation and its before- and after-treatment, the physician should communicate to the surgeon and together they should weigh the patient's status. But while I hold that no operation should be done without study of the case by a competent medical man, I also believe that no surgeon should ever operate solely on a medical man's opinion. He should on his own account study the

[1] Paper read before the College of Physicians of Philadelphia as part of a symposium on The Relation of Medicine and Surgery. The paper also formed the basis of an address before the Springfield Academy of Medicine, Springfield, Mass.

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case from the broadest aspect and arrive at an independent judgment. If the two men cannot agree, then a colleague of proper standing should be called in as arbiter. Cases will, of course, arise in which a determined surgeon, in sole charge of a patient, will operate with the whole faculty against him, or in which the medical man, having the patient's life primarily in his keeping, will refuse to consent to an operation that all the surgeons hold imperative. Such cases, however, do not alter the fact that the *modus operandi* I have sketched is, both for the patient and for the fair name of medicine, most desirable.

Coming now to the specific topic I have chosen, I am overwhelmed with the immensity of the subject of the medical diagnosis of conditions surgical. It appears to me of some advantage to have a working classification and to give to this a regional basis. A further advantage is obtainable by lopping off all consideration of things that are obvious. There are a number of conditions the surgical treatment of which does not admit of a difference of opinion—such as strangulated hernia, division of a large blood-vessel, fractures, dislocations, impaction of foreign bodies in the air passages—these need not detain us. Yet it might not be amiss to point out one or two possible errors in diagnosis. Thus I once saw a woman supposed to be suffering from neuritis of the brachial plexus in whom I discovered a dislocation of the humerus. And further, in a study of cervical rib made several years ago, I found that this condition may lead to the diagnosis of aneurysm of the subclavian artery and of neuritis. A correct diagnosis would render possible a cure by surgical means.

Beginning with the head, medical diagnosis concerns itself with such surgical and quasi-surgical conditions as fracture, tumor, abscess, and meningitis. In many respects the first is the most important, inasmuch as where alcoholism co-exists the fracture may be overlooked. Not a few young internes have made this grievous mistake and have perhaps sacrificed life, and incidentally brought discredit upon themselves and their hospital. I have always taught that no obviously alcoholic patient should be sent from the hospital if he presented one of two conditions—a very rapid or an unnaturally slow pulse—the former might indicate a dangerous weakness of the circulation, the latter cerebral compression.

The medical diagnosis of tumor need not be discussed in detail. There is but one point I desire to emphasize, viz., that uremia may in every way simulate tumor of the brain and without the guiding hand of a clinician, a useless and probably fatal operation may be done.

Abscess of the brain most often springs from middle ear disease. As the history is not always definite and as the patient is not rarely seen in a stuporous state, the ears and mastoid processes should always be examined in every obscure "head case." A history of chronic ear trouble and intense uncontrollable headache should arouse suspicion of abscess.

Meningitis of the suppurative type is, thanks to Irving Haines, now being claimed, somewhat furtively as yet, by the surgeon as his domain. Hence the medical man must be prepared to diagnose it as early as possible. Intense headache, rigidity of the neck, Kernig's sign, the character of the spinal fluid after lumbar puncture, are the signs and symptoms leading to a correct diagnosis.

In the neck the principal disease to interest us is exophthalmic goiter. No disease is more easily recognized and yet he who does not see it at once may remain blind to it despite its obviousness until someone else points it out. The medical man is called upon to diagnose the disease, the cardinal symptoms of which are too well known to need mentioning here, and at the same time to determine whether the patient is in an operative state—assuming that an operation is contemplated. He will advise against immediate operation if the patient is highly thyrotoxic—has pronounced tachycardia, enlarged heart, slight fever, gastric symptoms, and psychic exaltation.

In the case of lymphatic enlargements in the neck, the physician has to determine whether they are tuberculous, leukemic, or due to Hodgkin's disease. A blood examination will reveal the second, but is of little help in differentiating between the other two. The hard character of the enlargement and the presence of glandular masses elsewhere is in favor of Hodgkin's disease. It should also be remembered that spinal symptoms are sometimes an early manifestation both of Hodgkin's disease and of leukemia.

A word might be said about the status lymphaticus. If it can be proven that death in this condition is due to compression of the trachea by the enlarged thymus, then the medical man should know how to diagnose it speedily so that the surgeon may be called in time. The age of the patient, cyanosis, inspiratory dyspnea, dullness over the manubrium, and perhaps a laryngeal examination are aids to prompt diagnosis.

In the chest the diagnostic problems of surgical conditions are few and not very troublesome. Most important is empyema. As far as its diagnosis is concerned, it should always be thought of in children suffering from fever with marked sweating and anemia. It should furthermore be borne in mind that it may

be a terminal condition in the aged, manifesting itself only by fever and slight dyspnea. Between these extremes, a diagnosis is rendered somewhat easier if a history of preceding pneumonia is obtainable. There are, however, rare instances in which empyema seems to be there from the beginning. It then simulates pneumonia very closely. If the empyema is interlobar, the symptoms will suggest the presence of pus but the physical signs may fail to reveal its location. Localized tenderness may sometimes act as the divining rod.

If the medical man has located the pus by means of the exploring needle, the surgeon in operating should make his incision at the same place, no matter whether the spot is best from a surgical point of view or not. I have seen a surgeon disregard, for the purpose of getting better drainage, the point of puncture, and fail to find the pus. Sometimes with very marked symptoms only a spoonful of pus is present, and this may be missed if the surgeon does not follow the point of original entry.

When empyema has been diagnosed in an adult and the history reveals no previous chest condition, the possibility that the pus may be below the diaphragm should be envisaged. Depression of the liver dullness, a patch of tympany, data suggesting the existence of an old gastric ulcer or appendicitis, together with a radiographic examination will usually determine a subphrenic abscess. Exploratory puncture should be made with a needle of large caliber. It will demonstrate the presence of offensive "colon" pus and perhaps gas.

Abscess and gangrene of the lung are rare—diagnosis is far less difficult than localization. The X-ray is very helpful but may mislead us as to depth and height. The other signs and symptoms hardly need discussing.

The surgical conditions involving the heart are chiefly two—mediastinopericarditis and pericardial effusion. The operation for the former—cardiolysis—is still on trial, so that the medical diagnosis does not greatly interest the surgeon. Pericardial effusion is usually overlooked, more often, I think, than any other disease. The operation for paracentesis is done as often by the medical man as by the surgeon, but when the fluid is purulent the latter should be called in to establish drainage. I need not dwell on the diagnosis except to say that pericardial effusion may be mistaken for pneumonia. I have seen one case that might have been saved had the proper diagnosis been made.

A curious diagnostic error in connection with disease of the heart has come to my notice two or three times and as it has a

surgical interest I will cite one case. A patient had a large tender epigastric swelling, vomiting, anorexia, and great prostration. The surgeon to whom he had been referred diagnosed a gastric carcinoma, and decided to operate, but before doing so wanted a medical opinion. This opinion was "mitral stenosis, loss of compensation, enlargement of the left lobe of the liver, and congestion of the stomach."

In the diagnosis of surgical conditions of the abdomen, it is of practical advantage to treat separately what English and American writers call the *acute abdomen.* Many acute conditions are not grave and demand medical treatment only, such as indigestion, ptomaine poisoning, so-called, and lead colic. But a careful examination and a good history are always necessary or mistakes will be made. Assuming that the case is one of considerable severity—then, having ruled out a dietetic error as the cause, the first question should be: Is the trouble really in the abdomen or is it in the chest? A few months ago I was asked to see a man who was about to be placed on the table to be operated upon for appendicitis. The expert anesthetist, upon making a cursory examination, had grown a little suspicious of the heart and had demurred taking the responsibility of administering ether without the support of a medical opinion. Study of the case forced me to the conclusion that the man had lobar pneumonia and not appendicitis. The diagnosis was confirmed by subsequent events. This is not the only experience of the kind that I have had but in none did operation hover so close. I am inclined to think that too much stress is laid upon vomiting. If the initial chill of pneumonia follows hard upon a heavy meal, whether the patient is an adult or a child, vomiting is likely to occur.

Not only appendicitis but gall-stone colic, acute pancreatitis, perforation of a gastric or duodenal ulcer, may be simulated by chest conditions. Hence, before definitely diagnosing any one of these, the chest must be carefully explored. The laity, ignorant of the tribulations of the doctor, would never forgive an error in diagnosis that entailed an abdominal operation for a chest condition, but we who know how one may mimic the other, should be sparing in our criticism.

In the diagnosis of other conditions causing the acute abdomen, the history is of incontestable value. The age of the patient, previous attacks of pain and leukocytosis, may determine the diagnosis of appendicitis. It is indeed a fair assumption that acute inflammatory conditions of the abdomen during adolescence are of appendiceal origin, quite regardless of the area of greatest pain.

I say quite regardless of the area of the greatest pain advisedly; the greatest *tenderness* is usually found on the right side.

In women the most important acute abdominal conditions to bear in mind, aside from appendicitis, are ruptured extra-uterine pregnancy and torsion of an ovarian cyst. The former is not difficult of diagnosis. The history may help but does not always do so—pallor, sighing inspiration, abdominal dulness, and vaginal examination establish the diagnosis. Torsion of an ovarian cyst I have met four times. In none of the cases had there been any previous knowledge of the existence of the cyst or of any pelvic trouble whatever. Illustrative of the importance of medical diagnosis I may say that in the first case a diagnosis of uremia had been made by the attending physician on account of uncontrollable vomiting, there having been no other definite abdominal symptoms.

Acute conditions of the abdomen also rouse the suspicion of rupture of an ulcer of the stomach or of the duodenum. As prompt recognition is of the greatest importance, I will dwell for a moment on the diagnostic features of rupture in duodenal ulcer, as that is a fairly common happening.

Perforation of the ulcer is usually an extremely sudden process. It causes at once intense pain and collapse which may be followed in a little while by a temporary lull in the symptoms. This lull, which is probably caused by the non-irritant character of the duodenal contents, is very deceptive and may lead to errors in diagnosis. The pain is usually in the epigastrium but may be in the appendix region; the abdomen, until near the agonic period, is of board-like hardness. In the final diagnosis the history is of the greatest importance: a history of periods of disturbed digestion with pain (hunger pain), especially nocturnal, alternating with periods of good health. The male sex, as is now well known, predominates in duodenal ulcer.

Empyema of the gall-bladder may set in with acute or "stormy" symptoms, to use a Teutonic idiom, and may be diagnosed as ruptured gastric ulcer. The diagnostic points upon which I would lay stress are the history of previous attacks of colicky pain, good health in the intervals, tenderness in the gall-bladder region, and fever. Sometimes the gall-bladder can be felt if very light pressure with the warmed hand is made.

Another acute condition requiring a skilled medical diagnosis is acute pancreatitis. The symptoms of that are not characteristic. They may be interpreted as ruptured ulcer or empyema of the gall-bladder or intestinal obstruction. Perhaps the most valuable guide to correct diagnosis is to have pancreatitis in one's *arrière*

pensée. Many difficult conditions, as Charcot remarked long ago, are happily diagnosed by merely thinking of them. If there is a history of gall-stones, the diagnosis of pancreatitis, if otherwise justified, is greatly strengthened.

A rather peculiar diagnostic difficulty came under my notice last year. A surgeon asked me to see an old lady suffering from intense pain in the right upper quadrant of the abdomen. It was doubtful whether the trouble was in the gall-bladder or in the right kidney. Careful examination showed an erythema following the intercostal nerves and extending over the right upper abdomen. There were no vesicles but it seemed so much like herpes zoster that I ventured that diagnosis. Within a day or two the well-known vesiculation appeared. Dr. Lawrence Litchfield, of Pittsburgh, has recently reported several similar cases.

I have not exhausted the acute abdominal diseases, but time does not permit me to include all of them. A word, however, about perforation in typhoid fever. Few conditions impose such a heavy responsibility upon the doctor. If he could be sure, his course would be easy, but the diagnosis is not as simple as some writers claim. A sudden pain, slight leukocytosis, rise in the pulse rate and of the temperature, and disappearance of the liver dulness are nearly sufficient for diagnosis and justify surgical intervention. All the symptoms, barring the last, may, however, be produced by suppuration of a mesenteric gland; but as this is also an operative condition, the possible confusion matters little.

Coming now to the consideration of more chronic conditions, we find one of the most difficult tasks to be the proper interpretation of the functional disturbances of digestion. Which are and which are not amenable to surgical treatment? Though the work of surgeons like the Mayos, Moynihan, Deaver, and Robson, has greatly clarified this subject, it still remains one of undoubted perplexity. The too enthusiastic abdominal surgeon, seeing some cases of dyspepsia and hyperchlorhydria associated with gastro-duodenal ulceration, concludes that all such cases have a similar basis. I believe that hyperchlorhydria may be a purely functional condition. Even hunger pain and hyperchlorhydria are not infallible signs of duodenal ulcer. Yet, if the patient so suffering is a man and in every way a fit surgical risk, we are probably justified in advising an operation, on the assumption that the cause of his trouble is duodenal ulcer. The X-ray in skilful hands is of great diagnostic value, showing in these cases a hypermotility of the stomach with rapid propulsion of the bismuth meal into the duodenum. In every case of so-called gastric neurasthenia or nervous

dyspepsia, characterized by bloating, eructation of gas, a variable appetite, and nervous depression, an organic basis should be suspected. Often it is gall-stones. A correct diagnosis is impossible without a careful history and a thorough physical examination, particularly search for Mayo Robson's tender point. We must not be misled by left-sided pain, for just as appendicitis may sometimes cause pain on the opposite side, so may gall-stones, especially when there are adhesions between the gall-bladder and the stomach.

As a matter of medico-surgical interest, I should not omit to mention the fact that the gastric crises of locomotor ataxia may closely simulate gall-stone colic.

The subject of splanchnoptosis is one of great interest at this time. Its relation to chronic ill health and to constipation makes correct diagnosis and proper treatment a pious desideratum. I have not been convinced that surgery is the only way to success and believe that the admirable work of Coffey, of Portland, Maine, has demonstrated that much can be accomplished by purely non-operative means.

Abdominal tumors present great diagnostic difficulties, and the most skilled clinician often goes astray. Those involving the stomach are perhaps the least perplexing. Gastric symptoms of short duration, loss of weight, signs of food retention, and sub-acidity suggest carcinoma. Confirmation may be obtained by an X-ray examination. The position of the tumor is not of great moment. It may be anywhere from the right rectus to the left flank, from the epigastrium to below the umbilicus. Every effort should be made to diagnose malignant disease before a tumor appears so that removal can be accomplished before other parts near and distant are inseminated.

There is a type of tumor in the abdomen that gives rise to unusual diagnostic pangs. It may be found in the region of the colonic flexures on the left side and on the right side anywhere from Poupart's ligament to the border of the ribs. At first examination such a tumor may impress one as malignant if the patient has reached the cancer age, or as tuberculous if he is younger. Careful examination will, however, show certain peculiar features —the growth is rapid, there is usually a spot of great tenderness; there may be a periodic or continuous fever; and the blood count shows a leukocytosis. These signs, indicate, I believe, that the tumor is inflammatory, no matter how smooth or nodular, how small or large the growth may be. The mimicry of disease is never greater than in the case of these inflammatory swellings which have their origin in the appendix or in a diverticulitis of the colon.

The diagnosis of appendicitis is commonly so easy that the veriest tyro in medicine can make it. Difficulties arise in chronic cases, where the symptoms are chiefly those of dyspepsia and in certain acute cases in which the appendix occupies an abnormal position. In every case of dypepsia in early adult life, the physician before incriminating the stomach or the nervous system, as is so often done, should carefully palpate the region of the appendix. Soreness when the colon is inflated with air and pain referred to the epigastrium on pressure at McBurney's point have recently been acclaimed as diagnostic signs of chronic appendicitis.

Intestinal obstruction is an important field in which prompt medical diagnosis with the aid of the surgeon often saves life. I shall not take your time to rehearse the symptoms of the various types of obstruction. Some, like strangulated hernia, are easily recognized if one makes it a practice in all cases to examine the hernial openings whether a hernia is visible or not. I want to speak about two points only, first, that acute pancreatitis may simulate ileus and, second, that kaleidoscopic uremia may present the picture of intestinal obstruction.

With regard to the spleen, the condition of chief surgical interest is splenomegalic anemia, splenogenous cirrhosis of the liver, or Banti's disease. Here it is the medical man's duty to establish a correct diagnosis, inasmuch as removal of the spleen is the approved and proper treatment. The diagnosis is based on enlargement of the spleen, on a history of hemorrhages from the nose or the stomach, on the presence of anemia with leukopenia, and, in more advanced cases, on evidence of coexisting hepatic disease.

The surgical conditions involving the kidney give rise to pain in the loin and flank. If the trouble is inflammatory, whether intrarenal or extrarenal, there will be tenderness in the costo-iliac space. From the surgeon's standpoint the conditions demanding particularly accurate diagnosis are perirenal abscess and unilateral nephritis.[2] A microscopic and bacterioscopic examination of the urine will assist in the diagnosis. It should be borne in mind, as I have already mentioned, that herpes zoster may in its pre-eruptive state simulate these renal conditions.

One other condition needs mentioning here on account of the diagnostic problems it brings in its train, and that is Pott's disease. Pott's disease is never too old to cause trouble. For some unknown reason, the tubercle bacilli in the sheltered region of the spine seem to live forever. If an abscess forms it will travel downward and

[2] See paper by Riesman and Müller, "Acute Unilateral Nephritis, with Report of a Case," Archives of Internal Medicine, June, 1913.

may then cause symptoms of great perplexity, intercostal neuralgia and thoracic aneurysm being some of the diagnoses I have seen made.

In the case of the extremities, the surgical conditions coming under the physician's ken are few. I have mentioned dislocation simulating neuritis. Perhaps the most important is osteomyelitis, which when near a joint is likely to be mistaken for articular rheumatism. In a child, persistent pain at or near one joint is almost never rheumatic in origin. Furthermore, it should be remembered that what may seem to be abscesses along the course of the bones may in young infants be blood extravasations the result of scurvy. A proper diagnosis by the medical man, based on a careful history of the case, may prevent a useless and hurtful operation.

An interesting condition of growing importance is thromboangiitis. This may be erroneously treated as rheumatism by the medical man, and, as in one case I have seen, as flat-foot by the surgeon.

I have not exhausted the surgical conditions which it may become the medical man's duty to diagnose. I have tried to focus your attention upon those more difficult ones, borderland cases they might be called, in which keen medical diagnosis is necessary for the proper coöperation with the surgeon, a coöperation he should not only be glad to accept, but eager to seek.

I would emphasize once more the value of a medical examination, not only in obscure but also in plain, simple surgical cases. The physician might find diabetes, nephritis, grave anemia, bronchitis, or serious heart disease, anyone of which would influence the surgeon in his work. Many delayed deaths after operation might thus be averted. I also feel that in medical cases which may at any time assume a surgical aspect, the surgeon should be consulted long before an operation becomes imperative.

In order to increase his diagnostic skill, the physician should make it a rule to be present at all operations on cases that have come before him. Sir Berkeley Moynihan in England and Deaver in this country have found it necessary to remind us physicians of the value of the *autopsia in vivo*.

In closing, permit me to say that in all spheres of life, the best work is team work, and the best team for the cure of human ills is the great medical triumvirate—the laboratory man, the surgeon, and the sane, level-headed physician.

BRUIT OVER THE EYEBALL IN EXOPHTHALMIC GOITER [1]

About two years ago I saw a young girl with exophthalmic goiter. She had all the signs of this polysymptomatic disease, and as the vascular phenomena were especially well marked, it occurred to me to place the stethoscope over the eyeball, whereupon I heard a loud hum or bruit synchronous with the beat of the heart. When I saw her again some weeks later the sound was still present. As I had not heard or read of this sign before in connection with exophthalmic goiter, I naturally thought that I had made an original discovery. My belief was strengthened when I did not find any reference to it in any of the monographs on exophthalmic goiter. A deeper search of the literature, however, showed me that the sign had been discovered before, but had not found its way into even the most recent works on the disease. Dr. Barker [2] does not enumerate it in his comprehensive article in which he cites no less than thirteen eye signs.

Quite recently I saw with Dr. Westcott of Atlantic City a woman, aged 35, suffering from exophthalmic goiter. All the classical signs and symptoms of the disease were present, including a probable substernal goiter and pigmentation of the face. On placing the stethoscope over the eyeball, I heard the bruit most strikingly. Without telling Dr. Westcott anything, I asked him to listen. He heard the sound immediately and was much amazed by it.

The sound when present is easily elicited by placing the bowl of the stethoscope over the eyeball with the lids closed. At first one may be a little confused by a more or less continuous sound or hum which is evidently due to the muscular movements of the eyelids, but very soon one can make out the rhythmic murmur keeping time with the pulse. As I have intimated, the sound has been described by several writers. The first to notice it was Snellen, whose observation was reported by Donders.[3] Duroziez [4] heard a

[1] Read before the Section in Medicine of the College of Physicians, Philadelphia, Nov. 22, 1915.
Reprinted from The Journal of the American Medical Association, April 29, 1916, Vol. LXVI, pp. 1381 and 1382.
[2] Barker, L. F.: The Diagnosis of Exophthalmic Goiter, The Journal A. M. A., Oct. 12, 1907, p. 1235.
[3] Donders: Arch. f. Ophth. Albrecht von Graefe's, Berlin, 1871, p. 102.
[4] Duroziez: Gaz. d. hôp., June 16, 1874, No. 69, p. 548.

sound over the eyes in exophthalmic goiter, but as he declared that the same bruit was audible over the normal eye, we must accept his own explanation of it: that it was due to the rotary movement of the eyelids, hence not the sound in question. Hueter [5] spoke of a sound audible over the eye with the dermatophone, but as he heard the same sound over the temporal region and as he does not speak of exophthalmic goiter specifically, his observation is not germane to our subject. Schönfeld,[6] in the course of a description of a single case of exophthalmic goiter, says, "On placing the stethoscope over the eye, a hum synchronous with the pulse could be heard." Carrington [7] and Drummond [8] also give clear descriptions of the bruit.

In view of these several observations it is strange that the sign is not mentioned by systematic writers on exophthalmic goiter or by textbooks on diseases of the eye. The bruit, like other signs of exophthalmic goiter, is not constant, and I have looked for it in vain in several quite typical cases of the disease. I have noticed a similar sound several times in aortic insufficiency, which is not surprising since many of the vascular phenomena of the two affections are very similar.

[5] Hueter: Centralbl. f. d. med. Wissensch., Dec. 21, 1878, p. 929.
[6] Schönfeld: Ein Fall von Borbus Basedowii, Inaug. Diss., Berlin, 1881.
[7] Carrington: Tr. Ophth. Soc. United Kingdom, Session 1885-1886, VI, 99.
[8] Drummond: Brit. Med. Jour., 1887, I, 1027.

SOFT EYEBALL IN DIABETIC COMA[1]

Quite accidentally I tried one day the ocular tension in a case of diabetic coma, and was startled to find the eyeball of almost doughy consistency. On looking over the literature of diabetes I found that this symptom was first described by Krause[2] in 1903. He did not observe it in simple diabetes or in cases of acidosis unassociated with coma. In experiments on animals with acetone, diacetic acid and oxybutyric acid he failed to produce hypotonia of the eyeball; and he did find it in a dog rendered diabetic by pancreatectomy. Since Krause's first paper, few articles on the subject have appeared. Heine,[3] an ophthalmologist, refers to it in several publications. The observations of Lea Gite Schütz[4] are the most accurate, for they were made not with the finger but with the tonometer of Schiötz. She found that the tension varied from day to day, but that at the height of the coma it was extremely low or even nil. Few of the systematic writers speak of the symptom. Lépine[5] merely mentions it, referring to the papers of Krause and Heine. Among the many works on ophthalmology that I consulted, only the small monograph of Groenouw,[6] the book of Römer[7] and the article of Heine[8] speak of it.

Hertel[9] made a number of interesting experimental observations bearing on the symptom. He found, for example, that the electric conductivity of the soft eyeball was raised, showing that osmotic changes had taken place. By lowering the molecular concentration of the blood of animals, he succeeded in producing a hypotonia similar to that of diabetic coma in man. The degree of hypotonia could be varied by modifying the amount of substance introduced and the time consumed in its introduction. Various sodium salts,

[1] Read before the Section in Medicine of the College of Physicians of Philadelphia, November 22, 1915.
Reprinted from the Journal of the American Medical Association, January 8, 1916.
[2] Krause: Ueber ein bisher nicht bekanntes Symptom bei Coma diabeticum, Verhandl. d. 21. Kong. f. inn. Med., Leipzig, 1904, p. 439.
[3] Heine: Ueber Augenstörungen im Coma diabeticum, Versamml. d. ophth. Gesellsch., Heidelberg, 1903; Ueber Lipaemia retinalis und Hypotonia bulbi im Coma diabeticum, Klin. Monatsbl. f. Augenh., 1906, II, 451.
[4] Schütz, L. G.: Untersuchungen über den Augendruck beim Coma diabeticum, Inaug. Diss., Strassburg, 1913.
[5] Lépine: Diabète Sucré, Paris, 1909, p. 578.
[6] Groenouw: Augenleiden bei Diabetes mellitus, Halle, 1907.
[7] Römer: Lehrbuch der Augenheilkunde, Berlin, 1910, p. 647.
[8] Heine: Lehrbuch der Augenheilkunde, T. Axenfeld, 1915, p. 755.
[9] Hertel: München. med. Wchnschr., 1913, p. 1191.

urea and sugar were the agents employed. Ehrmann[10] brought about hypotonia by injections of sodium butyrate and sodium isovalerianate, but in Hertel's opinion the hypotonia is not a specific effect of these salts as the same result can be obtained with sodium chlorid, sodium phosphate, urea and sugar. Chemical examination of the eyes showed that the substances injected had penetrated into the eyeball.

The soft eyeball in diabetic coma is not due to blood pressure changes; it is also not an agonal phenomenon, for it is not present in persons dying from other causes. Whether the ketone bodies play a part in its production is not definitely established. In acidosis without coma the symptom is not present. As, however, in acidosis with coma the acetone bodies are probably retained in large quantities, they may have a share in the production of the soft eyeball. In one of my cases of diabetic coma, in which ketone bodies were not found in the urine at any time, the soft eyeball was not present. In a recent case of diabetic coma in my care, that of a woman aged 41, with intense acidosis, the intern and I tested the tension repeatedly and found that it varied, as shown by the following records:

Oct. 26, 1915, on admission, the patient is conscious but lethargic; breath exhales a strong fruity odor. The urine contains sugar and diacetic acid in large quantities. Tension of eyeballs practically normal.

October 28, the patient is in coma. The pupils are contracted; the tension is greatly diminished in both eyeballs.

October 29, the patient is profoundly comatose. The tension of the eyeballs is somewhat greater than yesterday, but still markedly below normal.

Krause,[11] who observed it in twenty-two cases of coma, was of the opinion that the soft eyeball was a bad prognostic sign, but Schütz found that in one of her three cases recovery took place. Regardless, however, of prognostic value, the sign is important from the diagnostic standpoint. Heine[7] goes so far as to say that whenever found in a case of coma it proves the coma to be diabetic. Further observations are necessary before such a strong statement can be fully accepted.

As to the constancy of the sign in diabetic coma I cannot speak; in the last three cases of coma under my observation—the only ones in which I tested for it—I found it twice. One would hardly expect it to be present in every case, for constant symptoms are rare not only in diabetes but in all diseases.

[10] Ehrmann, quoted by Hertel (Footnote 8).
[11] Krause: Deutsch. med. Wchnschr., 1907, p. 84.

SOME POINTS IN PHYSICAL DIAGNOSIS[1]

The four topics I have chosen for discussion are perhaps not of fundamental importance, but will, I hope, prove of value to the clinician. I shall present them with utmost brevity.

Movable Dulness Not Always a Sign of Fluid

It is almost universally believed that movable dulness in the chest is a sign of the presence of fluid. So firmly is this belief held that when the other signs of effusion are equivocal, this one is commonly permitted to determine the diagnosis. I should like to point out, however, that in some instances movable dulness is produced by another cause.

In the cases that I have in mind, what seems to be fluid is in reality the liver changing its position. When the patient is sitting up or standing, the liver is found to be one or two interspaces higher than it is when he is lying down, a striking change in resonance being in consequence produced. I take it that when this phenomenon occurs, it is due to a softness of the liver, causing it to rise when the patient stands up and to fall when he lies down. It is possible that the state of tonus of the diaphragm is an additional factor in its production.

In order not to be misled, it is necessary to locate carefully the apex beat, and to determine whether or not it is displaced to the left. One must also look for movable dulness in the axilla, as well as in front; and in very obscure cases recourse must be had to the roentgen ray or to tapping.

Ulnar Percussion

In a number of obscure cases of suspected gallbladder disease, the ordinary method of eliciting tenderness proves fruitless. The discovery of a tender area would greatly aid in the diagnosis, yet one may press as firmly as is justifiable, and the patient will not complain. For such cases, the late John B. Murphy recommended fist

[1] Read before the Association of American Physicians, Washington, D. C., May 2, 1922. Reprinted from the Journal of the American Medical Association, June 24, 1922.

percussion. That, however, appears brutal, and may not be without risk. As a substitute for it, I have found ulnar percussion very satisfactory; others, I am quite sure, have had the same experience.

The method of employing it is simple: The patient is asked to take as deep a breath as possible and to hold it. Then suddenly one strikes a quick but not hard blow over the upper part of the right rectus muscle, with the ulnar side of the hand. If there is any disease of the gallbladder, the blow will cause a sharp pain. If one is in doubt as to whether this pain is superficial and due to the blow on the integument, all that is necessary is to perform the test on the left side.

The same method of ulnar percussion is applicable to the determination of sensitiveness over the kidneys. By striking the loin at right angles to the long axis, it is possible to localize pain due to stone or to inflammation in and about the kidney. I am quite sure that it permits of a sharper localization than does fist percussion. Here, also, it is necessary to compare the two sides.

Clavicular Auscultation

It is often of interest to determine whether or not an aortic murmur is transmitted into the neck. By the customary method of placing the stethoscope over the cervical vessels, a murmur is at times created by pressure. Even a very gentle application of the stethoscope may produce a murmur. To avoid this source of error the stethoscope, which must be either a Bowles or some other form of diaphragm stethoscope, should be placed over the clavicle. If the murmur is a transmissible one, it will be well heard all along the bone, where no artery can possibly be pressed upon.

This method is also of value in another respect. Frequently one encounters cases of marked hypertension, in which by every rule the aortic second sound should be accentuated, but in which it is found not to be loud. In a number of such cases, in which the second sound at the aortic area was not at all in keeping with the height of the pressure, I have heard a loud second sound over the clavicles. I would explain this anomaly on the theory that some extrinsic mechanical factor interferes with the transmission of the intensified second sound to the usual place of ausculting, in the second right interspace. The same factors do not interfere with the audibility of the sound over the clavicles. This is really a very striking phenomenon, although not a common one.

Diastolic aortic murmurs are also often well heard over the collar bone.

Transdigital Auscultation

Timing heart murmurs is not always easy. This is particularly true of mitral murmurs. The question frequently arises as to whether one is dealing with stenosis or with regurgitation at the valve orifice. Timing by means of the radial pulse is unreliable, and by means of the carotid is also not very satisfactory. Several years ago I described a method that has proved of considerable help in this matter. I have called it "transdigital auscultation." To practice it, it is necessary to employ a diaphragm stethoscope, and not one of the bell type. The index or middle finger is flexed at a right angle, and its tip is placed directly over the apex beat. The stethoscope is then laid on the horizontal phalanx of the flexed finger, at the angle. It will be found that murmurs may be heard nearly as well through the finger as when the stethoscope is placed directly on the chest; and, since auscultation and palpation are performed at the same place, it is obvious that one can tell readily whether a murmur occurs before the finger is lifted, synchronously with the lifting, or afterward. The method also serves well for eliciting the Duroziez murmur in cases of aortic insufficiency. This murmur, really a double murmur, is heard in the femoral artery when pressure is made on it with the stethoscope just below Poupart's ligament. Sometimes the pressure is distinctly painful; at others, the stethoscope disk is too large for making satisfactory compression. If the artery is not properly compressed, only one sound is heard. By transdigital auscultation, the drawbacks just cited are obviated—the to and fro murmur can readily be brought out by regulated pressure with the tip of the finger.

SOME REMARKS ON PHYSICAL DIAGNOSIS: 1. TRANSDIGITAL AUSCULTATION 2. ULNAR PALPATION [1]

1. Transdigital Auscultation—The timing of heart murmurs is occasionally very difficult, particularly when the murmur is in the apical region. Textbooks on physical diagnosis advise that in such circumstances the fingers should be placed upon the carotid artery. Murmurs synchronous with the carotid pulse are considered systolic; all others, either diastolic or presystolic, as the case may be. When the carotid artery is easily accessible, it answers very well as a guide; but it is not always possible to locate the vessel with sufficient accuracy to make the necessary comparison. Some endeavor to time a murmur by means of the radial pulse; but this is not a good method, as the pulse at the wrist occurs perceptibly later than the cardiac systole.

There are times when, owing to diffuseness of the apex beat, it is possible to auscult with a stethoscope, while simultaneously ascertaining, with the hand placed upon the heart, when the systole occurs. In such a case the timing of a murmur is readily accomplished. When, however, the carotid artery or the pulsation of the precordia outside of the area immediately ausculted is used as a guide, the attention is necessarily divided. This is undesirable, since in order to determine whether a given murmur is systolic or presystolic, the fullest concentration of the attention is required.

While engaged one day in an arduous endeavor to time a musical murmur, the more common methods having failed me, I made use of the one that I desire to bring to your notice. It consists in ausculting through the hand placed over the heart, and can be used satisfactorily only with one of the newer binaural stethoscopes. I have found that known as the Bowles to answer best. It is a modification of the phonendoscope, and consists of a shallow, concave bowl, and a diaphragm of tin or rubber. With this instrument it is possible to hear the heart sounds and heart murmurs with surprising distinctness through the hand placed on the precordia.

[1] Read before the Medical Society of the State of Pennsylvania, September, 1904.
Reprinted from *American Medicine*, Vol. IX, No. 16, pages 641-642, April 22, 1905.

It must be evident that such a method greatly facilitates the timing of a murmur, inasmuch as the palpation and the auscultation are done at the same time and place. I have found that not only is it possible to auscult directly through the fingers and hand, but that almost equally good results can be obtained by placing the finger, flexed at a right angle on the apex beat and then resting the stethoscope lightly upon it.

The principal advantage of transmanual auscultation will be found in distinguishing presystolic from systolic murmurs. The differentiation of these two murmurs is frequently encompassed with great difficulty, and in my experience in teaching I have noticed that students find this the most difficult part of cardiac physical diagnosis. I need scarcely emphasize in this article the importance of differentiating these two kinds of murmur at the mitral valve. In mitral stenosis, indicated by the presystolic murmur, the treatment is quite different from that demanded in mitral insufficiency, indicated by the systolic murmur. In many cases of the former affection, digitalis is not only useless, but distinctly harmful; and any method that will facilitate an accurate diagnosis, to this extent aids in the proper treatment of a case.

The successful practice of the method of transmanual auscultation presupposes the existence of a palpable heart beat. As in the first case in which I employed it (one of musical diastolic murmur), the method may also be of value in timing peculiar murmurs having a wide area of diffusion.

2. Ulnar Palpation—Of the four cardinal methods of physical diagnosis—inspection, palpation, percussion, and auscultation—the second, palpation, is least often employed; and yet it is as valuable as any, at times even affording information that none of the others can give. The reason for its comparative lack of popularity is that, as ordinarily practiced, the results obtained are unsatisfactory—at least, with regard to the determining of the tactile fremitus. The prevailing method of ascertaining the tactile fremitus is to lay the flat of the hand on the chest while the patient is speaking. This is the only method generally taught and described in textbooks on physical diagnosis, and is the one that, with few exceptions, I have always seen employed by physicians and students in making their routine examinations. The exceptions are constituted by the times when an occasional examiner has determined the fremitus, especially in the supraclavicular spaces, by using the tips of the fingers.

It must be evident that the hand, when laid on flat, will in many instances cover an area much larger than that which is the seat of

disease. What is actually felt in such circumstances is an average fremitus, produced by a combination of the fremitus of the diseased area with that of the surrounding uninvolved regions. For example, if the lesion is one of consolidation, the resulting increase in fremitus will be somewhat dampened by the lesser fremitus of contiguous normal areas; while if the lesion is one that naturally lessens the fremitus—as, for instance, a localized plastic pleurisy—the diminution will not be clearly discerned when the hand covers normal lung tissue as well.

The method that I propose is analogous to that used in percussion, in that it confines the examination to the individual interspaces. It is extremely simple and not at all revolutionary; and, while original, may not be new, for it is quite likely that others have employed it.[2] It consists in laying the ulnar side of the hand in each interspace successively, while the patient counts "one, one, one"; "one, two, three"; or "ninety-nine," according to individual preference. The ulnar surface of either the hand or the little finger must be firmly placed in the interspace, the hand being held almost at a right angle with the chest. It is advisable to stand a little to the side of the patient and to use the same hand for both sides of the chest.

An inspection of the hand will show that the ulnar side is really a part of the palm. It is hairless and has a very delicate sense of touch. I have been unable to find in works on physiology a comparative study of the sensitiveness of the various parts of the hand specifically mentioning the ulnar side. I have examined a number of persons, using the method of Weber (that is, determining the smallest distance at which two points can still be recognized as two), and in this way have found that the ulnar side of the hand and of the little finger is as sensitive as are the thenar and hypothenar eminences and the center of the palm. Indeed, in some persons the ulnar side seemed to be the most sensitive of the four zones. It is, however, not so sensitive as the finger-tips.

The method gives accurate information and enables one to discover small shades of difference in the fremitus of contiguous interspaces and of corresponding areas on the two sides. It has its best field in the diagnosis of effusions, especially in determining the upper level of the exudate. As a rule it is practiced most successfully on the front of the chest. On the back, by reason of the diffi-

[2] Since reading this paper my attention has been called to the fact that the method has been used to some extent in Vienna; it is also briefly mentioned by Vierordt[3] and by Aufrecht.[4]

[3] Diagnostik der inneren Krankheiten, 1901, p. 144.

[4] Nothnagel's System: Diseases of the Bronchi, Pleura, and Lungs, English Edition, p. 465.

culty in locating the interspaces, it is not so satisfactory; but it may be employed even there.

I have called the method by the somewhat cryptic name of "ulnar palpation," for the reason that it is done with the ulnar side of the hand; and have taught it for the last eighteen months to students and physicians, who have quickly adopted it. It is not offered as a substitute for the method now in vogue, but as an addition to it. Both should always be employed.

PULSATION OF THE UVULA IN AORTIC INSUFFICIENCY[1]

The occurrence of pharyngeal pulsation in aortic insufficiency was, it seems, first brought to the attention of clinicians by F. Müller in 1889. Since then but few references have been made to the subject, and the majority of textbooks are silent upon it. A recent paper by Schlesinger,[2] of Vienna, has served to stimulate a renewed interest in the phenomenon.

Schlesinger examined 40 cases of aortic regurgitation, but found unmistakable pharyngeal pulsation in only a small number. Much caution is necessary in the examination, as muscular movements produced by attempts at retching or swallowing may simulate pulsatile phenomena. The patient should be instructed to hold the mouth open steadily and to breathe quietly. The employment of a tongue-depressor did not, in my limited experience, seem to interfere with the interpretation of the pharyngeal movements; but it is well to make the examination both with and without the use of this instrument.

Two types of pulsation of the soft parts are distinguishable: a communicated movement, connected with the throbbing of the carotids, and usually affecting the tonsils and faucial arches; and an independent movement, brought about by a systolic increase in the volume of the tissues. This manifests itself in a rhythmic turgescence of the soft parts. Schlesinger has observed the pulsation in the tongue, both by inspection and by palpation. It may likewise be discernible in the half-arches and in the uvula. At times the posterior wall of the pharynx is pushed forward with each systole of the heart; in some cases the swelling is so marked as to produce a distinct rhythmic narrowing of the oral and pharyngeal cavities. I have looked for the phenomenon in 3 cases of aortic regurgitation that have recently come under my observation, and found pulsation of the uvula in 2 of them.

Case I.—The first patient was seen in the dispensary of the University of Pennsylvania Hospital. He was a man of 37 years, who had a double

[1] Paper read before the University of Pennsylvania Medical Society, April 19, 1901. Reprinted from American Medicine, June, 1901.
[2] Wiener klin. Wochenschrift, October 4, 1900.

aortic murmur and dilated hypertrophy of the heart. The murmur was of the see-saw quality, and could be heard over the greater part of the chest. The capillary and water-hammer pulses were both well marked. On inspection of the pharynx, the uvula was seen to quiver synchronously with the pulsations of the heart; at every systole, its tip was tilted forward and brought nearer to the base of the tongue. The movements were rendered more noticeable by the fact that with every change of position the reflection from the glistening, mucus-covered surface of the uvula was modified. I was not able to convince myself that there was pulsation of the half-arches or of the posterior pharyngeal wall; there was no rhythmic swelling of the tongue.

Case II.—The second patient was a girl of 16, who came to the University Hospital Dispensary from Chester, Pa. She had aortic regurgitation and hypertrophy of the heart. There was only a single, diastolic murmur at the base. The capillary and Corrigan pulses were present. In this patient there was also a distinct pulsation of the uvula, synchronous with the heart's action. Other pulsatile phenomena in the pharynx or mouth were not present.

Both patients were exhibited to the students in my ward classes, who witnessed the phenomenon.

Case III.—The third case, seen in private practice, was a typical one of aortic disease, with double murmur, in a boy of 10 years. He had a capillary and a water-hammer pulse, but I was unable to find any rhythmic pulsation of the uvula or other parts of the pharynx. Why it was absent in his case, I am unable to say.

The phenomenon is, of course, of the same nature as the capillary pulse, although it is possible that in such soft parts as the tonsils, the half arches, the uvula, and the tongue the vibration of the small arterioles may participate in the production of the pulsation. As a physical sign, pharyngeal pulsation has no special diagnostic value and possesses no greater significance than the capillary pulse. The knowledge of its existence merely adds one more point to be looked for in the critical study of a case, and thus helps to stimulate and to sharpen the powers of minute observation.

SORENESS OF THE TONGUE AS AN INAUGURAL SYMPTOM OF PERNICIOUS ANEMIA *

A few years ago, William Hunter propounded in a manner most emphatic the view that pernicious anemia is due to oral sepsis. Many of us were not, however, convinced that he had proved his thesis, even though he based it upon a study of 75 cases of true Addisonian anemia. The cause of pernicious anemia is still locked up in the casket that shelters leukemia, cancer and sarcoma; but I am optimistic enough to believe that some one will soon find the key. But even if oral sepsis is not the cause of pernicious anemia, there are, at times, oral symptoms that bear, in their intensity and chronology, such a striking relation to the affection as to constitute more than a mere accidental phenomenon. The cases I have to report seem to me to illustrate this point.

Case I.—Mrs. M. D., married, fifty-four years old, a native of Australia, was seen with Dr. Beverly S. Ober, of Springfield, Massachusetts. On Christmas Day, 1912, she fell and broke her arm. A severe brachial neuritis followed. About six months later she began to have a biting, stinging sensation in the tongue. The normal coating disappeared, leaving a raw and tender surface. The burning sensation gradually spread to the inner side of the cheeks and lips. As time went on, however, it affected chiefly the tongue, which also became streaked with red lines. The papillæ became implicated, and the burning increased. The tongue felt, as the patient put it, as if it had been scraped and had no top. Food had a queer taste. The character of the food itself made little difference in the abnormal sensation. When I saw the patient, the tongue was of a carmine color and very tender to the touch. A small ulcer was present on the left side of the cheek. The teeth were in good condition. Aside from a little pyorrhea, the patient had never had any dental trouble. A single tooth, found defective on X-ray examination, had been extracted.

On physical examination, nothing more of moment was found. The blood, except for some anisocytosis, was practically normal.

Having no other satisfactory explanation to offer for the glossitis, I told Doctor Ober that Mrs. D. would probably develop pernicious anemia; and this prediction was verified. When I chanced to see Doctor Ober, in November last, he told me that the patient had eventually developed pernicious anemia, and had died of it.

* Read before the Section of Medicine, College of Physicians, Philadelphia, March 27, 1922.

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CASE II.—Two weeks ago, I had the privilege of seeing with Dr. J. M. Godfrey, of Philadelphia, Mrs. A. M., a native of Philadelphia, who presented the clinical and anatomical picture of pernicious anemia. Five years ago, she began to have trouble with her tongue. A sense of diffuse soreness and a feeling as if the tongue had been scorched by hot tea, were experienced. She is sure that there was no connection between the soreness of the tongue and bad teeth. Long before the tongue became sore, she had gotten plates; and her son-in-law, an excellent dentist, had kept the few remaining teeth, as well as the plates, in good condition. The surface of the tongue was never cracked or ulcerated. Two years ago, or three years after the soreness of the tongue began, Mrs. A. M. found herself growing weak. This weakness has gotten progressively more intense, and is now very marked, constituting the patient's chief complaint. The tongue is no longer sore. For the last three months, she has had nausea and vomiting before breakfast. Her appetite, however, is good. So far, she has not lost much of her original weight, which, two years ago, when in her opinion her illness began, was 240 pounds.

Mrs. M.'s tongue was, when I saw it, small, atrophic, pale, smooth, velvety and free from any coating whatever. The papillæ had entirely disappeared.

CASE III.—Three days after I saw the second case, I was asked by Dr. William K. Müller, of Germantown, to see Mrs. McG., a woman of sixty-eight years, whose chief complaint was pain in the knees. Noticing her extreme pallor, I asked whether she had ever had a sore tongue, and elicited a surprised affirmative. It appears that Mrs. McG.'s illness began two years ago, with great pain in the tongue, which felt as if it was ulcerated. After a few months, during which she lost strength rapidly, the tongue condition improved; but it became worse again last summer. At the time of my visit, the tongue was no longer sore. In appearance, it was the counterpart of that of Mrs. M. (Case II). It was very small, pale, smooth, velvety and somewhat glazed. The papillæ were totally atrophied. There were only two teeth—incisors—left. All the others had been removed about twenty years before, plates having been worn since that time. There was a little pyorrhea about the roots of these two teeth; but they were not painful, or in any way troublesome. The blood count, made the next day, bore out the diagnosis of pernicious anemia. It showed 680,000 red cells, 6900 white cells, and 15 to 20 per cent. hemoglobin. There was marked poikilocytosis, megalocytosis and microcytosis. No nucleated red cells were present. The differential count was as follows:

Polymorphonuclears	64 per cent.
Small mononuclears	28 per cent.
Large mononuclears	8 per cent.

Doctor Müller had a blood transfusion done. Ten days later, the red cells were 1,380,000—about double what they had been before, and the hemoglobin nearly 50 per cent.

The bond uniting these three cases is, primarily, a severe glossitis, which either directly inaugurated or by some time preceded the pernicious anemia.

While there is no actual proof of a poison in pernicious anemia, the blood destruction and the well-known spinal cord changes strongly suggest the existence of a slowly acting toxin. It may

temporarily exhaust itself or be neutralized, which explains the remissions, but it is never, or hardly ever, entirely destroyed. The same poison probably acts upon the tongue and mouth. It is at times present long before the blood alterations are sufficient to attract attention, although a careful examination might reveal some tell-tale change.

In many respects pernicious anemia bears an analogy to septic endocarditis—both are of long duration; both are subject to remissions; both bear some obscure relation to the spleen; both tend to a fatal termination. By making a blood culture on special media, such as Noguchi's, it may perhaps be possible to find the virus responsible for pernicious anemia.

The principal point that I wish to make in this brief report is that in all cases of sore tongue in which syphilis and distinctly local causes can be excluded, the possibility of pernicious anemia should be borne in mind.

LEUKOCYTOSIS IN MALIGNANT DISEASE *

The Report of an Unusual Case

Studies of the blood in malignant disease stress the anemia, but make only a scant mention of leukocytosis, though that is not infrequently present.

Andral,[1] it seems, was the first, in 1823, to call attention to an increase of white cells in the blood of a person who had died of cancer. In 1867, Lucke and Virchow [2] found leukocytosis in patients with malignant disease. Virchow attributed this to an increased flow of lymph, the increased number of white blood cells being in his opinion derived from the tumor itself. Palmer, in 1896, described a case showing multiple glandular swelling with a normal blood picture, later changing to one of leukemia. At necropsy a primary round-cell sarcoma of the thymus with metastasis in various organs and bilateral suppurative nephritis were found.

In 1896, Martin Matthewson and Alexander [3] reported several cases of sarcomatosis with marked leukocytosis, in which the predominating cells were of the lymphocytic or mononuclear type.

The studies of Grüner, in 1916,[4] on the change in the leukocytic picture in malignant disease are of unusual interest. He concludes that if there is neutrophilia with bizarre forms, if many of the lymphocytes show ameboid outlines, if the monocytes show ameboid nuclei, the case is almost certainly one of malignant disease. Comparatively recent reports, by Dieballa and Entz,[6] Bizarri [5] and Piney,[7] record cases similar to our own. According to Piney there were prior to his report of a single case, only two similar ones on record, namely, those reported by Dieballa and Entz and by Bizarri.

In our case the blood picture was so unusual that it is deemed worthy of being reported.

H. S., a married man, aged sixty-nine years, has had asthma for thirty years. About eighteen months before coming under observation he had hemoptysis but without visible impairment in health until the past few months, when he began to have burning pain between the shoulders, worse

* Read June 5, 1929.
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Written in collaboration with David A. Cooper, M.D.

on lying down. Recently he has had difficulty in swallowing and a girdle sensation around his lower chest. There was nothing of importance in the previous history or in the family history.

Physical Examinations. The patient is a well-developed man of about seventy years. The pupils are equal and react promptly. There is no sinus or mastoid tenderness. The tongue is coated, the teeth are in poor condition. There are no glandular enlargements in the neck. The chest is of emphysematous type. The heart is slightly enlarged on percussion; percussion also shows a definite increase in the supracardiac dulness. The heart sounds are weak, but there is no arrhythmia, no murmur. The right lung shows a few rhonchi at the base. In the left lung the percussion note is impaired between the vertebral border of the scapula and the spine; vocal resonance is diminished in this area and the breath sounds are harsh; a few rales are heard over the left base. The abdomen reveals nothing abnormal. There is slight edema of the ankles, the knee-jerks are normal. There is no tenderness over the long bones or sternum.

The temperature during hospitalization varied from 98° to 100°, the pulse from 90 to 100, and the respiration from 24 to 30.

The urine was negative on repeated examinations.

The Wassermann test was negative.

A roentgenogram of the chest showed the heart and lungs to be negative, but there was a dense shadow in the posterior mediastinum that suggested an aneurysm of the descending arch of the aorta or a tumor.

Roentgenographic studies of the long bones revealed no metastasis; the left pubic bone, however, was suspicious.

The examination of the blood showed: Red blood corpuscles, 4,000,000; white blood corpuscles, 56,300; hemoglobin, 78 per cent.; neutrophiles, 95 per cent.; lymphocytes, 3 per cent.; mononuclears, 1 per cent.; myelocytes, 1 per cent. Many of the neutrophiles were young forms. The leukocytes varied from 40,000 to 60,000 on repeated examinations during the four weeks of observation.

The two following counts are typical: hemoglobin, 80 per cent.; white blood corpuscles, 64,800; neutrophiles, 91 per cent.; lymphocytes, 4 per cent.; mononuclears, 2 per cent.; basophiles, 1 per cent.; myelocytes, 2 per cent.

White blood corpuscles, 59,600; neutrophiles, 92 per cent.; lymphocytes, 3 per cent.; metamyelocytes, 3 per cent.; myelocytes, 2 per cent.

A diagnosis of mediastinal tumor was made and roentgen-ray therapy instituted. The patient showed no improvement and was allowed to return to his home, where he died soon afterward. A necropsy was performed and a large mediastinal growth was found that on section proved to be a sarcoma of large spindle-cell type. Unfortunately, at the autopsy specimens were not taken from the bone-marrow.

The possible explanations for a leukocytosis in malignant disease are:

1. Associated infection.
2. Metastasis to bone-marrow.
3. Hemorrhage.
4. Absorption of toxic products from the growth.

1. Secondary infection in malignant growths situated on a surface is an ever-present possibility. Such is the case in bronchial

carcinoma when the tumor causes obstruction and the development of pneumonitis distal to the site of the lesion. Infection is also prone to occur in renal carcinoma with ureteral blockage, and, of course, it is a common occurrence in malignant tumors of the gastro-intestinal tract.

2. Bone-marrow Metastasis: The work of Piney[7, 8] has placed this mechanism for the explanation of leukocytosis on a firm basis. The profound changes in the blood picture in some cases of malignant disease are best explained by assuming an injury to the bone-marrow. Piney believes the metastasis to be by way of the blood stream rather than by way of the lymphatics.

And kind of malignant growth may give metastasis to the bone-marrow. Sarcomas are more prone to give this type of metastasis. Osseous metastasis causes marked changes in hemopoesis. These changes fall into two main groups, the more common type which simulates pernicious anemia, described by Ehrlich in 1878,[9] and the rarer form in which a leukemoid blood picture is found. There is apparently no relationship between the site of the primary tumor and the character of the blood picture.

3. Hemorrhage, which may be sudden or gradual, stimulates the bone-marrow to increased activity, with the production of white blood cells as well as red cells; this probably accounts for the moderate leukocytosis that is seen relatively frequently in malignant disease. Hemorrhage into the tumor itself is often an added stimulus for the production of a leukocytosis.

4. The absorption of toxic products from the growth itself might conceivably act in a chemotactic way upon the leukocytes. Ewing[11] states that "the uncomplicated tumor process seems to have no capacity to attract leukocytes to the circulation." Too little is known about the production of toxic substances in tumors to justify any definite conclusions. A moderate leukocytosis might be due to the secondary anemia so often found in malignant disease and could be attributed to a stimulation of the bone-marrow.

Discussion. We have presented a case of spindle-cell sarcoma, arising in the mediastinum, with marked leukocytosis. A reasonable explanation of the blood picture is metastasis in the bone-marrow, even though there was no roentgenologic evidence of such metastasis. In the consideration of this point of metastasis to bones, we should like to refer to two other cases that we have observed.

H. R., a man, aged fifty-five years, had carcinoma of the stomach with marked roentgenologic evidence of metastasis to the spine and pelvis; yet his blood picture during a year's observation, almost up to the time of his death, was only that of a mild secondary anemia.

The second patient, Mrs. K. W., aged sixty-six years, had been anemic for years. Her case, after careful study, had been diagnosed as typical pernicious anemia. She improved under liver therapy and did not return for a year. On readmission she was found to have an inoperable carcinoma of the stomach. There was no clinical evidence of bone metastasis, but at autopsy, which revealed a large cancerous growth of the stomach, the bone-marrow was found hyperplastic and on microscopic section showed metastasis.

Our patient with the marked leukocytosis showed no definite evidence of infection, although he had a moderate irregular fever and some sweating. Miller and Jones,[12] in a study of pulmonary growths, find fever without other evidence of infection a constant symptom. They believe that it is due to the growth *per se*.

The probability that hemorrhage was a factor in the production of the leukocytosis in our case is unlikely, as the anemia was of a mild degree. Fitz-Hugh,[12] in a study of the blood in gastrointestinal malignant disease, found no constant relationship between the degree of anemia and the number of leukocytes in the blood.

Absorption from the tumor as an exciting cause of the leukocytosis is a possibility, but since there was only a mild degree of anemia, it seems more logical to assume that the high leukocyte count—a leukemoid blood picture—was due to bone-marrow metastasis, even though roentgenologic evidence of such metastasis was lacking.

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HISTORICAL AND GENERAL

THE GREAT IRISH CLINICIANS OF THE NINETEENTH CENTURY[1]

When, a few days ago, I read a draft of the Home Rule Bill which the British government has introduced in Parliament, I wondered what the great medical worthies whose lives I have been studying would say if they were to reappear on the world's stage. They lived at a time when the tragic muse had not tears enough to bewail the fate of Ireland; at a time when the passions engendered by the Act of Union were still burning fiercely; at a time when the two great Churches—each preaching the doctrine of love of fellow man—were hating and reviling each other in a manner that beggars description. When I read of some of the things that were done by the one to the other I could scarcely believe that I was reading of the nineteenth century; they imitated savages so faithfully!

I have an idea that of all the men whose story concerns us—Corrigan, Stokes, Graves and Cheyne—Graves alone would be actively interested in the great events in his country's history. He impresses me as the greatest of this quartet, a man loyally wedded to his profession, yet with wide human interests. Graves all his life was in sympathy with the ancient philosopher who said, "Nihil humanum a me alienum puto." Stokes was a scholar, a good observer, with esthetic tastes, but not caring much for the great political questions that stirred his contemporaries. Occasionally he utters an altruistic platitude, but it is evident that his heart was not deeply moved. He was opposed to Home Rule, though he welcomed the Catholic Emancipation of 1829. As to Corrigan, it is difficult to ascertain how he stood in the critical days of Irish history. Belonging to what was at that time the unpopular faith in Ireland, though held by the majority, his official biographer of an opposite faith has done him scant justice. When I come to speak of his medical work, I shall have to break a lance in his behalf.

The fourth of the group was not an Irishman at all, but a Scotchman with the typical characteristics of that strong, yet sentimental race. His sympathies were evidently with the ruling powers, for he

[1] Read before the Medical History Club of Philadelphia, and in part before the A. M. P. O. Medical Fraternity.

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received high honors from them—no less a one than that of physician to His Majesty's forces in Ireland, a most distinguished post.

If they were to come to life, Graves and Corrigan would surely side with Redmond and Asquith, Stokes probably not. As for Cheyne, he, as we shall see, did everything with a motive. He was shrewd and calculating, and might have espoused Home Rule in Dublin and opposed it in Belfast. Perhaps I am doing his memory an injustice, but thus he has impressed me in his remarkable autobiography.

When we consider these men in their medical relations, one of the things that strikes us is the remarkable circumstance that the city of Dublin should have contained, at nearly the same time, four great luminaries. Yet it is not strange when we reflect that in the glorious days of Pericles there walked the streets of Athens men like Aeschylus, Thucydides, Phidias, Sophocles, Anaxagoras and Socrates. Graves and Stokes, and to a lesser degree Corrigan and Cheyne, made Dublin the third medical city in the world, Paris being first and Edinburgh second; and even Edinburgh at that time did not have a comparable galaxy. Dublin had not been heard of before, nor has it been heard of since. In our day few Americans go there, and they only for the vast experience obtainable in the great Rotunda Hospital; but in the first half of the nineteenth century it drew men from this and other countries who were eager to walk the wards of the Meath Hospital with Graves and Stokes, or the Harwicke Fever Hospital with Cheyne, or the small infirmary in Jervis Street presided over by Corrigan. By a curious coincidence, the volume of lectures by Graves which I consulted in my reading, and which I show you here, was purchased in Dublin by Moreton Stillé, a graduate of the University of Pennsylvania and a brother of Alfred Stillé, the famous professor of medicine in our university a generation ago. Moreton Stillé went to Dublin for postgraduate study, and, though he did not remain there long, finding the opportunities offered by Vienna, where the great Skoda was at his zenith, more attractive, he acquired a high regard for both Graves and Stokes. These two were almost the only physicians in the English-speaking world that were practicing real bedside teaching. I cannot help thinking of Marion Sims, who was graduated in Philadelphia about the same time, or a few years earlier, without having ever seen a patient at close range. His graphic account of his experience when called to see a little child, his first patient, should be interesting to the students of our day who practically live in the wards of hospitals in their senior year.

It is difficult to say who deserves the greater credit, Graves or Stokes, for the introduction of bedside teaching. Graves was the

older and probably the pioneer. Strictly speaking, Graves was not the first to do clinical teaching. Thomas Bond preceded him in this country, and the great Boerhaave in Leyden. The first official attempt at clinical teaching, after the dissolution of the Aesculapian schools, had been made even earlier, in 1578, in the Hospital of St. Francis at Padua, by Albert Bottoni and Marc Oddo (Renouard, Histoire de la Médicine, Paris, 1846, p. 309). That practical bedside teaching, however, was in vogue more than eighteen hundred years ago appears from the following lines from Martial:

Languebam, sed tu comitas protinus ad me
Venisti centum, Symmache, discipulis.
Centum me tetigere manus Aquilone gelatae,
Nec habui febrem; Symmache, nunc habeo.

I'm out of sorts, but Symmachus is here,
His hundred pupils following in the rear;
All feel my pulse with hands as cold as snow,
I had no fever then—I have it now.

Graves' merit consists in having given the students opportunity to make routine observations of patients assigned to them, for reports of whose conditions they were held responsible. He was the first to break down "the impassable gulf which in that aristocratic era lay between the student and the teacher." His method in many respects is that in vogue in the best medical schools today.

Graves

Robert James Graves (1796-1853) is the Trousseau of Ireland, a splendid observer, a brilliant lecturer, a fascinating writer. No man appreciated his qualities more than Trousseau himself, as may be seen in the following excerpt from a preface written by him to the French translation of Graves' lectures:

> For many years I have spoken of Graves in my Clinical Lectures; I recommend the perusal of his work; I entreat those of my pupils who understand English to consider it as their breviary; I say and repeat that, of all the practical works published in our time, I am acquainted with none more useful, more intellectual; and I have always regretted that the Clinical Lectures of the great Dublin practitioner had not been translated into our language. . . .
>
> As Clinical Professor in the Faculty of Medicine of Paris, I have incessantly read and re-read the work of Graves; I have become inspired with it in my teaching; I have endeavored to imitate it in the book I have myself published on the Clinique of the Hotel-Dieu; and even now, although I know almost by heart all that the Dublin Professor has written, I cannot refrain from perusing a book which never leaves my study. . . .

Although a clinical observer, he loves the accessory sciences; we see him frequently having recourse to physiology, in the domain of which he loves to wander; to chemistry, with which he is acquainted, which he estimates at its true value, and to which he accords a legitimate place. . . .

Graves is, in my acceptation of the term, a perfect clinical teacher. An attentive observer, a profound philosopher, an ingenious artist, an able therapeutist, he commends to our admiration the art whose domain he enlarges, and the practice which he renders more useful and more fertile.

Graves' name is of course enshrined forever in the name Graves' disease, whether justly or not, I have not time to discuss. Nearly every country claims for some favorite son the honor of having first recognized the disease: England for Parry, Italy for Flajani, Germany for Basedow; and even in this country we have a possible claimant. Graves' original account is as follows:

I have lately seen three cases of violent and long-continued palpitation in females, in each of which the same peculiarity presented itself, viz., enlargement of the thyroid gland; the size of this gland, at all times considerably greater than natural, was subject to remarkable variations in every one of these patients. When the palpitations were violent, the gland used notably to swell and become distended, having all the appearance of being increased in size, in consequence of an interstitial and sudden effusion of fluid into its substance. The swelling immediately began to subside as the violence of the paroxysm of palpitation decreased, and during the intervals the size of the gland remained stationary. . . . The palpitations have in all lasted considerably more than a year, and with such violence as to be at times exceedingly distressing; and yet there seems no certain grounds for concluding that organic disease of the heart exists. In one, the beating of the heart could be heard during the paroxysm at some distance from the bed—a phenomenon I had never before witnessed, and which strongly excited my attention and curiosity. . . . The enlargement of the thyroid, of which I am now speaking, seems to be essentially different from goiter in not attaining a size at all equal to that observed in the latter disease. Indeed, this enlargement deserves rather the name of hypertrophy. . . .

A lady, aged twenty, became afflicted with some symptoms which were supposed to be hysterical. This occurred more than two years ago; her health previously had been good. After she had been in this nervous state about three months, it was observed that her pulse had become singularly rapid. This rapidity existed without any apparent cause, and was constant, the pulse being never under 120, and often much higher. She next complained of weakness on exertion, and began to look pale and thin. Thus she continued for a year, but during this time she manifestly lost ground on the whole, the rapidity of the heart's action having never ceased. It was now observed that the eyes assumed a singular appearance, for the eyeballs were apparently enlarged, so that when she slept, or tried to shut her eyes, the lids were incapable of closing. When the eyes were open, the white sclerotic could be seen to a breadth of several lines, all round the cornea. In a few months, the action of the heart continuing with unceasing violence, a tumor, of a horse-shoe shape, appeared on the front of the throat and exactly in the situation of the thyroid gland. This was at first soft, but soon attained a greater hardness, though still elastic. From the time it was first observed, it has increased little, if at all, in size, and is now about

thrice the natural bulk of the fully developed gland of the female after the age of puberty. It is somewhat larger on the right side than on the left. A circumstance well worthy of notice has been observed in this young lady's case, and which may serve to throw light on the nature of this thyroid tumefaction. The circumstance I allude to is that from an early period of the disease a remarkable disproportion was found to exist between the beats of the radial and of the carotid arteries, those of the former being comparatively feeble, while those of the latter were violent, causing a most evident throbbing of the neck, and accompanied by a loud rustling sound. In about fourteen months the heart presented all the signs of Laennec's passive aneurysm; the tumor in the neck is subject to remarkable variations in size, sometimes diminishing nearly one-half. None of her family have had goiters, nor was she ever in any of the usual localities of the disease.

In his Clinical Lectures Graves deals with general rather than with special subjects, while Stokes confines himself to diseases of the heart and lungs, and fever. Graves made a careful study of the epidemiology of cholera, and in a voluminous essay discusses the outbreak in England and elsewhere in the old world, and in the United States, taking his information about the latter from an article by a famous Professor of Medicine in the University of Pennsylvania, Samuel Jackson. Graves was the first to show clearly that cholera travelled, and travelled only along lines of human contact. "The results of this study of the epidemic led Graves to a suggestion, the importance of which to the well-being of the human race it would be hard to overestimate. Referring to our ignorance of the laws of epidemics, he proposed, with the view of determining these still hidden laws, that the different civilized governments of the world should unite in the wide establishment of medical observatories, in which, always in connection with a complete system of meteorological observation, careful records should be kept of the rise, progress, and character of disease, whether endemic or epidemic." It took the cholera 20 years to encompass the earth, while influenza, he remarks, "often traverses the same space in a few months."

Graves was a great traveller and a remarkable linguist. On one occasion when on a pedestrian journey in Austria, having neglected to carry his passport, he was arrested as a spy and thrown into a dungeon. His assertion that he was a British subject was disbelieved by the authorities, who insisted that no Englishman could speak German as he did. In his imprisonment, which lasted ten days, he suffered great privations.

Unlike Stokes, he had a keen sense of humor, as the following extract from one of his letters reveals. While in Rome he found sleeping difficult, due to the presence in all bed-rooms "of a certain animal which, together with the culices and ranae palustres, may have robbed Horace of a night's rest on the journey to

Brundusium. A friend of mine was so tormented by their bites that when visiting the capitol he flung, in a fit of rage, thirty of the ringleaders headlong down the Tarpeian rock."

Toward his patients he was exceedingly kind. He denounced the practice prevailing in France and in Ireland of discussing hopeless cases in the presence of the patients. I find that our present method of bedside teaching is at times conducive to the same reprehensible practice that so outraged Graves' sense of propriety. Students, when asked to give their opinion of the nature of a case, often use terms understood by the laity—cancer, tuberculosis, Bright's disease—forgetting what a terrible effect such a word may have on the mind of the patient. These terms should never be employed within the hearing of the sick.

Graves' achievements in medicine apart from his discovery of exophthalmic goiter are many, but none gives him greater claim to immortality than the part he took in revolutionizing the treatment of fevers. Up to his time fever patients were starved. Graves insisted that such patients must not be allowed to suffer from starvation. He says:

> In a patient laboring under fever and a protracted abstinence, whose sensibilities are blunted and whose functions are deranged, it is not at all improbable that such a person will not call for food, although requiring it; and if you do not press it on him, and give it as a medicine, symptoms like those which arise from starvation in the healthy subject may supervene. . . . You may, perhaps, think it unnecessary to give food, as the patient appears to have no appetite, and does not call for it. You might as well think of allowing urine to accumulate in the bladder because the patient feels no desire to pass it. You are called upon to interfere where the sensibility is impaired, and you are not to permit your patient to encounter the terrible consequences of starvation because he does not ask for nutriment.

Stokes, in his sympathetic biography, quotes the following story:

> Graves was going round the hospital, when, on entering the convalescent ward, he began to expatiate on the healthy appearance of some who had recovered from severe typhus. "This is all the effect of our good feeding," he exclaimed; "and lest, when I am gone, you may be at a loss for an epitaph for me, let me give you one, in three words: 'He fed fevers.'" [2]

Graves was largely responsible for the opium treatment of peritonitis, which proved so valuable and was extensively employed up to the period when peritonitis ceased to be a medical disease and became a surgical affection.

His ideas on the subject of tuberculosis were far in advance of his time and practically those universally adopted today. He writes thus (Clinical Lectures, New Sydenham Society, Vol. 2, p. 118):

[2] These words are, however, not on his tombstone.

Make your patient lay aside slops and tea and let him take wholesome fresh meat, bread and good beer. He should rise early and breakfast early, let him dine, also, early. When the weather permits, let him remain in the open air four or five hours, taking exercise on a jaunting car or on the top of a coach. Never abandon cases of consumption.

The best climate for the treatment of consumption, in his opinion, is that of the East and West Indies, South Carolina, Florida, the northern states of South America or Egypt.

As I have said before, Graves was deeply interested in the political events of his time, especially in the Hungarian Revolution and in Great Britain's Asiatic policy, which he studied with the zeal of a responsible diplomat. He was interested in art and did some painting. On a journey in Italy he formed a friendship with the artist Turner that had a great influence upon his life. A curious anecdote is told of their first meeting. They travelled together for months, enjoying each other's company, sketching side by side, without either inquiring the name of his comrade, and it was not until they reached Rome that Graves learned that his companion was the great artist.

Stokes

William Stokes (1804-1878) came of a long line of distinguished men. He was an indolent youth, fonder of reading poetry and romance, especially the tales and ballads of Sir Walter Scott, than of Latin and mathematics. His son tells how he was roused from his lethargy:

One day, while in his favorite retreat, he fell asleep but shortly afterwards was awakened by some warm drops falling on his face. He started up and saw his mother bending over him. Her tears had awakened him. Stung with remorse at having been the cause of so much suffering, his nature appeared to undergo a complete and salutary change, and the dreamy, indolent boy suddenly became the ardent, enthusiastic student.

He had no college training, but was educated by his father and private tutors. After taking courses in chemistry in Glasgow he matriculated in the Edinburgh Medical School, where he fell under the spell of Dr. Alison. Alison must have had a marvelous personality, judging by what Stokes and another pupil, Acland, say about him. While yet a student, Stokes wrote a small volume on the use of the new and much ridiculed instrument called the stethoscope,[3] and to him is due much of the credit for popularizing Laennec's great invention. Returning to Dublin, he was at once elected physician of the great Meath Hospital in the place of his father,

[3] The attitude of the medical profession toward the stethoscope in the early days of its use is well illustrated in Oliver Wendell Holmes' poem, "The Stethoscope."

who had resigned. Here he became the colleague of Robert James Graves, with whom he worked side by side in friendly relationship for nearly thirty years. In 1842 he was chosen Regius Professor of Physic in succession to his father, who had held the same chair. At the height of his career, Graves having died, he was probably the ablest physician in Europe. Diseases of the heart and lungs especially interested him, and there are few chapters in these subjects that he has not enriched. He understood better than his contemporaries, better even than the school of Laennec and than many of his successors, that the murmur is not everything either in the diagnosis or in the prognosis of diseases of the heart, and that a functional diagnosis is of more importance than an anatomic one. It is comforting to the student and the practitioner to read of the modesty of a man who had studied heart murmurs better than probably any man since his day—barring perhaps the elder Austin Flint. In one place he says:

> We read that a murmur with the first sound, under certain circumstances, indicates lesion of the mitral valves. And again, that a murmur with the second sound has this or that value. All this may be very true, but is it always easy to determine which of the sounds is the first, and which the second. Every candid observer must answer this question in the negative. In certain cases of weakened hearts acting rapidly and irregularly, it is often scarcely possible to determine this point. Again, even where the pulsations of the heart are not much increased in rapidity, it sometimes, when a loud murmur exists, becomes difficult to say with which sound the murmur is associated. The murmur may mask not only the sound with which it is properly synchronous, but also that with which it has no connection, so that in some cases even of regularly acting hearts, with a distinct systolic impulse, and the back stroke with the second sound, nothing is to be heard but one loud murmur. . . .
>
> So great is the difficulty in some cases, that we cannot resist altering our opinions from day to day as to which is the first and which the second sound.

Stokes was one of the first to urge a definite required course of gymnastics or pedestrian exercise in the treatment of heart disease. His ideas on tuberculosis were remarkable, considering how inadequately he knew the pathology of the disease. He believed in the curability of phthisis even after excavation has formed. (Diseases of the Chest, p. 474.) His treatment in its essentials differed but little from that in vogue today. The patient was first put to bed and then was allowed to be about, taking exercise in mild weather and afterwards removing tc a milder climate to perfect his recovery.

> In a case with cavity (Diseases of the Chest, p. 474), yet in which the symptoms and signs are not progressive, the patient's best chance I believe to be the use of a seton, and travelling. If he does not recover, his life will be probably prolonged. He should take as little medicine as possible;

he should adopt all strengthening means, and use such a regimen as experience points out as the best. Heated rooms, cough mixtures, acid draughts, inhalations, narcotics, repeated counter-irritation, and all the varied and harassing treatment which ignorance supposes to be curative, these are not the means of recovery.

The association of his name with the peculiar type of breathing called Cheyne-Stokes breathing, and with a strange malady of the heart—slow pulse and cerebral symptoms—Adams-Stokes disease, will assure him an easy immortality. The respiratory symptom was first observed by Cheyne (Dublin Hospital Reports, Vol. 2, p. 217) in a case of fatty degeneration of the heart. I shall refer to this later on. The Adams-Stokes syndrome was first noticed by Robert Adams, a surgeon, in 1827, but Stokes' careful analysis of Adams' case, as well as his own observations, makes him virtually the real discoverer. The condition is characterized by repeated attacks of syncope, pseudoapoplexy, convulsions, and permanently slow or irregular and feeble pulse.

The original account of Adams' disease appeared in a paper on "Cases of Diseases of the Heart Accompanied with Pathological Observations," in the Dublin Hospital Reports, 1827, IV, 353, and is as follows:

An officer in the revenue, aged 68 years, of a full habit of body, had for a long time been incapable of any exertion, as he was subject to oppression of his breathing and continued coughing. In May, 1819, in conjunction with his ordinary medical attendant, Mr. Duggan, I saw this gentleman; he was just then recovering from the effects of an apoplectic attack, which had suddenly seized him three days before. He was well enough to be about his house, and even to go out. But he was oppressed by stupor, having a constant disposition to sleep, and still a very troublesome cough. What most attracted my attention was, the irregularity of his breathing, and remarkable slowness of the pulse, which generally ranged at the rate of 30 a minute. Mr. Duggan informed me that he had been in almost continual attendance on this gentleman for the last seven years; and that during that period he had seen him, he is quite certain, in not less than 20 apoplectic attacks. Before each of them he was observed, for a day or two, heavy and lethargic, with loss of memory. He would then fall down in a state of complete insensibility, and was on several occasions hurt by the fall. When they attacked him, his pulse would become even slower than usual, his breathing loudly stertorous. He was bled without loss of time, and the most active purgative medicines were exhibited. As a preventive measure, a large issue was inserted in the neck, and a spare regimen was directed for him. He recovered from these attacks without any paralysis. Œdema of the feet and ankles came on early in December; his cough became more urgent, and his breathing more oppressed; his faculties, too, became weaker.

In one respect Stokes, so advanced a student of cardiac and pulmonary diseases, was reactionary and hopelessly conservative, namely in his attitude toward fever. A word that we now use in

the sense of a symptom, he and his contemporaries employed as the name of a disease. And so we read of fever, its symptoms and treatment, as we read today of pneumonia. At first this is somewhat confusing, but the matter becomes clear when we realize that the fevers known in Ireland were chiefly typhus and intermittent malaria. The Irish typhus stood a close second to emigration in decimating the population of Ireland; for many years it had epidemic exacerbations, as for instance in 1847-48, about the time of the great famine, during which it caused frightful devastation, even among physicians. Stokes, good pathologist that he was in regard to diseases of the heart, believed in the essentiality of fever and looked upon anatomic lesions as accidental and unimportant complications. This view naturally caused him to consider typhus fever and typhoid fever, which also occurred in Dublin, one and the same disease, an opinion which he maintained until his death in 1878. When one remembers that in 1837 Gerhard and Pennock, in Philadelphia, clearly showed that typhus fever without intestinal lesions and typhoid fever with intestinal lesions, the *fièvre typhoïde* or *dothiénentérite* of the French, were totally distinct diseases, and that Lombard of Geneva a year earlier had made the same claim, one realizes how averse Stokes was to changing his opinion. This was no doubt due to his conservative character. As he himself says, "There is nothing more difficult than for a man who has been educated in a particular doctrine to free himself from it—even though he has found it to be wrong." Even intermittent fever was to Stokes merely a variety of fever, a typhus variant, and not a distinct entity. Certainly this tenacity of view is remarkable, as his death occurred only two years before Laveran's discovery of the *Plasmodium malariæ*.

Stokes' ideals of medical ethics were of the highest. The following are some of the principles laid down by him. They need neither explanation nor emphasis:

> Never, when brought in as a consultant, declare the nature of a disease in the absence of the medical attendant.
>
> Never hold that you have any property in a patient; be tolerant with the sick in their restless desire to seek other advice; preserve your independence; eschew servility.
>
> As regards conduct in society, never allude to your success in practice. Be silent when quackery is discussed. Be tolerant when those who converse on medicine, while ignorant of its foundation, reject legitimate medicine.
>
> Never originate discussion on medical topics in conversation. As regards conduct toward the profession, consider first the patient, second your professional brother, lastly yourself. Be reticent, lest by a casual word upon the previous treatment of the case, you inflict a stab in the dark on your brother's reputation.

When patients come from the country, never ignore their local attendant, only correspond with them through him.

Do not communicate any fresh discovery in the case that you may make, without communicating such first to him.

Make no change of treatment without writing your opinion to him. Have no professional quarrel.

Like a wise physician, Stokes had his non-medical hobbies. He was fond of music, a student of Shakespeare, a lover of art and an art critic, and an archeologist of no mean ability. By reason of these cultural interests his home was the meeting-place of the intellectuals of Dublin and in it all the distinguished visitors to the city were entertained, On one occasion Carlisle spent an evening at Stokes' house. Perhaps because of his unconquerable Hibernophobia, Carlisle was anything but pleased with his visit, while Stokes pronounced Carlisle not only a bore, but a hyperborean.

The writings of Stokes are voluminous, but of them all the work on the Heart and Aorta and those on Diseases of the Chest are, and will remain, medical classics. His fame would be greater if he had not written his monograph on Fever. Many were the honors conferred upon him. The one he prized the most was the *Ordre pour le Mérite*, bestowed upon him by the German Emperor in 1876. His biographers say he was elected a member of the National Institute of Philadelphia. I have searched in vain for this institute. The name cannot refer to the American Philosophical Society or the Academy of Natural Sciences, of neither of which was Stokes a member.

Corrigan

Sir Dominick Corrigan (1802-1880) is known to all of us through the Corrigan pulse. His article on permanent patency of the aortic valves, in the Edinburgh Medical and Surgical Journal for 1832, written only seven years after his graduation, is a masterpiece and a classic. Although historians say that he was not the first to describe the condition, Vieussens and Hodgson having preceded him, there is no doubt that his description is the best even to this day, and that justice is not outraged by preserving his name in connection with the disease. It is a remarkable fact that Corrigan studied the condition clinically and pathologically in an institution where he had but six beds. As Walsh says ("The Irish School of Medicine," Johns Hopkins Hospital Bulletin, September, 1906):

He did not visit his hospital merely to see patients, but to study the cases carefully. His success is only another example of the necessity for seeing much, and not many things, if there is to be any real progress. In our day, physicians scarcely consider that they have any hospital experience unless they are attending physicians to several hospitals, seeing at least

one hundred patients a week. The result is that patients do not receive the skilled care they should, and that advance in medicine suffers because of the wasted opportunities for clinical observation while a busy attending physician rushes through a ward and the resident physician has only time for the routine work that enables him to keep just sufficiently in touch with the progress of his cases to satisfy the hurrying chief physician.

Corrigan's writings are few. Aside from articles in journals, all I have found is a small monograph on Fever published in Dublin in 1853. Like his contemporaries, he believed in the primary nature of fever and looked upon anatomic lesions as secondary results and not as essential parts of the process; but unlike Stokes and Graves, he differentiated much more clearly ordinary typhus from what he called insidious typhus or follicular enteritis, which is our typhoid. I am inclined to think Corrigan was not well-read in the literature of his time, for he seems to have had an open mind which would have been quickly guided aright by a study of the works of others, especially those of Gerhard and Pennock. To that extent I agree with his biographer, Norman Moore, although I think the latter is too severe in his general judgment that Corrigan is a much overrated man. The monograph on Fever shows clear insight and sound judgment, and his attention to details in treatment is admirable. In some conditions his practice was truly heroic, as when he advised blistering the entire abdomen for tympanites. Like the great George B. Wood, he was a believer in turpentine, which he gave in large doses for the same condition. A few years ago the medical profession was startled by the announcement that quinine in large doses was a cure for pneumonia. A number of articles have been written on this supposedly new discovery, yet Corrigan in 1856 (Dublin Hospital Gazette, 1856, III, 177) advocated the same treatment.

Cheyne

I have chosen to include John Cheyne (1777-1836) in the list of the great Irish clinicians. As a writer he has no claim to be placed on a par with the others. But as a great practitioner, a good observer, and a generally remarkable man, his life is worthy of a little study. I have said he was a Scotchman, the son of a Leith physician whom he began to assist in leeching and bandaging at the tender age of 13. He was sent to the medical school in Edinburgh at 16, too young, he himself confesses, and was graduated at 18 by the aid of a "grinder." Under the inspiration of Sir Charles Bell he became absorbed in pathologic studies and in diseases of children. But he did not find Edinburgh a congenial field for practice. On looking about for a new location, he observed that

in Dublin the medical profession was highly respected, and so he settled there. His method of study was one that on many occasions I have adjured my own students to follow. When he observed a well-marked case of a disease, or when an epidemic broke out, he studied the best monograph obtainable on the subject.

Cheyne early in his career endeavored to become acquainted with the characters of those who moved in the highest ranks in the profession, hoping by discovering the cause of their success to follow in their footsteps. Nevertheless, practice in Dublin was slow in coming to him. The few friends he had advised him to go into company and to give entertainments to those who had it in their power to advance his interests. At last he yielded—reluctantly he says—but finding that his own circumstances did not permit of return entertainments for others, he refused to repeat the experiment. After his election to the Meath Hospital and to a lectureship in the College of Physicians, his practice grew by leaps and bounds. In 1816, six years after coming to Dublin it amounted to £1710 or about $8600, and soon reached an average of £5000 or $25,000, which it maintained for ten years. Being of a weak constitution, he was obliged to circumscribe his practice by refusing to go a distance from Dublin or to undertake attendance upon patients in the country. He was sure that had his health permitted he could have added £1500 to his income, making it $32,500 a year. Considering the purchasing power of money in the year 1820, Cheyne must have had a practice that is equalled by few living physicians in the United States.

Many of his statements, in their frankness and their shrewdness, remind one of Benjamin Franklin's autobiography. I cannot do better than to quote a few characteristic paragraphs which very clearly show Cheyne's diplomacy, as well as insight into human nature.

> As I was much more generally employed as a consulting than as an attending physician, I endeavored to escape interruption in my chief line of business. I returned to my home at appointed times to form new engagements, but I left no account of my route when I set out from home. When I was tracked and obliged to yield to an unexpected requisition, the patient for whom I was sent was perhaps dead; or he was dying and I was unable to leave him; or the attack was over and he was again well, and my sole recompense was a complimentary speech; or I was led to supersede the family physician engaged elsewhere, which gave rise to explanations, and to a negotiation to replace him in attendance. In the meantime, disappointment to those patients and their medical friends who were waiting for me necessarily occurred, and thus a ruffle of the spirits, very unfavorable to the consideration of a difficult case, arose and continued for hours.

He always observed punctuality, which was not practiced in Ireland, yet nowhere regarded with more complacency.

When a case of disease was assuming an unfavorable aspect, and when the question was mooted, "To whom shall we apply for further help?", it has, in a multitude of instances, been decided in my favor solely by the consideration that I would appoint the earliest hour for the meeting, and that I might be expected to appear within five minutes of the appointed time. . . .

I always endeavored to prevent changes of the medical attendants in a family unless in cases of obvious neglect or ignorance; and even then I never hinted at a substitute. If requested by a patient to recommend a surgeon, accoucheur, or apothecary, to attend in his family, I mentioned the names of three or four men of established character, and advised my patient to discuss their merits with his friends, and decide at his leisure. . . .

I was much employed in the families of my brethren. I found this a painful distinction. . . .

It must, however, be admitted that professional success, like every other good thing in this life, has in its nature many seeds of decay. The same circumstances which tended to bring the present favorite into general repute are probably already operating in behalf of his destined successor. Thus, the physician to whom his fellow-citizens award the possession of the most skill is generally called upon to assist when all assistance is too late, and sarcastic remarks tending to promote his downfall are made when the patient dies and becomes the subject of ephemeral talk.

Cheyne's writings are few. The most important, aside from his autobiography, is the article to which I have already referred, in which he described the arythmic breathing known as Cheyne-Stokes respiration. The following are his words:

For several days (the patient's) breathing was irregular; it would entirely cease for a quarter of a minute; then it would become perceptible, though very low; then by degrees it became heaving and quick; and then it would gradually cease again. This revolution in the state of his breathing occupied about a minute, during which there were about 30 acts of respiration. ("A Case of Apoplexy in which the Fleshy Part of the Heart was Converted into Fat," Dublin Hospital Reports, 1818, II, 216.)

At the end of his forty-ninth year he became affected with a species of nervous fever. He continued working until 1821, when failing health compelled him to give up work, at a time when his income had reached phenomenal proportions. He retired to Sherrington, a country village of England, devoting himself to a modicum of practice and a large amount of religious contemplation. He does not state the nature of his disease; but as he had a cataract and gangrene in the lower extremities, it is fair to infer that he had diabetes, possibly also arteriosclerosis.

I am at the end of my essay. The four men of whose lives I have told you something all had remarkable personalities, which would win renown for them if they were living today. Without the advantages of the microscope, the thermometer, the blood-counting apparatus, and the numberless devices that aid us in the diagnosis and treatment of disease, they accomplished a great

deal, enough to make them immortal, by the aid of their sense of touch and of hearing. Are we not making a mistake in our day by relying too much on instruments of precision? Can we not take a lesson from these men and train our powers of observation as they did? There are many undiscovered clinical facts—perhaps diseases—which another Graves and another Stokes, coming after us, will see. Then his contemporaries will wonder why we of the twentieth century were so blind.

THE DUBLIN MEDICAL SCHOOL AND ITS INFLUENCE UPON MEDICINE IN AMERICA[1]

The Irish, a mixture of primitive pre-Celtic peoples and of Goidelic Celts coming from the European continent, developed in the early Middle Ages, out of their own resources and untouched in any marked degree by the all-pervading influence of Rome, a remarkable indigenous culture. In particular they elaborated a native type of Christianity which with characteristic energy and wandering spirit they carried to Scotland, to Northern England—to Northumbria—to France, to Belgium, and to Switzerland. St. Columba, of Iona, and St. Columbanus, of Luxeuil, stand forth as the great militant missionaries of that first flowering period of Irish civilization. Although they and their successors had to succumb to the greater might of Latin Christianity,[2] they left dotted over Europe a number of large monasteries which became active centers of learning for the medieval world.

Unfortunately for civilization, the age of learning in Ireland was of short duration. I have not the time nor is this the place to discuss the causes for the decadence of Irish culture. Those who are interested will find a keen analysis of the factors involved in Henry Osborn Taylor's "The Medieval Mind" and in Oman's "History of England," Vols. I and II. Suffice it to say that for nearly 1100 years Ireland's influence upon European culture was negligible. Barring an occasional poet or essayist or a universal genius like Robert Boyle, Ireland did not produce a perpetuating body of learned men who made their influence felt beyond the confines of the Green Island.

Of the history of Irish medicine in the Middle Ages, little is known and the subject is largely an untilled field. Norman Moore (*St. Barth. Hosp. Rep.*, 1875, ii, 145) has resuscitated a few of the

[1] Read before the Section of Medical History of the College of Physicians of Philadelphia, November 30, 1921.

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[2] The chief contentions had to do with the method of determining the annual Easter festival and the mode of tonsure and a few other trivial differences. All were smoothed out eventually at the Synod of Whitby in 664.

original manuscripts in the Irish language. Most of them are translations from the works of Bernard de Gordon, especially from his "Lilium Medicinae"; of John of Gaddesden's "Rosa Anglica"; of the works of Avicenna, of Averroës, of Isaac, and of the Salernitan School. Much space is given to the writings of Isidorus. This Isidorus is the famous Spanish churchman, bishop of Seville, who not only was a master of theology but a writer upon every branch of knowledge of his day. The fourth chapter of the twenty making up his "Etymologiae," perhaps the earliest encyclopedia extant, deals with medicine.

In one of the manuscripts (Arundel, 333), the date of which is 1514, a number of ancient and medieval authors are cited, among them one Philaretus, of whom little is otherwise known. His treatise is on the pulse and is based upon the teachings of Galen on the same subject. Philaretus, however, describes only ten varieties of pulse, while Galen classifies twenty-seven different kinds as regards size and twenty-seven as regards rate. What a memory task for the student of medicine of early days!

It appears that in ancient Ireland physicians commanded a high respect; thus Diáncécht, who cured the wound of Naudhat after that chieftain had lost his hand in battle and provided him with a silver hand and thereby with a kingdom,[3] is said in the ancient law books to have given "judgments which were the first."

It is evident from the most cursory review of Irish history that the great Italian Renascence which fired the dormant mind of France and Germany and paved the way for the Elizabethan period in England, somehow failed to cross the Irish Sea. But eventually Ireland had a Renaissance which, though late, was noble. It began with medicine and spread to literature and physical science, indeed to all departments of learning. The revival, as far as it concerned medicine, was in every way remarkable and gave the Dublin Medical School in the first half of the nineteenth century a place of the highest importance and made of it a center whence the continent of Europe and the schools of this country drew inspiration.

We shall better understand the position of the Irish school if we review briefly the history of the medical schools in Europe. The first to emerge from the undifferentiated scholasticism of the Middle Ages was that of Salerno, whose influence, though short-lived, was enormous while it lasted. Montpellier took its place and is remembered among other things as the school where the great Sydenham studied. Next came the University of Paris and that of Padua; the latter, though not disputing even remotely the palm with Paris, was

[3] There was an ancient law in Ireland that a man who was not perfect could not be king.

nevertheless the alma mater of many great men. Paris from the time of that great Franciscan friar, Roger Bacon, of Albertus Magnus, and of Petrus Hispanus never lost its high place except during the delirious period of the French Revolution. The University of Leyden came next as a Mecca and then Vienna, which brings us down almost to the latter half of the eighteenth century.

About this time, the Edinburgh School emerged upon the horizon and became a steady beacon light, shining with special warmth upon the American Colonies and soon after upon the young independent nation. It is no part of my task to discuss at any length the influence of the Edinburgh School upon American medicine, and I am referring to it merely because it is closely connected in aim and spirit with the Dublin School; and also because, in the formative period of our national life, a greater influence was exerted upon medicine by Edinburgh than by any other place. In a very real sense, medical education in this country is a heritage from that of the Athens of the North. The period of Edinburgh's greatness coincides with the life of Cullen, the Monros, Drummond, Gregory, and the strange, enigmatic John Brown. As an index of the popularity of the Edinburgh Medical School, we have the fact that between 1768 and 1788, sixty-three Americans studied there. Curiously, only one of these came from New England (Alfred Stillé: "Life of John Dickinson," quoted by Packard: "History of Medicine in the United States," Philadelphia, 1901). A minor reason for the strong trend towards Edinburgh was that one could obtain there the degree of M.D., while London bestowed only that of M.B.[4] The preëminence of the Edinburgh School endured about seventy-five years; then it waned, partly from a cyclical decline in the greatness of its men, partly because of keen competition, mainly from two quarters, Paris and Dublin. Dublin's fame as a medical center was created by a few men, and had no continuity. With their death died its renown; yet although its life was short—a span of scarcely twenty years—it had an influence that endures in this country until the present day.

Three striking features characterize the early development of medicine in this country. The first is an instinct for travel, as indicated by the large number of doctors from the young country who went abroad to study. It would not be altogether to the advantage of American medicine if the habit of going abroad were to die out, as some ultra-patriotic citizens fondly hope; but even if the practice should become rare, there is no reason why

[4] It may be remembered that at first the University of Pennsylvania granted only the degree of M.B. in course, while Columbia University bestowed the more popular M.D. at graduation.

men should not go from one medical school to another in this country during their undergraduate years.

The second feature is the previously cited influence of the Edinburgh School. The Medical School of the University of Pennsylvania, the oldest in the United States, is the direct descendant of Edinburgh University, having been founded by John Morgan on his return from Edinburgh in 1765. Samuel Bard, the co-founder of the College of Physicians and Surgeons in New York, was likewise a student at Edinburgh.

The third feature is the early age at which men ripened into prominence and leadership. Not only was this true of medical men; it was also true of statesmen, scientists, and artists. One reason why men matured so much earlier in those days is because the institution of a rigid four years' college course had not yet attained the sanctity of a canon law or the inviolability of a constitutional enactment. Men's progress depended on their abilities, and not upon the accumulation of a certain number of units of credit.

The fame of the Irish School began at about the time when that of Edinburgh was beginning to wane. What made the School of Dublin suddenly great? It was principally the work of two men, Graves and Stokes, master and pupil, who are in a large measure responsible for the type of clinical teaching prevailing in this country today. I have elsewhere sketched the history of clinical teaching ("The History of Clinical Teaching," *Annals of Medical History*, 1920, ii, No. 2, 136-147); how slight and hesitating its beginning in 1574, in Italy; how, after a time, it disappeared completely; how, in this country, less than one hundred years ago, men were graduated without ever having examined a patient,—in proof whereof, I would refer you to that most fascinating of autobiographies, J. Marion Sims'.[5] As Graves states in one of his brilliant lectures, even in France at that time the teaching in the wards was expostulatory rather than practical, the professors indulging in long harangues to large groups of students. Only in Germany did Graves find the right method employed. He praises the gentleness and humanity of German physicians, who, not to shock the patient's sensibilities, would put unpleasant diagnoses in Latin; contrary to the practice in France of discussing in the vernacular the worst possibilities in the presence of the sick man or woman. He had little patience with his own countrymen, who had "one language for the rich, and one for the poor."

In their influence upon internal medicine in America, Graves

[5] See also "The Great Irish Clinicians of the Nineteenth Century." Johns Hopkins Hosp. Bull., 1913, Vol. XXIV, No. 270.

and Stokes compare with John Hunter and Astley Cooper in theirs upon surgery. To be sure, in making this statement, I do not intend to class Graves and Stokes with John Hunter, who through his genius and originality stands by himself as the sign of an era in the history of medical science.

Graves, whom Alfred Stillé classed among the great of the earth, was the son of a clergyman, and illustrates what I have said about early maturity. At the age of twenty-four, he delivered an introductory clinical lecture, in which he pointed out, as one writer says (Kirkpatrick: "History of Medical Schools in Trinity College, Dublin," 1912), those basic principles of medical education which were destined to change the clinical teaching, not only of the Dublin School, but of medical schools throughout the world. Under the old method, the majority of students never came in contact with the patients at all, but had to trust solely to their ears for information. This information was, until the year 1831—at least in Dun's Hospital—given in Latin; as Graves says, "I have called the language Latin in compliance with the generally received opinion of its nature."

It is an interesting commentary on medical examinations of the day of Graves that he states with such amazement ("System of Clinical Lectures," Graves and Gerhard, Third Edition, Philadelphia, 1848, p. 22) that it was not unusual for the Italian clinician, Tommasini, to spend more than two hours upon eight or ten cases. That was of course before history taking had become an art; before percussion and auscultation had been incorporated into the routine of physical examination; and before the laboratory had made a place for itself in medical practice.[6]

Graves, in the Meath Hospital, taught medicine at the bedside and gave the students themselves an opportunity to examine patients. Physical examination at that time had barely emerged from its age-old chrysalis. Percussion was still in the hands of the few, notwithstanding the fact that Auenbrugger's great discovery was more than fifty years old; and the translation of his book by Corvisart, the method's second father, about twenty. The stethoscope was looked upon by many as a toy; even as a harmful one, as is shown in Oliver Wendell Holmes's facetious poem, "The Stethoscope." As long as the advantages of percussion and auscultation were not realized, physical examination was considered of minor importance; and just as men today inveigh against the laboratory as stifling the older methods of careful physical exam-

[6] During the yellow fever epidemic in Philadelphia in 1793 Benjamin Rush saw from 100 to 120 patients a day, not to speak of those who stopped him on the street to seek advice.

ination, so men in the day of Graves and Stokes and of Gerhard and Jackson decried the Laënneckian method and that of Auenbrugger as threatening to cause a neglect of the study of symptoms.

Graves, as well as Stokes, of whom I shall speak more fully later, while not the first to make use of bedside teaching—Boerhaave had done it 100 years earlier—did it so consistently and so successfully that it was adopted by clinical teachers elsewhere and especially in this country where the lectures of Graves had been published in repeated editions and had been read with avidity. Moreover, the Americans who studied in Dublin brought back with them the methods of bedside teaching, to learn which had been, as Moreton Stillé states, their chief motive for going to Ireland.

It is hard to estimate the influence Graves exerted upon medicine in this country through the publication of his clinical lectures, many editions of which were brought out by Philadelphia publishers. Trousseau's comment on these lectures is such a remarkable tribute that it deserves to be quoted:

> For many years I have spoken well of Graves in my clinical lectures. I recommend the perusal of his work; I entreat those of my pupils who understand English to consider it as their breviary; I say and repeat that of all the practical works published in our time, I am acquainted with none more useful, more intellectual.

What clinician is living today of whom such words of praise may be spoken?

I shall not refer in detail to the specific contributions of Graves to medicine; his name is, of course, enshrined in Graves' disease, which is described in his "Clinical Lectures" (Philadelphia, 1838, p. 136), and in his "System of Medicine" (Philadelphia, 1848, p. 570). He points out clearly the goiter, the rapid heart, the exophthalmus, the lagophthalmus, and the nervousness.

Keen and penetrating as was the mind of Graves, he did not realize the imminence of great discoveries in the field of medicine; otherwise he would not have indulged in dangerous prophecy which led him to write as follows in the *Dublin Journal of Medical Sciences*, vii, 136:

> It is true that we are—and I fear shall ever remain—ignorant of this poison (of fever). We know just as much of the nature of the febrile miasm or the virus of syphilis as was known in the very infancy of medical science; the mode in which either acts still continues among the impenetrable arcana of nature. All we can do is to observe their effects, and, from them, draw practical conclusions which may be rendered available to treatment; to study their phenomena with attention, and to employ such remedies as observation and experience have proved to be most applicable, without expecting to be able to explain their effects in the majority of instances.

Fever is, in a strict sense of the word, a general disease; and there is, in the case of a fever patient, no one point on which the physician can lay his hand and say, "Here is the local habitation of the disease; if I can succeed in removing this, I am certain of success."

Little did he think that on the Continent Henle's scientific imagination was dreaming of a *contagium vivum*; that Virchow was patiently and quietly elaborating his revolutionary theories of cellular pathology; and that the anthrax bacillus was nearly ready to have itself discovered.

Graves' share in the differentiation of typhus and typhoid fever is, in a sense, passive and indirect. There was apparently little typhoid fever in Ireland, so that his experience was limited largely to typhus. Yet he must have seen typhoid fever on the Continent. Moreover, it is highly probable that cases of the disease came to the Meath Hospital but Graves, believing firmly in the essentiality of fever and looking upon fever as a disease entity, did not make the distinction drawn by others.[7]

The first to draw attention to the radical differences between typhus and typhoid was H. C. Lombard, a physician of Geneva. In two famous letters dated June 13 and July 18, 1836 (*Dublin J. M. Sc.*, 1839, Vol. XIV), Lombard pointed out the pathological and clinical differences of the two diseases. His letters apparently made very little impression in Europe, and it was left for W. W. Gerhard, of Philadelphia, to establish the differences for all time. Although Gerhard was never in Ireland, he was thoroughly familiar with Graves' description of typhus fever and used that description, as well as an experience with a few cases seen in Scotland, as the primary basis for his work. Graves, though not appreciating the full value of Gerhard's signal contribution, reciprocated, as did the other members of the Irish School, the good will of the American clinicians. When Gerhard published a description of typhus fever as he had observed it at Blockley, Graves at once accepted it as an accurate description of the same disease prevailing in England and Ireland. Gerhard delivered his lecture at the Philadelphia Hospital and published it in the first number of the *Medical Examiner*, a Philadelphia publication of ephemeral existence (Stewardson, *Transactions of the College of Physicians*, 1863-1874, IV, 473).

Stokes (1804-1878) although younger than Graves, was even more conservative—probably because he came of a long line of eminently respectable ancestors. His father, Whitley Stokes, was Regius Professor of Medicine in Dublin for many years and a dis-

[7] "In the whole range of human maladies, there is no disease of such surpassing interest and importance as fever." "Clinical Lectures," edited by Dunglison, Philadelphia, 1858, p. 254.

tinguished scholar in various fields. Though Stokes outlived Graves by many years, he never gave up his belief in the unity of fever—in fever as a disease with different forms of anatomic manifestations. Only one who deliberately shut his eyes to the evidence could maintain such an outworn creed.

The relation between Graves and Stokes was admirable, and helped to strengthen their influence upon their immediate pupils and upon the world at large. Whenever an important issue arose, as, for instance, the defense of stethoscopic auscultation, they entered the lists together, neither jealous of the other. They must be credited in a large measure with popularizing the use of the stethoscope in this country as well as in Great Britain. The opposition to this instrument was more intense than anyone of the present day can conceive. Indeed, the attacks made by some contemporaries of our own upon the laboratory are but a feeble echo of the antistethoscopic storm.

As an illustration of the attitude, in the year 1838, of Graves and Stokes, and a now forgotten writer named Clutterbuck, I will quote the following letter published by the two Irishmen in the *Dublin Journal of Medical Sciences*, 1839, XIV, 138:

Dr. Clutterbuck versus the Stethoscope. Dr. Hope, on Auscultation in Valvular Disease. In the heading of this notice, we have connected the names of the above gentlemen; because, although they are in no way related as authors or colleagues, they have (no doubt, unwittingly) joined to injure the cause of auscultation and of science in their late publications; the one, by attempting to detract from its value; the other, by ascribing to it powers which it does not possess. In the *London Medical Gazette*, for July 28, 1838, we have a lecture of Dr. Clutterbuck on the Treatment of Periodical Asthma and on Blood-Letting in Specific Inflammations of the Chest. In this lecture this irritable effusion appears:

"I may take this opportunity of advertising to the method of investigating diseases of the thorax by auscultation; that is, by listening attentively to the sounds emitted during respiration and also by sounding the cavity by tapping with the ends of the fingers on different parts of the chest. This mode of examination has always been resorted to more or less by physicians; though, from the employment of a load of new terms invented chiefly by our ingenious neighbors, the French, and introduced by some of our own practitioners, who have enjoyed the advantages of the Parisian schools, one would be led to suppose that a new region of science had been discovered, not inferior to mesmerism or homeopathy. As a specimen of the new language introduced on the occasion, I may enumerate the following, indicating, it is supposed, as many various conditions of the organs in question. Thus, in the compass of a few pages, you will meet with the following: Pectoriloquy, perfect and imperfect; bronchophony; pneumothorax; rhonchus; crepitation, fine and coarse; vocal resonance; tinkling echo; metallic tinkling; amphoric, or bottle-like, sound; clicking; bubbling; gurgling; snuffling; whiffs of a cavernous respiration, fistular resonance, like

that of a pan-pipe or key; pectoriloquy, forming a little island of voice; *cum multis allis.*"

Dr. Clutterbuck seeks to destroy the fame of Laënnec by the worn-out system of denying his originality. Can he point out a single author who used auscultation as Laënnec did, from the time of Hippocrates to the discovery of the stethoscope? He cannot. He is strangely ignorant, when, combining the modes of auscultation and percussion, he states that "this mode has always been resorted to by physicians"; and his joke about auscultation as equal to mesmerism and homeopathy comes with bad grace from one himself the author of an unphilosophical and exploded theory of fever.

But Dr. Clutterbuck is an auscultator. He can tell by "the tone of the cough, whether there is not a great cavity in the lungs, the result of suppuration or ulceration." He can tell with "tolerable precision whether a quantity of mucus lies lose and flooding, as it were, in the air tubes!" He can judge of the state of the larynx by the sound of the voice; and ascertain whether the lungs are pervious to air. His powers of diagnosis are certainly great; his power in chest disease must be equally valuable.

We suspect Dr. Clutterbuck's sense of hearing must be injured; for to him, the "ear-trumpet" magnifies, but distorts the sound, rendering it less distinct than before. He holds that it may be classed with the telescope and the microscope, and includes all three in his anathema, and he adds that "the information thus acquired, supposing it to be correct, comes too late, in general, to be of any practical use. It serves to indicate the consequences of disease, rather than disease itself; and that, at period when they are far beyond the power of art to remedy."

It is not true that auscultation only detects fully formed diseases. Its chief value is the facility with which it enables us to recognize the true nature of pleurisy and pneumonia, often a few hours after they have commenced; and consequently, at a time when the knowledge thus obtained leads to the almost instant arrest and cure of the disease.

We would ask Dr. Clutterbuck whether it is of no practical use to discover an apyrexial hepatization; to distinguish between this and a circumscribed pleuritic effusion? to discover whether, in a case of laryngeal disease, the lungs are healthy or diseased? to distinguish between an empyema with or without a pulmonary fistula? to detect a foreign body fixed in the bronchus? to distinguish, in a case of stridulous breathing, where tracheotomy is apparently called for, between tracheal disease and the pressure of an intrathoracic tumor? to detect the existence of effusion into the pericardium? or to discover latent disease of the mucous membrane, parenchyma, or serous structures in a case of typhus fever? We might add an hundred more of such instances.

Let us be clearly understood. We write these remarks for the junior student, who might be deterred from studying an important and now indispensable part of his profession by the statements above quoted. We seek not controversy with Dr. Clutterbuck. His opinions can only affect the uninformed.

In the next number, Dr. Hope, of whom we wish to speak with the respect which his labors have earned for him, has authorized the publication of a series of diagnoses made by his pupils after a ten minutes' lecture on the most difficult part of medicine, namely, the valvular diseases of the heart. The pupils were inexperienced and, as far as we can learn, availed

themselves solely of physical diagnosis. Their conclusions in thirteen out of fifteen cases were correct; "although they had, amongst others, to deal with the rare diseases of the pulmonic orifice."

That the pupils, after having been instructed in Dr. Hope's views of the causes and situations of valvular murmurs, should have come to conclusions such as he would have done, is not wonderful; but that these conclusions were correct, we have only Dr. Hope's word for. We shall not examine into the evidence of the conclusions, for we know it to be insufficient; but we object to the whole proceeding as calculated to revive the often repeated and refuted objection to the advocates of auscultation, that they neglect the history of the case and vital phenomena. The following considerations, we wish to impress on the pupils of the Meath Hospital:

First, that the physical signs of valvular disease are not yet fully established; second, that taken alone, they are in no case sufficient for diagnosis; third, that even in organic diseases, the nature and situation of murmurs may vary in the course of a few days; fourth, that all varieties of valvular murmurs may occur without organic disease; fifth, and last, that organic disease of the valves may exist to a very great degree without any murmur whatsoever. Of this assertion, we shall hereafter bring abundant proofs. R. J. Graves and W. Stokes.

All this is admirable and good advice at the present day.

Stokes had already published a small octavo volume of 239 pages, entitled "An Introduction to the Use of the Stethoscope, with Its Application to the Diagnosis of Diseases of the Thoracic Viscera, Including the Pathology of these Various Affections." He was only twenty-one at the time—another illustration of early maturity. This is the first work on the subject in the English language; for it he received the respectable sum of £70.

While Stokes' name will be forever remembered in connection with Adams-Stokes disease and Cheyne-Stokes breathing, his contributions to medicine are greater than is indicated by the two conditions to which his name is attached. For the English-speaking world, at least, he helped to carry on the work of Graves and to give physical diagnosis the place that it deserves in clinical medicine. This he did through his direct teaching, and also through his magnificent work on "Diseases of the Chest and Aorta," which, for its wealth of observation, its clarity and accuracy of description constitutes a classic in medical literature. It was translated into German soon after its appearance, the translator, Gerhard von dem Busch, speaking of it as follows:

Since the publication of Laënnec's great work, which formed an epoch in medical history, many valuable treatises have appeared in France and England on the same subject, but none of them can bear comparison with that which has lately emanated from the pen of Dr. William Stokes, of Dublin.

All in all, Stokes must be looked upon as a pioneer in clinical

teaching, and the second great cardiologist in the history of medicine, Corvisart being the first.

In yet another direction was the Dublin School a pattern for America. The first Pathological Society in the English-speaking world was established at Dublin in 1838, with Graves as its first President. The following year, and probably as a direct consequence of Dublin's example, a Pathological Society was organized in Philadelphia. This is not the one now existing, which was not born until 1857. On some other occasion, I hope to give an account of the earlier society, of the existence of which I was ignorant until some years ago I found it mentioned by Pennock in his edition of the works of James Hope, and was led to trace its short career through the medical journals and other publications of the day.

I have said nothing, so far, of Corrigan and of Cheyne, who are also luminaries in the Irish galaxy, but who do not rank with Graves and Stokes in influence upon American medicine. Both were unusual men, nevertheless. Corrigan, by his article on "Permanent Patency of the Aortic Valves" (*Edinb. M. J.*, 1832) has given us an example of a classical essay produced by a man who had a hospital of but six beds to supply him with the necessary material. Although not the first to describe this disease,—the French claim that honor for Vieussens; the English, for Cowper or Hodgson,—his account is by far the best; and justice is not violated by preserving his name in connection with the disease. Corrigan also gave the first description of chronic fibrosis of the lung, which he called cirrhosis, in analogy to Laënnec's cirrhosis of the liver, preferring, as he said, to "add an additional fact, rather than a new name, to our science."

Of Cheyne—he of Cheyne-Stokes breathing—little need be said with respect to the relation of Irish to American medicine. He was a good observer, but preferred a large and lucrative practice to teaching and medical writing. In consequence, he had an extraordinary income during the most active ten years of his life. Then he broke down physically, and apparently mentally, giving himself over to fantastic religious and philosophical speculations.

Much might be written of the Dublin surgeons during the Golden Age of Irish Medicine—of Colles; of Adams; of Carmichael; of Macartney; of William Wallace, who introduced the use of potassium iodide in syphilis; and of Francis Rynd, who first employed hypodermic injections for the relief of pain, using the gravity method. They were all conspicuous men, but of less direct influence upon teaching and practice in this country than their more highly gifted medical contemporaries.

Many Americans must have gone to Dublin to sit at the feet of Graves and Stokes; but although I have searched diligently, I have found definite records of only four. I am speaking, of course, of the formative period of medicine in this country. In later times, the Rotunda Hospital has probably attracted a goodly number, more for the sake of gaining a wider experience than for the purpose of getting inspiration.

The first to visit Dublin was apparently John Y. Bassett (1804-1851), of Huntsville, Alabama, whom Osler, in one of his most charming essays, has rescued from oblivion as the "Alabama Student." Bassett was a rare personality—fearless, intelligent, philosophical—who must have had a powerful influence upon his contemporaries, but who died too young and wrote too little to have made a permanent impression upon American medicine. He went to Europe in 1836, visiting Edinburgh, Glasgow, Belfast and Dublin, where he must have come under the influence of Graves and Stokes, and where it appears he thoroughly enjoyed himself. After leaving Dublin he spent two miserable weeks in London, made miserable by the atrocious weather. The fortnight ended, he "shook the mud of England from his feet at Dover, and departed, hoping never to be soiled with it again." He went to Paris, and although he does not mention it, probably attended classes at La Pitié with Bowditch, Jackson, Oliver Wendell Holmes, Shattuck, Gerhard, and Stillé.

It is regrettable that we know so little of Bassett. His wonderful "Credo," one of the finest things of its kind in medical literature, stamps him as a man of the loftiest ideals. This "Credo" deserves to be quoted:

> I do not say that the study of nature, human and comparative, as far as it relates to medicine, is an easy task. Let anyone undertake a foreign language, and, when he thinks he has mastered it, let him go into its native country and attempt to use it among the polite and well-informed. If he succeed, let him go among the illiterate and rude, where slang is current; into the lunatic sylum, where the vernacular is babbled in broken sentences in the mouth of an idiot, and attempt to understand this. Should he again succeed, he may safely say that he knows that language. Let him then set down and calculate the cost in labor, time and talent; then square this amount, and go boldly into the study of physiology; and when he has exhausted his program, he will find himself humbly knocking at the door of the temple, and it will be opened. For diligence, like the vinegar of Hannibal, will make a way through frozen Alps. It is the "Open Sesame" of our profession. When he is satisfied with the beautiful proportions of the interior, its vast and various dimensions, the intricate and astounding action of its machinery, obeying laws of a singular stability, whose very conflict produces harmony under the government of secondary laws—

if there be any secondary in nature!—when he is satisfied (and such are not satisfied until informed), he will be let to his ultimate object, to take his last lesson from the poor and suffering, the fevered and phrenzied, from the Jobs and Lazaruses,—into the pest-houses and prisons, and here, in these magazines of misery and contagion, these Babels of disease and sin, he must not only take up his abode, but following the example of his Divine Master, he must love to dwell there;—this is pathology.

When such an one reenters the world, he is a physician. His vast labors have not only taught him how little he knows, but that he knows this little well. Conscious of this virtue, he feels no necessity of trumpeting his professional acquirements abroad; but, with becoming modesty and true dignity, which constitute genuine professional pride, he leaves this to the good sense of his fellow citizens to discover.

Many of us fail because "the world is too much with us." For the lonely "Alabama Student," this was evidently not the case. Writing in April, 1851, shortly before his death, he says: "This world has never occupied a very large share of my attention or love. I have asked but little of it, and got very little of what I asked." He died at forty-six, his work and mission unfulfilled, but assured of perpetual renown through the labor of love of Osler's understanding spirit.

Perhaps no one was more influenced by his Dublin teachers than Alfred Stillé, the last representative of a vanishing epoch whom I have seen with my own eyes. Born in Philadelphia in 1815, of Swedish ancestry, he was graduated from the University of Pennsylvania, and had the good fortune (the best of luck, Osler says) to become House Surgeon at Blockley under W. W. Gerhard. He also studied with Pennock, a man whom he found of finer character, though possibly less intellectual, than Gerhard. Under these two physicians, Stillé saw typhus in Blockley. Afterwards he made a special study of typhoid fever in the wards of Louis, of Paris, and had the opportunity, also, of observing typhus with Vulpes in Naples, Tweedie in London, Allison in Edinburgh, and Graves in Dublin. Graves made a profound impression upon him, and no doubt helped to determine his future career, sharing this influence in some degree with that idol of American students—Louis, of Paris. Stillé's writings contributed to make Gerhard's differentiation between typhus and typhoid accepted in Europe. Probably his greatest work is his essay on "Cerebrospinal Fever," based on the study of a virulent epidemic at Blockley Hospital.

Another worshipper at the Dublin shrine was Moreton Stillé, brother of Alfred, who, in the tragic unfulfillment of his ambition and in his early death, reminds one of John Y. Bassett. On starting for Europe he wrote:

I go abroad with a determination, made neither hastily nor without reflection, to be up and doing, and to profit by the privilege I enjoy to the utmost. If I know myself, I shall not be content with a place in the crowded middle ranks of the profession.

His plans were to pass some time in Dublin, that he might avail himself of the numerous advantages it then offered to the medical student; but more especially to improve himself in physical diagnosis, "for the cultivation of which many of its teachers were justly celebrated." The remainder of his time abroad, he expected to pass principally at Paris. Unforeseen circumstances evidently caused him to modify his plans, for his last winter was spent in Vienna.

After a winter in Dublin, Dr. Stillé repaired to London. His time had been so profitably and pleasantly spent in the former city that he left it with much regret. The circle of society into which he was admitted was not only refined and intellectual, but, for one constituted as he was, possessed even a higher attraction in the ease and informality of its intercourse. He had also become acquainted with several of its most distinguished physicians, among whom were Drs. Stokes, Graves, Churchill, Hamilton, Law and McDonnell, from all of whom he received many civilities and attentions. He was in particular treated with marked kindness by Stokes, who evidently appreciated his good sense and the earnestness with which he devoted himself to his studies. In his last letter from Dublin, he mentions with pride that for two of his most precious and flattering letters of introduction to Dr. Todd, of London, and Louis, of Paris, he was indebted to Dr. Stokes.

He had been greatly attached to Stokes, in whose society he was much thrown from his daily attendance at the hospital; in his correspondence he gives frequent utterance to an enthusiastic admiration of that great physician's character.

In June, 1849, cholera broke out in the Philadelphia Almshouse —that is, in Blockley. The care of the patients was at first undertaken by the resident physicians; but the number of sick so rapidly increased that it was considered necessary by the Poor Guardians to institute a separate cholera service. To this, Dr. Moreton Stillé and Dr. Edward R. Mayer were appointed in connection with the Medical Board, consisting of the Chief Resident Physician, Dr. Benedict, and the Consulting Physicians of the Hospital, Dr. Page and Dr. Clymer. Ten days after the commencement of his duties, Stillé was himself attacked by cholera and narrowly escaped with his life.

Moreton Stillé's fame rests chiefly on his book, "Medical Jurisprudence," written in collaboration with Francis Wharton. It is the first American work on this subject.

In practice, Stillé failed of the success that it was his ambition to achieve; he died, a rather disappointed man, at the early age of thirty-three. His older brother outlived him nearly forty years.

Meredith Clymer, the fourth of the Dublin students, although born in England, was the grandson of George Clymer, one of the Signers of the Declaration of Independence. He was graduated from the University of Pennsylvania in 1837, at the age of twenty-one, and studied in Europe, at London, Paris and Dublin, from 1839 to 1841. Besides filling several teaching positions in Philadelphia, he was physician to the Philadelphia Hospital from 1843 to 1846, and Consulting Physician until 1852. As an index of his early ripening, I may make mention of the fact that he was Editor of the *Medical Examiner* of Philadelphia in 1838, at the age of twenty-one. He resumed the editorship in 1843, on his return from Europe. He was one of the pioneer neurologists of this country, and after removing to New York, limited his practice to nervous and mental diseases. After a very active career as a practitioner and as a writer, he died in New York in 1902.

And now summing up in conclusion the influence of the Dublin School of Medicine upon medicine in America, we find that it was exerted in two ways: (a) through the direct contact of the great Irish teachers with American pupils, walking the wards of the Meath Hospital and Sir Patrick Dun's Hospital with them; (b) through the extraordinarily able books and articles from the pens of the Irish masters.

As to the result, it manifested itself primarily in the methods of clinical teaching. The practice of Graves and Stokes of having the students examine and follow the cases in the hospital became the American method. It is the one obtaining everywhere in this country today. Incidentally the Irish School contributed to the popularization of the new methods of physical diagnosis, percussion and mediate auscultation—methods brought back to this country in the main from Paris by a group of brilliant young men from Boston and Philadelphia. It is quite probable that the earliest and strongest interest in the use of the stethoscope in this country was aroused by the famous essay of Stokes.

In the vivid consciousness of our obligations to Edinburgh, to London, to Paris, to Vienna and to Berlin, let us not forget the more modest, yet important debt we owe to Dublin.

THE RISE AND EARLY HISTORY OF CLINICAL TEACHING[1]

The history of medicine is in a sense the history of civilization. Among a given people, ancient or modern, the state of medicine is as much an index of its culture as are its art and its literature. The world is, however, too busy to study medical history in order to find out what level a nation has attained at any particular time. This applies not only to the non-medical world but also to medical men themselves. Only a few have an interest in the history of their calling; and yet nothing is more instructive or inspiring, whether viewed from the narrower standpoint of the physician or from the broader one of the student of the race, than is the development of medicine throughout the ages. At the present day the lay public knows a great deal about medicines, but very little about medicine. If the people knew more concerning it they would have a greater respect for what medicine has accomplished.

From the vast and inexhaustible mine of the history of medicine I have extracted a single chapter, in itself large and fascinating, yet, strange as it may seem, few have written upon it. There are tomes upon tomes of medical history, some dealing with the doctrines and practices in vogue at different epochs or periods—Hindoo, Greek, Egyptian, Arabic, Talmudic medicine, for example. Few, however, concern themselves with the history of medical teaching, with the ways in which the accumulated knowledge has been transmitted from generation to generation. It is a consideration of that phase of medical history that I have made my task in this essay.

The medical students of today, who are virtually living in the wards of hospitals for the greater part of their last year in medicine, and in that way coming into direct personal contact with patients, cannot realize what the teaching of medicine was a few generations ago. In my student days we saw only a few medical cases close at hand. Most of them were seen from the benches in the amphitheater and I do not think that we ever had an opportunity of making a complete physical examination of a single

[1] Reprinted from the Summer, 1919, issue of the Annals of Medical History, Vol. II, No. 2, pp. 136-147.

patient. Yet we were better off than the men who were our teachers; and if we go back but a little farther, we come to a time when there were no clinical facilities whatever. J. Marion Sims was graduated in Philadelphia in 1835 and immediately went to his home in South Carolina to practise. His sign, which was a very big one, had not been out long before he was called on to treat a child of the leading citizen of the town. He had never until then been in contact with a patient and had never made a physical examination. In consequence, he felt himself helpless, and when the child died he was profoundly depressed. Then when a second child in the same family died shortly afterward under his ministrations, he quietly took down his sign, dropped it into a well, and migrated to Alabama. Fortunately for American surgery he did not carry out his intention of giving up the practice of medicine for good.

The first teacher of medicine was necessity. When primitive man received a wound during the chase or in combat, another member of his tribe or of his family applied soothing herbs, the virtues of which he knew as the result of some happy accident. After having obtained success with this treatment, he would initiate his son or some one else into the secret of the preparation and use of the soothing lotion. Thus arose surgery. In the case of internal diseases, and especially those of epidemic character, the causes of which were to him unfathomable and mysterious, man sought the help of his gods and naturally applied to those who knew the wishes of the gods, the priests. These tried to appease the wrathful deity with prayers and incantations—a survival of which we see today in public prayers for the sick. The priests were always the ablest and shrewdest men in the community and by experience through the ages gained considerable practical knowledge in the treatment of disease. In that way there came to be added to the religious ceremonies methods of therapy of more or less value. The religious practices and therapeutic methods were handed down in the priestly castes by oral tradition.

Among the Greeks, however, the priesthood never had a very strong influence; and the practice of medicine was rather a secret in certain families or social groups. The first teacher of medicine among the Greeks was the legendary Esculapius, who taught his son Machaon to bind up the wounds of the Trojan warriors, and his other son, Podalirius, to attend to their internal ills.

Eventually the common experience of the medical families was written down; and a study of the written works was added to oral tradition. The actual teaching was carried out in the so-called

iatria, which may be compared to our out-patient departments or dispensaries, and which were usually built in close proximity to an Esculapian temple. In the *iatria,* the physician received and examined the patients, prescribed and distributed medicines, performed surgical operations and gave instruction to pupils. The most famous *iatria,* or schools, were those of Cnidos and of Cos. The latter was the birth place of Hippocrates, under whom, at about 400 B.C., Greek medicine reached its zenith. As teachers of medicine Hippocrates and his contemporaries, for the most part unknown to us, were not excelled for a thousand years; indeed, for nearly two thousand.

Hippocrates was a wonderful observer and impressed upon his disciples the importance of bedside observation. In a sense, physical diagnosis originated with him; for he discovered the succussion splash, pleural friction and pulmonary rales. He advised that in order to hear these sounds the ear be laid upon the chest for a considerable length of time. This is the earliest mention of auscultation. The Hippocratic School also tested the temperature of the body with the hand, and by palpation determined the boundaries of the liver and spleen. It is scarcely believable, and yet it is a fact, that fifteen hundred years later these simple but valuable physical methods were thought to be of no importance and were scarcely taught anywhere.

After Alexander the Great's time, Alexandria became the center of Greek life and medical teaching. Under Herophilus and Erasistratus, the Alexandrian School attained great fame, so that it was a distinction to any physician to be able to say that he had studied at Alexandria.

Among the Egyptians, from whom the Greeks undoubtedly derived some of their knowledge, medicine was in the hands of the priests, who controlled all the learned occupations. The foundations of instruction were the Holy Books in which all Egyptian knowledge was contained. These books were an encyclopedic work of forty-two parts, of which the last six were devoted to medicine. The first of these treated of anatomy; the second, of diseases; the third, of surgery; the fourth, of drugs; the fifth, of diseases of the eye; and the sixth, of diseases of women. Only fragments have come down to us. They are contained in the "Book of the Dead," and in the "Ebers Papyrus." There are medical allusions in the cuneiform inscriptions of the Babylonians and the Assyrians; but in so far as they have been deciphered, they tell us little about the teaching of medicine, and are chiefly formulas or, as in the Code of Hammurabi, tables of fees and penalties.

Among the Hindus, the teaching of medicine early reached a high plane; and the Yajur Veda, in the Commentaries of Charaka and Suśruta, contains explicit instructions as to the education of the physician. Suśruta recommends to the student of medicine both theoretical and practical training. "He who is only theoretically educated," says Suśruta, "and is inexperienced in the details of practical treatment, does not know what he should do when he receives a patient, and conducts himself as foolishly as a coward on the battle-field. On the other hand, a physician who is educated practically and not theoretically lacks the esteem of better men." This reminds one of the dictum of Osler, "to study the phenomena of disease without books is to sail on an uncharted sea, while to study books without patients is not to go to sea at all." The Hindoo teacher was therefore advised to instruct his pupils in the use of salves and remedies, in the performance of surgical operations and in general medical practice, "since through hearing lectures no one can become proficient in the medical calling." Suśruta taught that the sweet taste of urine was a sign of disease. He advised that a thorough history be taken of every patient, saying that the patient should be asked where he lives, the season of the year in which his trouble arose, his position, his affairs, the nature of his pain, his general strength, appetite, and the duration of his illness. Operations were taught on inanimate objects. No physician was allowed to have more than five or six pupils.

Hospitals existed in India not alone for human beings, but even for animals as early as 300 B.C. (There is one known to have existed on the island of Ceylon in the fifth century B.C.) In view of the fact that the study of anatomy was totally neglected it is remarkable that Indian medicine was able to reach such a high plane. This is one of the riddles of medical history.

Among the Romans, medicine was on a much lower level than among the Greeks. Sacrifices, magic formulas and oracles were supposed to cure disease. A few curative herbs were employed. As stated by Seneca: "Medicina quondam paucarum fuit scientia herbarum quibus sisteretur fluens sanguis, vulnera coirent" (Medicine was the science of a few herbs by means of which the flowing blood was staunched and wounds were united. Epis. 95).

Under the Greek influence, a higher type of medical practice gradually came into vogue; yet medicine was for a long time looked upon as a despised trade. The Roman nobles had it taught to their slaves; or sometimes, as in the case of M. Portius Cato, they acquired it themselves in order that they might teach it to their slaves and keep a watch over the health of their own families. But

with the tremendous political and social development of imperial Rome, medicine could not long remain patriarchal. Probably the constant foreign wars, requiring the services of skilled physicians, helped to bring about the downfall of the patriarchal system. For a long time, however, medicine remained a private matter or a free trade that could be followed by anyone. Under Alexander Severus, special auditoriums were assigned to medical teachers, in return for which they had to instruct poor students free of charge. It is probable that the *valetudinaria* which rich Romans established for their slaves were used for medical instruction. That this instruction had a decidedly modern aspect is shown in a sort of novel by Philostratus, in which mention is made of two physicians who visited the sick accompanied by thirty pupils. Such visits were made in large consultation rooms, called *tabernæ medicinæ*, or simply *medicinæ*. As a further evidence that clinical teaching similar to our ward visits existed, we have the famous lines of Martial (Epigr. V. 9):

> Languebam, sed tu comitatus protinus ad me
> Venisti centum, Symmache, discipulis,
> Centum me tetigere manus aquilone gelatæ,
> Nec habui febrem; Symmache, nunc habeo.
>
> I'm out of sorts, but Symmachus is here,
> His hundred pupils following in the rear;
> All feel my pulse with hands as cold as snow,
> I had no fever then—I have it now.

After the fall of the Roman Empire we find the teaching of medicine conducted like the apprenticeship of a trade. A youth who wanted to become a physician would attach himself to a friendly practitioner, much as in the preceptorial system. This arrangement in a modified form lasted until about twenty-five years ago.

With the spread of Christianity and the establishment of hospitals by the ecclesiastical orders, medical practice, to a large extent fell again into the hands of the priests, particularly the Benedictines, who according to Puccinotti were the first in the Middle Ages to give clinical and didactic instruction. It seems also that in the time of Charlemagne, 764-814, the teaching of medicine received some attention at his court; few data, however, have come down to us regarding this school.

When celibacy became a law among ecclesiastics, priests were forbidden to practice surgery and to treat diseases of women.[2]

[2] It appears that for a time celibacy was enforced among physicians also. At any rate, in 1452, Cardinal d'Estouteville, charged by Pope Nicholas V. with the reorganization of the University of Paris, obtained the suppression of celibacy "as an impious and unreasonable thing for a doctor." (Supoy, "Le moyen âge médicale," p. 27.)

Among the Arabs at this time, medicine was at a very high level. They had hospitals with vast numbers of students, who were instructed both practically and theoretically. There were hospitals at Damascus, Bagdad, Cairo, and probably elsewhere, in Europe and Northern Africa, wherever the Saracens had gained a strong foothold. Yet progress under the Arabs was not so great as it might have been, despite clinical teaching in the hospitals, for the reason that dissection was indirectly forbidden by the tenets of the Koran, a corpse being "unclean."

The first real progress in medical teaching after this time is coincident with the rise of the great University of Salerno, the origin of which is shrouded in obscurity, although, according to some of the Italian historians (as for example, Puccinotti: "Storia della medicina," vol. II, part 1, p. 247, "La Scuola detta Salernitane é benedettina e Cassinense di origine"), it is the offspring of the Benedictine monastery of Monte Cassino.[3] Since Charlemagne is known to have been interested in it (Ravon: "La France médicale," 1902, p. 409), its origin certainly dates back to the eighth century. Its medical faculty was composed of Greek, Italian, Jewish, and Arabic physicians, so that almost anyone could there study medicine in his own language. It was unusually free from ecclesiastical influence; the professors were married. Strange as it may seem, some of the lectureships were held by women, usually the wives or daughters of professors. Abella wrote: "De atro bilo et de natura seminis humani"; another, the famous Trotula, published a work on diseases of women entitled, "De mulierum passionibus ante, in et post partum"; and Rebecca, one on fevers, urines and the embryo.

The school received a great impetus through the Crusades, and many a wounded and sick Crusader as, for example, Robert of Normandy, son of William the Conqueror, was treated there. Clinical instruction must have been carried out at Salerno, although details are meager. We do know, however, that special attention was paid to dietetics. Under the great emperor Frederick II, in versatility and in ruthlessness not unlike the last of the Hohenzollerns and like him of Swabian blood, the medical school at Salerno in 1213 grew into a complete university. It is a fact worthy of note that the two great Continental universities of the Middle Ages, Salerno and Montpellier, arose out of medical schools. Frederick also gave to the Salernitan school an excellent code of laws and a curriculum. Three years had to be devoted to philosophy, and five

[3] Daremberg ("Histoire des Sciences Médicales," Tome I, p. 259) denies that the medical school of Salerno originated from the Benedictines, the Arabs, or the Jews, and holds that it is Neo-Latin or Greco-Latin in origin.

to medicine, with examinations at the end. Just as in Pennsylvania at the present time, this university examination did not *per se* confer the right to practice, the young physician had to associate himself for one year with an older practitioner—a custom similar to our hospital year.

I have just spoken of Montpellier, which is of particular interest to us, as the great Sydenham studied there. Montpellier was founded under the influence of the Saracens, who came from neighboring Spain. In 1137, the medical school had its own building. Its fame really begins with the advent of Solomon Matthæus from Salerno in the twelfth century. In 1220, Cardinal Conrad,[4] a German, demanded that everyone who intended to teach there must pass an examination. Pope Clement V, in 1308, established the rule that medical students must hear lectures for five years and during eight months, or two summers must attend a physician in medical practice. An intense rivalry existed between the University of Montpellier and the University of Paris. This rivalry was probably good for medical teaching; its bitterness is well illustrated in some of the Latin verses of Gilles de Corbeil, the great medical teacher of Paris in the thirteenth century. (Vieillard: *La France médicale,* 1902, p. 397.)

Under the corroding taint of scholasticism, both the University of Salerno and that of Montpellier rapidly deteriorated; the latter suffering eclipse through the growing fame of the University of Paris. In the seventeenth century, Montpellier experienced a temporary revival through the fame of Charles Barbeyrac (1629-1699), called the Hippocrates of Languedoc, who is remembered as one of Sydenham's teachers.

It seems that after the decline of the schools of Salerno and Montpellier, and at a time when learning in general was beginning to reanimate the world, in preparation for the coming of the Renaissance, medical teaching ebbed to almost the lowest possible point. Instruction degenerated into dialectical discussions and hairsplitting arguments based chiefly on the writings of Hippocrates and Galen. Even the great Rabelais was roused to wrath by the medical teaching of his day, which was "toute livresque." (Ledouble: *La France médicale,* 1907, p. 207.) There is extant a program of lectures in medicine at the University of Heidelberg

[4] It may not be without interest to quote a statute of this Cardinal dated 1220 regarding the University of Montpellier. It is a medieval example of the black list: "If a professor is in litigation with one of his pupils with respect to his salary or for any other reason, no other professor shall knowingly receive this pupil until he has given or promised satisfaction to his former master." The same statute forbids sordid competition among the professors: "No teacher shall attract to himself the disciple of another teacher, in order to take him away, by solicitation, present or any other means whatsoever."

for the year 1569. Professor Curio lectured on "De generibus morborum" of Galen, and explained "De morborum signis" of Hippocrates. Professor Erastus did not lecture, because he had gone to the fair in Frankfurt. Professor Melancthon, a nephew of the great Protestant reformer, delivered lectures in medicine on the basis of Galen. Would not Hippocrates, who had taken his pupils to the bedside of his patients and had taught them physical signs and keen observation, have marveled at the fact that, twenty centuries after his time, such inane discourses should constitute the sole instruction in medicine? Another hindrance to progress was the interdiction by the Church of dissection of the human body; and even after that was lifted, the obtaining of bodies for dissection was a difficult matter.

It is interesting to learn through the researches of Sudhoff ("Studien zur Geschichte der Medizin," Heft. 8) how medical students were taught in the University of Leipzig during the first hundred years after its foundation in 1409. The lectures were given from six to seven o'clock in the morning during the summer and from seven to eight during the winter. During the first and second semesters, the first canon of Avicenna, during the third and fourth the *liber tegni* of Galen, and during the fifth and sixth the aphorisms of Hippocrates, with commentaries by Galen, were explained. The course in "practical medicine," so-called, took place in the afternoon. The holder of the chair explained a book of Rhazes, the first chapter of the fourth book of Avicenna, and the fourth chapter of the first canon by the same author. The lectures were given in the church of St. Nicholas. As for surgery and anatomy, they were completely neglected at Leipzig during the first century of this school's existence.

At the University of Montpellier, which was already ancient when the University of Leipzig was established, teaching was carried out as follows: The lectures began at six o'clock in the morning and lasted one hour. They consisted of dictation or reading of Latin texts and making comments upon them. Dissections, inaugurated in 1376, did not take place more than once or twice a year and then the entire public was permitted to attend on paying an admission fee. There was absolutely no clinical teaching. The whole course occupied a total of about six months. At the end of this time the student in order to obtain his license had to practice six months outside of the city. If then he passed his examinations as a bachelor, the beadle clothed him with a red robe, while his comrades one by one administered a good blow with the fist. To obtain the doctorate he had to pass sixteen examinations.

When his studies were finally completed, the new doctor had expended about sixteen thousand francs though after the year 1550 the cost was reduced to eighty-one hundred and fifty francs, still a formidable sum (Paul Delmas, *Bull. mensuel de l'Académie des sciences et lettres de Montpellier,* March, 1913, No. 3).

Although hospitals were springing up all over Europe (in Germany, for instance, the Order of the Holy Ghost founded not less than 154), clinical instruction was not given in any of them. Not even in the great Hôtel Dieu of Paris, founded in the eighth century, was any use made of its wealth of clinical material for nearly a thousand years. What practical experience the student got was obtained by his attaching himself to some obliging physician outside of the university, who acted as an extra-mural teacher and took him along on his rounds. This custom eventually led to the establishment of policlinics, apparently first at Montpellier. By "policlinic" is meant something quite different from that which the word polyclinic now connotes, namely, an organization for visiting patients in their homes in various parts of the city. Hence, the word poli-clinic (πόλις, city); the present term, "poly-clinic" (πολύς, many), being really a misnomer. One of the Montpellier physicians, Theophrastus Renaudot, migrated to Paris, established a policlinic there, and became a protégé of Richelieu and physician to Louis XIII. In the Rue de Calandre at the Sign of the Golden Cock he established a sort of dispensary for the poor. He incurred, however, the enmity of the faculty of the University of Paris—particularly of its brilliant but vindictive leader, Guy Patin[5] (1601-1672), whose motto, *"Saigner et senner"* (Bleeding and senna) helped to make him famous. In consequence the dispensary did not last long; and yet it was practically the only attempt at clinical teaching in Paris for several centuries. It is almost inconceivable that the material of the Hôtel Dieu, which at this time had a capacity of two thousand beds, was not used for medical instruction. The conditions in this famous hospital were very remarkable as we know from a graphic account written by a Saxon tailor, Christopher Rink. This man entered the hospital as a patient and was received by an old barber, who touched him in various places to determine the nature of his disease. A priest recorded his name in a book, and two assistants conducted him to his quarters, where he was placed in a large bed between two other patients, in such a way that his head lay between the feet of his bed-fellows. This sort of community of living was quite the rule in those days; and

[5] Guy Patin anathematized William Harvey and spoke of Harvey's discovery of the circulation of the blood as "paradoxical, unintelligible, absurd, and harmful to human life."

even in the eighteenth century, three, four and even five patients were often placed in a single bed. Frequently as many as four puerperal women were put together. Both of Rink's bed-fellows died. The first treatment our Saxon tailor received was psychic, an attempt being made to persuade him to believe the right religious doctrine; but he was a staunch Lutheran and resisted. The following day the doctor came, with the apothecary and the barber; and the traditional bleeding began. Rink was bled not less than twenty times, and yet lived to tell his tale. For the nuns, who conducted the nursing in the hospital and of whom there were three hundred, he has only the highest praise.

Molière, in his inimitable comedy, "Le malade imaginaire," has drawn a true picture of the time. The son, Thomas of Diafoirus, comes up for his baccalaureate degree in medicine; and in his behalf the following statements are made: "He is firm in dispute, and strong like a Turk in his principles; and he never recedes from his opinion, but presses the argument to the last vantage point of logic; but, above everything else, that which pleases me," says his father, "and in which he follows my example, is that he is attached blindly to the opinions of the ancients, and that he will not comprehend nor hear the reasons and the experiences of the pretended discoverers of our times touching the circulation of the blood or any other opinion of equal stripe." To all questions as to the remedies to be used in the various diseases, Thomas invariably answers:

Clysterium donare,
Postea seignare,
Reseignare, repurgare
Et reclysterisare—

to which the chorus makes the following response:

Bene, bene, bene,
Bene respondere.
Dignus est intrare
In nostro corpore.

In Rome, as late as the sixteenth century, in order to become a physician the medical student had to pass an examination on the physics of Aristotle and the doctrines of Galen. This was followed by a question in which one of the examiners described the symptoms of a disease and then asked the name and treatment. Having passed this test, the final act of initiation was the giving of a banquet to the examiners.

About the middle of the sixteenth century, near the close of the

Renaissance, Professor Dal Monte,[6] a friend of Vesalius, made the first modern attempt at clinical teaching, in the hospital of St. Francis at Padua. Little resulted from Dal Monte's efforts, but under his successors, Oddi and Bottoni, in about 1578, real bedside teaching began. Until quite recently I accepted it as a fact, having seen it in a number of works, that the first clinical teacher was Boerhaave; but Renaudot, Petersen, Puschmann and other reliable authors have clearly demonstrated that the credit for inaugurating clinical teachings belongs to these two otherwise unknown Italians, Oddi and Bottoni. Oddi gave his clinical lectures in the women's ward and Bottoni in the men's ward of St. Francis' Hospital. They illustrated their lectures with autopsy material. Autopsies were, however, still forbidden by the ecclesiastical authorities. Not long after Oddi and Bottoni, a blight struck the University of Padua, so that when the Dane, Thomas Bartolin, visited the city, he found only a "scola de pulsibus et urinis." Nevertheless, short as the period of clinical teaching was at Padua, it bore great fruit. The new idea was transplanted first to Holland, where Jan Van Heurne, who had studied at Padua, introduced it. His own success was slight; far greater was that of his son, Otto Van Heurne, who followed him in 1601. Somewhat later, in 1636, Wilhelm Van Den Straten (1593-1681) established a remarkable clinic at Utrecht. He examined patients in the presence of a class of students, and discussed the diagnosis, prognosis and treatment with them. Following this, there was a public debate concerning the nature of the disease.

Under Otto Van Heurne the students in Leyden visited the clinic two days a week, four students acting as clinical clerks, as we know from an extant letter of Thomas Bartolin. The authorities, however, in their wisdom, decided that this sort of teaching was not of much use and commanded the professors to instruct their students in the knowledge that can be gained from a study of the pulse and the urine. As most of the diseases were believed to have their seat in the blood, and as the urine was looked upon as a percolate of the blood, it seemed logical to determine the chemical composition of the latter by a study of the former. This rendered diagnosis extremely easy. As an illustration, I might cite what the monk Mercurius taught (at a somewhat earlier period, it is true) regarding the pulse: "If one lays four fingers of the right

[6] Dal Monte took an active part in the battle raging between the two camps into which the profession was divided in his time on the matter of bleeding. The one upheld the Arabic method, according to which the bleeding was to be done at the point farthest removed from the disease focus; at the foot, for example, in pneumonia; the other practiced the Hippocratic method, according to which the patient was to be bled from the arm corresponding to the side affected. Dal Monte and Vesalius were Hippocraticists.

hand on the pulse of the right arm of the patient, one can conclude that the disease is in the head if the pulse is felt mainly by the index finger; that the disease is in the thorax if the middle finger feels it; and that it is in the abdomen if the fourth finger perceives the chief impact." One of the notable Byzantine physicians, John Actuarius, distinguished fourteen colors of the urine, each one having a definite diagnostic meaning.

In the days of Van Heurne, enemas were greatly in vogue, and much time was spent in instructing the students in their preparation.[7]

Under the stimulus of the invention of the thermometer, the magnifying lens, the microscope, and above everything else, through the epoch-making discovery by William Harvey, of the circulation of the blood, a spirit of rebellion arose against the authority of the ancients that had held medicine in bondage for so long. When a man appeared upon the scene who taught medicine at the bedside, students flocked to him from all parts of the world. This man was Boerhaave, called *"Medicorum Universæ Europæ Præceptor,"* under whom the medical school of Leyden attained an extraordinary fame. As a teacher his influence has probably never been equaled. The son of a clergyman, he was himself prepared for theology but preferred medicine. His teaching consisted in lectures and bedside demonstrations in which he followed the cases through their course. His, to us, absurd theories of *fluida* and *solida* and of temperaments, are characteristic of his time, but could not endure when morbid anatomy in the epoch-making work Morgagni (1682-1771) showed that disease had a local habitation. Boerhaave had a good deal of common sense and attributed many diseases either to poverty or to luxurious living, *"nihil citius debilitat quam luxus."* It does not appear that he made any autopsies, being in this respect far behind his predecessor in the Leyden chair, the famous De La Boë, or Sylvius (1614-1672). Considering that the seat of diseases was in the blood or the bile, he naturally could not appreciate the importance of local pathologic processes. The methods of the Leyden Clinic, which had only twelve beds, were carried to all parts of Continental Europe and by Pringle and others to England. In Edinburgh a number of men, directly or indirectly pupils of Boerhaave, established clinical teaching early in the eighteenth century. It appears that one Daniel Duncan

[7] A famous enema of Van Heurne's had seventeen ingredients, for the mixing of which the most minute directions were given. I might also mention another famous preparation—the mystical theriacum—which had no less than seventy-two constituents, and was looked upon as the apothecary's masterpiece. It is recorded that in 1754, in Nuremberg, the completion of this drug, which had required two months' labor under the supervision of the Senate, was celebrated with many civic festivities. Both Boerhaave and Van Swieten used theriacum, although the former's motto was *simplex sigillum veri.*

inaugurated such teaching in 1720, but the first regular courses were given by Rutherford and afterwards by Cullen, Gregory and Drummond. The last two were the first to teach in the English language, Latin having been used prior to that time. In the days of which I am speaking, every physician had to know Latin virtually as well as his mother tongue, and the better educated also knew Greek. It was the possession of the Latin language that made it possible for men to study and to teach in any university in Europe, enabling Sydenham to go to Montpellier and Harvey to Padua. I am one of those who regret to see the Latin language disappearing from the college curriculum. A fair amount of Latin and a little Greek are of inestimable value to the medical student and the physician.

The Edinburgh school is of special interest to Americans, as it was there, under Cullen and others, that John Morgan, the founder of the medical school of the University of Pennsylvania, the first medical school in this country, was educated as well as William Shippen, Jr., Benjamin Rush, Samuel Bard and many other pioneers.

One of Boerhaave's greatest pupils, Van Swieten, was called to Vienna by Maria Theresa and there laid the foundation for Vienna's subsequent position as a center of clinical teaching. Being overwhelmed with practice, Van Swieten in 1752, called Anton de Haen, also a pupil of Boerhaave, from the Hague to take charge of clinical teaching in Vienna. De Haen received the enormous salary of five thousand florins in order that he might devote himself exclusively to teaching. He was thus the first of full-time clinical teachers; but as the position yielded the munificent income just mentioned, his problem was not quite as difficult as that of professors in American schools confronted with the question of deciding between full- or part-time teaching. There are other reasons why De Haen should be remembered. He reintroduced the Hippocratic practice of allowing fever patients to have fresh air. On the basis of the doctrine of crises it had become the custom to swathe and cover fever patients and keep every breath of air from them, a practice that has not altogether died out among our foreign population, especially among the Italians.

De Haen espoused the study of bowel excretions as a means of diagnosis and prognosis. This study, though not pursued in quite as unscientific a manner as was that of water casting, was very popular among medical men, which fact led the satirical Gideon Harvey, physician of Charles II, to speak of doctors as *"medici stercorarii qui morbos per anum expellunt."* One of De Haen's

assistants, a Jesuit priest by the name of Stoll, deserves to be mentioned in a history of clinical teaching. Aside from having the questionable honor of being the father of the bilious diathesis, which has dragged itself through the ages to this day, he has the greater distinction of being one of the first to insist upon thorough physical examinations. He did not, however, resort to percussion, though he writes that in pleurisy the percussion note is like that of the thigh.

The impetus given to clinical teaching by these men endowed the Vienna school with a wonderful reputation, which later great clinical teachers maintained until the outbreak of the world war.

The French school of clinical teaching began a little later and passed through numerous vicissitudes. Although clinical teaching was proposed as early as 1562 by one Pierre de la Ramée, practically nothing was done until the close of the eighteenth century. It is doubtful whether anything could have been done in Ramée's time, for one physician then had charge of about a thousand beds in the Paris hospitals. Lamenting the utter inadequacy of the teaching of medical students, Ramée exclaimed: *"de nouveau médecin, cimetière boussu."* About two hundred years later (1778) Duchannoy and Jumelin proposed the reintroduction of clinical teaching. Arguing in favor of such teaching they expressed themselves as follows: "Young medical students may reasonably be regarded after their studies as a body of young soldiers who, abandoned to themselves and without leaders, ravage the provinces of a country which they should protect and succor." Their suggestion and protests were of no avail, and as late as 1787 the Royal Society of Medicine was compelled to make the statement that in France no physician had studied his art at the bedside of a patient. In not a single one of the thirty-two medical faculties of France was there any clinical teaching worthy of the name prior to the Revolution. Desault, in 1787, and Corvisart, in 1788, must be looked upon as the founders of clinical teaching in Paris. During the French Revolution all the old institutions and corporations were overturned. The medical faculty and the academy of surgery were abolished; the masters of medicine had no place to exercise their teaching, and the students had no schools, no instruction. Two courageous men, Forcray and Thorat, protested publicly against the prevailing political spirit which "seeks to destroy everything and to build up nothing"; an utterance that reminds us of the charge so frequently made today against Bolshevism.

On an earlier page I spoke of Morgagni and the influence of his work in morbid anatomy upon the teaching of medicine.

Morgagni, as the founder of the anatomic school, placed the habitat of disease in the organs instead of in the humors. But neither he nor his immediate successors divined any relation between the diseases of various organs. Another great generalization was necessary, and that we owe to François Xavier Bichat (1771-1802), who by showing that there was a similarity in the tissues composing the different organs of the body, became the founder of general anatomy. From his day onward disease was placed not in the organs as a whole but in the tissues composing them, and the fact became established that the same tissues in different organs might be subject to the same disease processes. It remained for the great Rudolph Virchow to carry the anatomic idea one step farther by his formulation of the cellular doctrine, under the ægis of which morbid anatomy has made enormous strides and maintains itself until this day.

Toward the end of the eighteenth century a powerful impetus was given to clinical teaching by John Peter Frank (1745-1821). Of a restless, roving disposition, Frank taught at Padua, Vienna, Göttingen, in Russia, and, for a brief period, in Edinburgh. The Edinburgh method of long discourses on certain diseases, without special reference to any particular case, in other words, the didactic lecture, did not appeal to him. In his courses he divided his students into two groups, the auscultants, who did not take part in practical demonstrations, and the practicants, who participated in the practical exercises. Believing that the functions of the teacher were to teach the healing art, he totally ignored incurable cases as being of no moment. He established a mortuary so that one could preserve a patient and be sure that he was dead before beginning the autopsy. His instructions to students are of interest: the history must be full of details, must be carefully taken and kept up from week to week. If the patient died the student had to read the history at the autopsy. The student who had assisted in the morning had to come back in the evening at a definite time to visit his patient. If any patient was seriously ill, the professor himself came. John Peter Frank, as well as his son Joseph, was an ardent supporter of the fantastic doctrines of John Brown, who was responsible for the promiscuous and intensive bleeding in vogue at the end of the eighteenth and at the beginning of the nineteenth century. Brownianism, though originating in Edinburgh, found its most zealous advocates in Germany and in America, particularly in Philadelphia.

One of the greatest advances in clinical teaching, indeed in the whole practice of medicine, came about through a discovery made

in the latter half of the eighteenth century, but not fully utilized until fifty years or more afterwards. In 1761, Leopold Auenbrugger, a modest physician connected with the so-called Spanish hospital of Vienna, published a small booklet of ninety-five pages which he called, "Inventum Novum ex Percussione Thoracis Humani ut Signo Arbstrusos Interni Pectoris Morbos Detegendi," in which he showed that valuable information might be obtained from striking the chest with the finger or, as he termed it, by percussion. The work remained unnoticed. Even his great fellow-citizen, Van Swieten, in a book on pulmonary phthisis and empyema published in 1765, does not mention percussion. A Frenchman, Rogières de la Chassagne, of Montpellier, translated the work into French and incorporated it as an appendix to a manual on pulmonary diseases, but so little did he think of percussion that he especially said that it would never occur to him to use such an absurd method.[8]

It was Napoleon's physician, Corvisart, who by translating the little work of Auenbrugger into French gave the method its second birth. Immediately percussion became widely popular, with the result that the Paris school under Louis, Laënnec and Piorry was for a time the Mecca of those seeking clinical instruction. Through the application of Auenbrugger's methods, and through the discovery of the stethoscope, physical diagnosis was advanced by leaps and bounds, almost to the stage in which we now have it. Notwithstanding the brilliance of the Paris medical faculty at this period, it had a great and worthy rival in the Dublin school, in which perhaps the best clinical instruction of the world was given in the middle of the last century. Graves and Stokes took their students with them into the wards of Meath Hospital and inaugurated the type of clinical bedside teaching in vogue at the present day. I have elsewhere published[9] the history of these great Irish clinicians, as well as that of Corrigan and Cheyne, all men who in power of observation, in keenness of analysis, and in the exercise of common sense, have not been surpassed in any land. In England medical teaching early took on a practical character. The reasons for this change are to be found partly in the practical type of mind of the English and their innate aversion to philosophical hypotheses, and partly in the fact that in England medical schools were

[8] Another author had the hardihood to write as follows: "La clinique, ou la leçon médicale au lit du malade (tel est le sens du mot *clinique*), se reduit maintenant a l'exploration sous toutes les formes: percussion, auscultation, mensuration et autres procédés qu'on qualifie ridiculement de scientifiques, et qu'on met volontiers en relief et en grande vénération auprès de la sotte majorité, en les affublant de noms étranges, bizarres, hybrides, le plus souvent absurdes, surtout quand ils sont empruntés de la langue grecque, en dépit de la logique et de l'étymologie." (Guardia: "La Médecine à travers les Siècles," p. 724.)

[9] The Johns Hopkins Hosp. Bull., Balt., Vol. XXIV, No. 270, August, 1913.

not as on the Continent, integral parts of universities, but were in intimate relation with the metropolitan hospitals where some of the physicians took pay pupils with them on their rounds.

The preëminence of the French school did not last long. Dominated by the spirit of Laënnec, its great fault was a disregard of physiology. In overemphasizing anatomy, gross and microscopic, it ignored the fundamental fact of biology—that form is an expression of function. The Vienna school soon became preëminent as the center of clinical teaching, and, as I have said above, remained so until the outbreak of the War.

I shall not carry the subject beyond this point. The next great step in the progress of clinical teaching came through the conjunction of the work of the laboratory with the work at the bedside. That step, which constitutes the greatest advance contributed to the teaching of medicine by our own time, lies beyond the scope of this essay.

MEN AND EVENTS IN THE HISTORY OF THE PHILADELPHIA PATHOLOGICAL SOCIETY [1]

The last act of that extraordinary screen play "Cavalcade" portrays the decadence, the moral disintegration, of present-day society. Weariness, hopelessness, bitterness, futility, sexual abandon—all are shown realistically but with restraint—the understatement hovers over this final scene as over the entire marvelous performance. When I saw it I wondered how far the spirit of 1930 might have gone in its sweep and whether medicine had been touched by it. In science there is certainly some evidence of its influence. The protagonists of modern physics are losing themselves in the sterile field of metaphysics. The statesman is looking through a glass darkly, without vision. What about medicine? That is the question I asked myself. Are there here too signs of decadence, of a tendency to unfruitful speculation such as characterizes astrophysics today and such as prevailed in medicine during the brief romantic period of the early nineteenth century? To this disturbing question I found, I think, an answer in the *Transactions and Proceedings of the Philadelphia Pathological Society.* In reading the *Transactions* over I came to the comforting conclusion that during the seventy-five years of the existence of our Society medicine had not deteriorated but had gone on steadily, clear-eyed, toward its goal, the understanding of disease and of the means of preventing and curing it.

We have met tonight to celebrate the seventy-fifth anniversary of the Pathological Society. Seventy-five years of sustained activity on the part of a medical organization is no mean achievement. While mankind may little heed our celebration we ourselves shall be benefitted and inspired by looking back over three-fourths of a century's scientific work. We are not the most venerable medical society in Philadelphia, for we have three older sisters, the College of Physicians, the Northern Medical Association and the County Medical Society. Many are of the belief that our Pathological Society was the first in Philadelphia, but such is not the case. A pathological

[1] Address delivered at the 75th Anniversary of the Philadelphia Pathological Society, March 9, 1933.

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society existed in this city as early as 1839. The *American Medical Intelligencer*[2] contains the following announcement:

THE PHILADELPHIA PATHOLOGICAL SOCIETY

A society under this title has been recently established in this city. Its objects are—the exhibition of specimens of morbid anatomy, met with in hospital or private practice, and the collection and preservation of these specimens in a museum of pathological anatomy. The society is already in esse, and holds weekly meetings. Its officers are: W. W. Gerhard, M.D., President; C. W. Pennock, M.D., and T. Stewardson, Jr., M.D., Vice-Presidents; Geo. W. Norris, M.D., Secretary; Edward Peace, M.D., Treasurer; and Paul B. Goddard, M.D., W. Pepper, M.D., and B. F. Hardy, M.D., Curators.

Instituted and supported by individuals so competent and zealous as the gentlemen mentioned, and their coadjutors, the society cannot fail to be conducted with spirit, and to tend to the advancement of the pathological knowledge,—one of the elements of sound therapeutics, which, after all, is the great object of medicine.

The interest of Dr. Gerhard, the Society's first President, in pathology was the outgrowth of his studies in Paris under the great Louis. As is well known, Gerhard established in 1836, shortly after his return to America, once and for all the anatomic differences between typhus and typhoid fever. He was undoubtedly the greatest American exponent of the new scientific methods of France, then deservedly in the ascendant. Large groups of students attended his lectures at the Blockley Hospital; 261 were registered at one time for the course. That the students were satisfied with the instruction they received at his hands is indicated in a set of resolutions adopted by them in 1841 and published in the *American Medical Intelligencer*. These resolutions are as follows:

A portion of the medical class of the University of Pennsylvania, who have attended the lectures at the Philadelphia Hospital, being desirous of expressing their sense of the value and importance of clinical instruction, and of their obligations to Dr. W. W. Gerhard, for the able course of lectures delivered by him at that institution during the present session, have met together for that purpose; therefore,

Resolved. 1st. That we consider clinical instruction the most important method of teaching the pathological states of the system, and of familiarizing the mind of the student with the means of correcting the aberrations from the standard of health.

2d. That we consider the course of lectures now being delivered on clinical medicine, at the Philadelphia Hospital, of great value, particularly because of the truly scientific as well as practical manner, in which diseases, involved in much obscurity, are elucidated.

3d. That we consider Dr. Gerhard eminently qualified to give instruction in clinical medicine and pathological anatomy, and that we particularly admire his unequaled skill in illustrating the diseases of the thoracic viscera.

[2] Vol. 3, 1839.

4th. That a committee of ten be appointed to present a copy of these resolutions to Dr. Gerhard, and to tender him our thanks for the zeal and ability which he has manifested in the interests of the class.

5th. That these resolutions be signed by the chairman and secretary, and that a copy of them be presented to the Faculty through their Dean.

6th. That a copy of these resolutions be also sent to the Medical Journals and newspapers of this city, with a request that they publish them.

The committee appointed under the fourth resolution, consists of the following gentlemen: Drs. C. Quarles and R. Kownslar, and Messrs. T. B. Lamar, M. A. Page, T. R. Spencer, W. H. Van Buren, Allen Gunn, H. Selden, T. L. Walker, and J. R. Justice—on motion the chairman was added to the committee.

J. A. Pleasants, M.D., Chairman
L. S. Joynes, M.D., Secretary

At the annual election on October 15, 1842, the following officers were elected:

President—Nathaniel Chapman, M.D.
Vice-Presidents—Jacob Randolph, M.D., Samuel George Morton, M.D., Charles D. Meigs, M.D.
Secretary—Thomas Stewardson, M.D.
Treasurer—George W. Norris, M.D.
Curator—Edward Hartshorne, M.D.

As this was the last election of which I have been able to find any record, it is likely that the Society went out of existence in 1843.

It would seem that four pathological societies antedate our own. The oldest of all is the Societé anatomique of Paris. It was originally founded on the 12th Frimaire in the year XII (December 3, 1803) by Dupuytren, but passed out of existence for lack of support five years later, Laënnec being its last President. On January 12, 1826, the Society was reconstituted under the presidency of Cruveillier, although the first volume of its Bulletins did not appear until fifteen years later. The Societé anatomique may thus lay claim to being the oldest pathological society in the world. The next in order is the Dublin Pathological Society, founded in 1839. Among its active members was the famous William Stokes of Adams-Stokes disease. It seems to have died in 1882. The New York Pathological Society was established in 1844, and the London Pathological Society in 1846; the latter since 1907 has been a Section of the Royal Society of Medicine.[3]

The second Pathological Society of Philadelphia, our own, had its beginning on September 29, 1857, when a group of twenty-seven gentlemen, most of them then or afterwards distinguished, met in the home of Dr. J. M. Da Costa, at 212 S. 11th Street, and organized

[3] The Chicago Pathological Society as such dates from 1881.

the Pathological Society of Philadelphia.[4] The first actual meeting was held on October 14, 1857. A Constitution was then adopted and the following officers elected:

President—Dr. S. D. Gross.
Vice-Presidents—Drs. René La Roche and Alfred Stillé.
Treasurer—Dr. Addinell Hewson.
Secretary—Dr. J. M. Da Costa.
Assistant Secretary—Dr. T. G. Morton.

The first presentation at this inaugural meeting was made by Dr. S. Weir Mitchell. It was a fatty liver from a child five and one-half years old. The fatty nature was not only visible to the naked eye but Mitchell had proved it by means of the microscope.

The meetings of the Society, through the courtesy of the Managers of the Pennsylvania Hospital, were held in the famous Picture House which was also for a time the meeting place of the American Historical Society. During the Civil War this choice of meeting place proved of great importance, because it was largely through the Staff of the Pennsylvania Hospital that the continuity of the Society, threatened by the absence of so many members at the Front, was maintained. After 1867 the meetings were held in the College of Physicians at 13th and Locust Streets, and it was there in the intimate downstairs room with its hard, wooden benches, that my membership began in 1894. In 1909 the Society moved to the palatial new home of the College, where it now meets. On occasion it has met in some of the hospitals of the city, in the Zoological Garden, and in joint session with the New York Pathological Society both here and in New York City.

The semi-centennial anniversary of the Society was celebrated on May 9, 10 and 11, 1907, with appropriate ceremonies. The banquet was made memorable by a delightful response to a toast by Dr. S. Weir Mitchell, who was then one of the two original members still living. The other, Dr. James Darrach, was too enfeebled by age to attend. Dr. Mitchell also read a clever poem. There were three notable memorial addresses by Frederick G. Novy, Alonzo E. Taylor and Simon Flexner, which together with several other papers were published for the Society by the *Journal of Medical Research* in Boston.

Aside from the American Philosophical Society and the College of Physicians, the Pathological Society has had the most distinguished history of any of the medical or scientific organizations in this city. The majority of its presidents—there have been forty-

[4] It is curious that there is no reference whatever in the *Proceedings* to the earlier pathological society, although Gerhard and Stillé were members of both.

three in all—have been men who played a conspicuous role in American medicine.

Its first president, Samuel D. Gross, was also the first real pathologist in this country. He was born near Easton, Pa., in 1805, and was graduated from Jefferson Medical College in 1828. While waiting for practice he translated books from the French and the German. At the age of twenty-five, two years after graduation, he wrote his first work, "A Treatise on the Anatomy, Physiology and Diseases of the Bones and Joints." When twenty-eight years old he was called to Cincinnati as Demonstrator of Anatomy in the Medical College of Ohio. Two years later he was appointed to the Chair of Pathological Anatomy in the same school, devoting himself to dissections, reading, and visits to the slaughter houses of Cincinnati. He acquired sufficient knowledge to write his "Elements of Pathological Anatomy" in two octavo volumes of upwards of 500 pages each. It was the first systematic work upon the subject published in the English language. One of the greatest compliments Gross ever had came to him through this book, for at a dinner given in his honor by Virchow in Berlin in 1868, his host suddenly and without any warning drew forth a large volume from under the table and rising took Dr. Gross by the hand and made him an eloquent address, complimenting him upon his labors as a pathological anatomist and referred to the work, which happened to be the second edition of the "Elements of Pathological Anatomy," as one from which he had derived much useful instruction and pleasure.

In 1840 Gross assumed the Professorship of Surgery in the Louisville Institute, afterwards the University of Louisville, where he had among his colleagues Daniel Drake, Charles Caldwell, John Esten Cook and Jedediah Cobb. His first class in Louisville numbered 204 which was eventually increased to 406, the largest number it ever had. Owing to a crisis in the medical school of Louisville, Gross accepted the offer of the Chair of Surgery in the city of New York, succeeding Valentine Mott. Though he enjoyed his life in New York, he found that the University of New York was unpopular with the local profession and the College edifice ill-adapted to its object; moreover, living and rents were exorbitantly high. These and other causes led him to tender his resignation and to resume his Chair in the University of Louisville. During his stay in Louisville, which covered the sixteen years from 1840 to 1856, he wrote many books and papers. His fame had spread so rapidly that he was asked to take the Chair of Surgery in the University of Pennsylvania. He declined and at the request of Dr. D. Hayes Agnew wrote a warm testimonial in favor of Dr.

Henry H. Smith, who was elected. Finally, a call came to him from his Alma Mater which he accepted; he gave his first lecture in Philadelphia on September 30, 1856. At the outbreak of the Civil War he wrote a brief manual of military surgery which was used extensively in both armies and was later translated into Japanese and published at Tokyo. His monumental work is his "System of Surgery" which went through six editions.

Gross was deeply interested in medical history and wrote numerous articles and books, among them the Life of Daniel Drake, John Syng Dorsey, Valentine Mott, Robley Dunglison, Ambroise Paré and others. It is remarkable how much he accomplished in a literary way considering that he was both a busy practitioner and an active teacher. As he himself said, his genius was the genius of industry, perseverance and common sense. He was a member of innumerable medical societies both here and abroad and had many academic honors.

I should like to talk about all of the Presidents but it seems to me better if I confine myself, with the exception of Dr. Samuel D. Gross, to those presiding officers no longer living with whom I was personally acquainted.

The third President, and the first one I knew, was Dr. Alfred Stillé. In the beginning the president was chosen for one year, but with Dr. Stillé the practice was changed for he was re-elected at the end of his term. Being, however, a great stickler for the proprieties, he declined the first re-election, but he was afterwards prevailed upon to accept and served two other terms. I came in touch with Dr. Stillé in his declining years through my membership in the Stillé Medical Society, an undergraduate organization in the Medical School of the University of Pennsylvania. Stillé entered Yale College, from which, however, he was expelled by reason of his having joined the "conic section" rebellion at Yale which led to the retirement of one-half of the class. He attended the brilliant lectures on anatomy by Dr. Granville Sharpe Pattison at Jefferson College but was graduated from the University of Pennsylvania in 1832. In 1835-36 he was house physician at Blockley, under W. W. Gerhard, who had just returned from Paris. Stillé also came under the influence of Dr. Pennock, who was associated with Gerhard. He says: "No doubt Gerhard was the more intellectual man but Pennock was the nobler of the two." Attracted by the great French school, Stillé became one of the large band of Americans who studied in Paris under Louis. His investigations on cholera and on epidemic cerebrospinal meningitis subsequently made at the Philadelphia General Hospital belong to

the classics of the prebacteriologic era. As a sample of his style and perspicacity I shall quote from a presentation made before the first Pathological Society on December 30, 1839. After presenting a case of rheumatism with endopericarditis, pleurisy and double pneumonia, Stillé concludes as follows:

> We are shown by the history of this case, that diseases, apparently unimportant in themselves, are not, on that account, to be lightly examined, or treated carelessly. We should always keep in view, not only the affection itself, but also its tendencies; remembering "how great a flame a little fire kindleth." In this instance a slight attack of a disease more regarded commonly for the transient pain it inflicts, than for the permanent injury it entails, was the first small link in a chain, which at last fettered and destroyed a young and vigorous life.

The fifth president, Dr. J. M. Da Costa, who served for three years, is remembered by many of the older physicians. A month ago, on February 7, occurred the one hundredth anniversary of his birth on the Island of St. Thomas in the West Indies. Da Costa studied in Dresden, Vienna and Paris; the last named city at that time contained a wonderful group of men from whom Da Costa obtained much of his encyclopedic knowledge of medicine. Among these great personalities were Duchenne, Nélaton, Ricord, Broca, Velpeau and Trousseau. It would be difficult to find anywhere at any time a finer group.

Da Costa was the first Secretary of the Pathological Society. His presentations were numerous and always couched in flawless English. At an early meeting he reported a case of primary cancer of the pancreas and noted that the gall bladder was fully distended with bile. A few months later he read an exhaustive paper on the same subject based on a study of 37 cases from the world's literature and included one of his own. He unfortunately did not realize the significance of the distended gall bladder, otherwise we should speak of Da Costa's instead of Courvoisier's law. Dr. J. H. Packard credits him with having been the first to demonstrate experimentally that the change of the liver in yellow fever was due to fatty and not to amyloid degeneration. In discussing apoplexy of the lung in connection with disease of the mitral valve, Da Costa states that he did not believe that pulmonary apoplexy was either of necessity produced by or connected with external pulmonary hemorrhage. He uses the term nodular apoplexy of the lung, evidently referring to what we now call hemorrhagic infarction. His famous study on the "Irritable Heart of Soldiers" is a classic known everywhere; it anticipated the neurocirculatory asthenia of the Great War.

In 1880, two years before the discovery of the tubercle bacillus, Da Costa made the following statement at a meeting of the Society:

> I believe then that pneumonic phthisis is a tubercular pneumonia and that the inflammation is tubercular from the outset or has acquired a tubercular nature through changes in the cell life which we do not understand.

At the Conversational Meeting on October 27, 1892, he read his well-known essay entitled "The Albuminuria and the Bright's Disease of Uric Acid and Oxaluria." Dr. Da Costa died of angina pectoris in 1900.

Dr. Da Costa was succeeded in the presidency by Dr. John H. Packard, whose fine, sensitive face surrounded by a straggling greyish-black beard is readily recalled by those who knew him. Dr. Packard was one of the most active men in the Society. He was a member of the Committee on Morbid Growths and made numerous presentations and read several important papers. I should like to refer briefly to one on pyemia read before the Society October 26, 1859. In this paper he attempts to explain the occurrence of suppuration at a distance from the primary seat, such as after amputation or injury. It is like a view from another planet. The idea that germs or living organisms might play a part is not even dreamt of, and in consequence Packard has to take refuge in a variety of theories that seem fantastic from our point of view. After reviewing the literature including the writings of Ambroise Paré, he comes to the conclusion that secondary suppuration after surgical operations, injuries or local inflammations is due to a purulent or pyogenic diathesis. He writes:

> The idea which I have sought to defend—that such abscesses occurring after injury or operations are due to a pyogenic diathesis, this being a state of the system not without analogy under other circumstances—is, I think, a new one. If tenable, it may afford a sounder basis for prophylactic or curative measures than those which have preceded it, and in this way it may be made practically useful.

Dr. Woodward in discussion agreed with what Dr. Packard had said with regard to the extreme difficulty of determining the existence of pus in the blood as seen under the miscroscope owing to the impossibility of discriminating between pus corpuscles and the white corpuscles of the blood; still in a case where these corpuscles are abnormally abundant, we can at least say that one of two conditions must be present: either the patient, from whom the blood had been drawn, is suffering from leukemia, or there is pus mixed with the blood. Dr. Woodward also spoke of the readiness with which under certain conditions pus might enter the circulation.

Dr. Henry Hartshorne with an approach to the true explana-

tion observed that although the secretion of pus in organs distant from the seat of injury might often be owing to purely diathetic influences, without any distinct connection existing between the secreting centers, as suggested by Dr. Packard, still there were cases, and he instanced two as having fallen under his own observation, in which the neighboring lymphatics had become red and hard, first at the seat of injury, and in which this induration and redness had rapidly traveled along the course of the lymphatic vessels to a distant gland, which had suppurated. Such cases, he thought, must at least be allowed to be owing to continuous inflammation, if not to the direct conveyance of the pus from one suppurating center to the other by means of the lymphatic vessels.

Packard was followed by a man whose fame probably exceeds that of any physician in the history of Philadelphia, S. Weir Mitchell. Mitchell was not only the first in the history of the Society to present a specimen but he was also a frequent contributor to its meetings, discussing all sorts of subjects in clinical medicine but showing eventually that his main interest lay in the field of nervous diseases.

Dr. Mitchell was born in Philadelphia and was a collateral descendant of Dr. John Kearsley of colonial fame. Although a graduate of Jefferson Medical College, where his father was professor, he was closely identified throughout nearly all his mature life with the University of Pennsylvania. His scientific work during the Civil War culminated in the great monograph prepared with Moorehouse and Keen on "Gunshot Wounds of the Nerves," which laid the foundation of his fame as a neurologist and investigator. As already stated, he made the first presentation in the history of the Pathological Society and for many years took active part in its deliberations. Although he had resigned several years before, he participated in the semicentennial celebration in 1907.

Mitchell's experimental work took a wide range: on the cerebellum, on the respiration of turtles, on snake venom, etc. It was under his inspiration that Simon Flexner and Hideyo Noguchi did their well-known researches on the nature of snake poison. Mitchell's contributions to neurology and to therapeutics—the Rest Cure—were epoch-making. In the midst of a busy practice and scientific work he found time to write a number of historical novels and many poems and addresses. In the College of Physicians his influence was paramount and much of the dignity which other cities find to encompass medical life in Philadelphia is due to his example. He died of pneumonia on January 4, 1914.

John Ashhurst, Jr., succeeded S. Weir Mitchell in 1870. As a

teacher of surgery, as a diagnostician, and as an author of surgical works, Ashhurst has had few equals in this country. His presentations were scholarly and like those of Da Costa interlarded with references to the European literature. It is not generally known that he had a sense of humor; true, it was a little heavy and pedantic and became manifest only on rare occasions. His judgments were severe and not tempered with mercy. This showed itself especially in his reviews of the surgical works of others which he wrote for many years for *The American Journal of the Medical Sciences.*

In 1873 choice fell on William Pepper whose father had been one of the curators of the earlier pathological society. William Pepper, Secundus, began his life in our own Society in the same modest office, that of curator. He was born in 1843, was graduated from the University of Pennsylvania in 1864, and became resident physician in the Pennsylvania Hospital in 1865. Subsequently he was elected pathologist and curator of the hospital's museum. Pepper was always deeply interested in pathology and taught it at the University of Pennsylvania. At the Philadelphia General Hospital he gave courses in practical medicine with H. C. Wood, Pepper meeting his classes at eight o'clock on Tuesday mornings. He was the first to notice the pigment in the blood and organs in malaria and with a better miscroscope might have been the discoverer of the malarial parasite fifteen years before Laveran.

One of the most important Philadelphia contributions to pathology was Pepper's discovery in 1875 of the red bone marrow in pernicious anemia. The Germans have claimed priority in this discovery for the great pathologist Julius Cohnheim, who described the condition and considered it a definite etiologic factor in pernicious anemia in 1877. There can be but little doubt that Cohnheim was unaware of Pepper's observation, nevertheless if priority is a matter of chronology, the honor of discovery belongs to William Pepper. Pepper's contributions to the Society number 84. In the 1870 edition of the famous textbook of "Diseases of Children," written by Pepper in association with J. F. Meigs, is to be found the best description up to that date of perforation of the appendix.

Pepper frequently served on the Committee of Morbid Growths, which in the early days was not a standing committee but was appointed as the occasion warranted. On November 22, 1865, he made the following report:

> In presenting to the Society this report upon the tumour referred to me at the last meeting, I think it but fair to say that, excepting as regards its general characters and the general considerations springing from them,

it is not worthy of being held to be conclusive. The changes produced in the relative consistence, in the colour, in the amount of granular debris, in the size of the cells and the appearance of their contents, are so great and so uncertain that, so far as the microscopic examination is concerned, I offer the results with great diffidence.

Although Pepper was then in the first flush of youth as physician, he showed a restraint and modesty that are not as common today as they might be. As a specimen of Pepper's style and of his keen mentality I shall quote a report on a case of aneurysm of the left middle cerebral artery with partial right hemiplegia and aphasia:

As the lesion was limited to the anterior half of the left hemisphere and to the motor portion of this side, the cineritious substance being quite healthy, it may be regarded as a case of confirming the localization of voluntary speech in the left hemisphere. The preservation of consciousness, intelligence and volition shows also that the lesion in aphasia is not of the intellectual portions of the brain but in the central motor nucleus through which the mental concepts must be transmitted to be formed into words. In accordance with this we find in this case the lesion limited to the motor tract of the left hemisphere.

These observations of Pepper show that he was familiar with the comparatively recent researches of Paul Broca on cerebral localization.

William Pepper was one of the most versatile men in American history. Besides being a physician he was an educator, an organizer, a public-spirited citizen, and when he died the *Public Ledger* said of him that he had "done the work of a dozen men." I had the honor with Dr. A. C. Abbott and the late Dr. F. A. Packard to be on the Committee of the Pathological Society to draw up resolutions on Dr. Pepper's death.

James Tyson, the thirteenth president, is remembered by the majority of Philadelphia physicians, for he lived until 1919. Born in 1841 of German ancestry, Dr. Tyson was graduated from Haverford College in 1860, and from the Medical Department of the University in 1863. He began early to exhibit an interest in pathology and was one of the first in the city to use the microscope regularly. In 1866 he was appointed microscopist and in 1870 pathologist to the Philadelphia General Hospital. Although his interest in pathology continued throughout his life (he came near being made Professor of Pathology in the University of Pennsylvania), his contributions to the science were few.

His successor as President in 1884 was E. O. Shakespeare, a descendant of Edmund Shakespeare, one of the brothers of the

poet. Although by training an ophthalmologist, he was an able bacteriologist and expert sanitarian. He was a co-discoverer with Dr. Louis Taylor of Wilkes-Barre of the cause of the fearful outbreak of typhoid fever at Plymouth in the Wyoming Valley. His monumental work on cholera prepared for the United States Government will always remain a landmark in the history of the disease. In the Spanish-American war he was associated with Dr. V. C. Vaughan and Surgeon-General George M. Sternberg, in the investigation of typhoid fever in the military camps. He defended ardently the specificity of the tubercle bacillus against Dr. Formad. When cholera broke out in Hamburg in 1892, and the fear of its importation created somewhat of a panic in this city, Dr. Shakespeare took charge of the quarantine arrangements. It was at that time that I had the honor of becoming his voluntary assistant in the bacteriological laboratory of the Philadelphia General Hospital, where he made his investigations. After his retirement from the presidency in 1885, he undertook at his own expense the publication of the *Proceedings* of the Society, as is mentioned in another place in this article. Dr. Shakespeare died in 1900 at the early age of fifty-four.

Dr. J. C. Wilson, the next president, is fortunately still among the quick.

Dr. F. P. Henry, his successor in 1887, was not a graduate of a Philadelphia school, but nevertheless he rose rapidly in professional honors after his arrival here in 1869. He was a man of broad culture and given to scholarly pursuits. Dr. Henry's contributions were of great importance, particularly those dealing with diseases of the blood. He was the first in this country to call attention to the "tabby mottling" of the heart in pernicious anemia which had been originally noted by Quain. Jointly with Osler he described atrophy of the mucous membrane of the stomach in a case of pernicious anemia. He did not think that the changes in the bone marrow observed by Pepper were of much importance.

It also appears from Dr. Henry's paper on pernicious anemia that Dr. Morris J. Lewis of this city was the first in this country to note the changes in the spinal cord in that disease. The microscopic examination in his case had been made by Dr. Charles W. Burr soon after the condition was described by Lichtheim in Germany.

Henry F. Formad was born in 1847 in the Russian Caucasus. Soon after graduating from Heidelberg he emigrated to this country and entered the University of Pennsylvania from which he received his degree of M.D. in 1877. He afterwards became demon-

strator of morbid anatomy in the University, and coroner's physician, and soon acquired a national reputation as a medicolegal expert. His knowledge of morbid anatomy was profound, based as it was on countless autopsies. He was also interested in bacteriology and through a peculiar circumstance acquired an unmerited posthumous fame. It came about as follows:

Formad had contended for the nonspecificity and unimportance of the tubercle bacillus, although pathologists everywhere were being won over to Koch's views. Professor Loeffler in 1907, in an excellent commemorative address on Koch's immortal discovery, mentioned Formad as one of Koch's opponents and passed over in silence all those Americans who had enthusiastically accepted the tubercle bacillus. This reminds me of one of Turgenieff's stories: An art critic had been accustomed to agree with the popular taste in all respects; no one paid any attention to him. He then decided to condemn everything and very soon he was the most noted man in town.

Dr. Formad took an active part in our Society, where his "wet brain" and "pigback kidney" of the alcoholic became popular phrases. His presidency covered two terms, 1889-90. Before he died in 1892 at the early age of forty-five, he had already become a legendary figure in Philadelphia.

Arthur V. Meigs, whose father and grandfather were doctors, was a graduate of the University of Pennsylvania and resident physician and afterwards visiting physician to the Pennsylvania Hospital. A conscientious, ultra-conservative practitioner and a student of pathological problems, he published a number of scientific articles, including several on milk analysis and two books dealing with the diseases of the blood vessels. He was elected president in 1891.

John H. Musser was of German-Swiss descent, the fourth physician in direct line. A graduate of the University of Pennsylvania in 1877, he served as resident physician in the Philadelphia General Hospital and joined our Society in 1880. In 1884 he became pathologist to the Presbyterian Hospital. Musser was a voluminous writer, many of his articles, such as the classical one on "Primary Cancer of the Gall Bladder and Bile Ducts," being based on painstaking pathologic studies. His knowledge of morbid anatomy made him a capable teacher of physical diagnosis and a diagnostician of rare ability and national renown. His energy was prodigious but he spent it recklessly in the pursuit of his calling, and death came to him in the form of angina pectoris at the age of fifty-six.

Frederick A. Packard, elected president in 1899, was one of three sons whose fathers have been presidents of the Society, the others being Samuel W. Gross and O. H. Perry Pepper. He was graduated from the University of Pennsylvania in 1885 with the highest general average. It was my good fortune to have him as chief on the medical service in the Philadelphia General Hospital. During the brief period of our association a friendship sprang up between us that was broken all too soon by Dr. Packard's untimely death in 1902 from typhoid fever. While his deep interest in the Pathological Society and in things pathological was to some extent inherited from his distinguished father, he was additionally inspired by William Osler, who inculcated in him that fondness for clinical medicine and pathology that would have made him a second Osler had he lived.

Speaking of Sir William Osler reminds me to say that during his sojourn in Philadelphia, Dr. Osler was one of the most active members of the Society. His presentations, numbering fifty-two, were largely from the autopsy room of the Philadelphia General Hospital. Of all the men connected with the Pathological Society during the last fifty years, his influence must be reckoned as the most significant. He held only one office, that of fourth Vice President, to which he was elected in 1887.

W. M. L. Coplin was pathologist to the Philadelphia General Hospital for thirty years and for many years professor of pathology in Jefferson Medical College. In addition he held several important public positions, among them that of Director of Health of Philadelphia. He was interested not alone in pathology but also in bacteriology and wrote many papers on both subjects and was the author of a textbook on pathology.

When I joined the Pathological Society there still existed a feeling of antagonism between the two leading schools of Philadelphia. It was next to impossible for a Jefferson graduate to be elected to an office in our Society. This did not seem fair to some of us, and when the election came around we planned to elect Dr. Coplin one of the four vice-presidents. Despite our well-laid plans, at the last moment a particularly loyal Pennsylvania alumnus who was not in the secret, nominated a member of the University Faculty as a fifth candidate. To our chagrin Coplin was defeated, but in the following year our plans did not go awry and thereafter there was never again any friction in the Society.

Allen J. Smith, whose kindly and helpful personality will not be forgotten by those who had the good fortune to know him, was an excellent pathologist and parasitologist. He was called to the

University of Texas in 1891 and built the school up from almost nothing to one of the best medical institutions in the South. In 1903 he returned to Philadelphia as Professor of Pathology, in succession to Dr. Simon Flexner. His contributions to pathology were largely in the domain of parasitology; to him belongs the credit of establishing the existence of hookworm disease as endemic in the United States. He was elected president in 1912 and died much lamented in 1926.

Richard Mills Pearce was elected President of the Society in 1913. Born in Montreal in 1874, he was graduated from Harvard Medical School and became a pupil of Councilman. Naturally he was well versed in pathology when he came to the University of Pennsylvania in 1900 as Demonstrator under Dr. Simon Flexner. In 1903 he left Philadelphia and thereafter held important positions in Albany and in New York City. He returned here in 1920 to fill the newly created chair of Research Medicine in the University. During his occupancy of this chair he made important contributions, particularly to our knowledge of the functions of the spleen. In 1923 he became associated with the Rockefeller Foundation and as its Director of Medical Education he did phenomenal work not only in this country but in many distant parts of the world. Richard Pearce exercised a strong and lasting influence in our Society and upon the spirit of research in Philadelphia; by his forthright personality he won the respect of all who came in contact with him.

M. Howard Fussell, elected President in 1915, was one of the most popular practitioners and consultants in Philadelphia. His interest in morbid anatomy was unusually keen and led him to make in nearly all cases of death, both in private and in hospital practice, requests for an autopsy, a request seldom denied him. He found like all other conscientious physicians the autopsy table, in the language of D. J. McCarthy, an excellent cure for megalomania. No doubt much of his success as a diagnostician was founded on his knowledge of the pathological changes in disease. Dr. Fussell died of angina pectoris at the age of sixty-six.

Paul A. Lewis, who was elected President of the Society in 1921, was an ideal scientist. Graduated from the University of Pennsylvania in 1904, he held a number of teaching positions until he became a Fellow of the Rockefeller Institute in 1908. In 1910 he came to Philadelphia as Director of Laboratories of the Henry Phipps Institute, with the title of Assistant Professor of Pathology and later as Professor of Experimental Pathology in the University of Pennsylvania. He also served as Director of the Ayer Clinical Laboratory of the Pennsylvania Hospital. In 1922, he resigned

from his positions in Philadelphia to become associate member of the Rockefeller Institute of Animal Pathology at Princeton. In 1929, under the auspices of the International Health Commission, he went to Bahia, Brazil, to investigate the nature of the virus of yellow fever. On June 25 he was stricken with that disease and died on June 30, 1929. Thus for twenty-five years Lewis devoted his best energies to investigations in pathology. He and Auer were the first to fathom the mechanism of anaphylactic death in guinea pigs. His work with Flexner on poliomyelitis in which his part was more than that of a subordinate assistant has become classical. In the Phipps Institute his investigations took a wide range and led to the publication of many important papers on tuberculosis. Until his death Lewis enjoyed the loyal friendship of those who were associated with him in the Pathological Society.

Some very distinguished men were honored by the Society through their election as corresponding members. Austin Flint, elected in 1858, a year after the founding of the Society, was one of the great medical teachers of his time. His name is enshrined in the Flint murmur of aortic insufficiency.

Alonzo Clark, another corresponding member, elected in 1859, introduced the opium treatment of peritonitis which was popular before the days of courageous abdominal surgery. Carl Rokitansky was an Austrian, or rather a Czech, who probably made more autopsies than any other man in history. His contributions to pathology are remarkable in number and quality; he was the first to discover bacteria in malignant endocarditis, the first to differentiate between lobar and lobular pneumonia. It was he who gave the name "acute yellow atrophy of the liver" to the condition he so well described. Unfortunately he could not divest himself of the antiquated humoral theories of crases and dyscrases, the incorporation of which in the first edition of his book gave his younger contemporary Virchow a chance for much caustic criticism.

Rudolph Virchow was elected to corresponding membership in 1898. I need say little about the man who did for pathology what Vesalius did for anatomy. Virchow was a truly great man and like all great men he was many-sided: pathologist, anthropologist, linguist, and editor; as statesman he dared defy the mighty Bismarck. He stands as a unique personality in medical history. In the same year in which the Society elected Virchow it also elected the most beloved American physician of our time to corresponding membership, Dr. William H. Welch. A man of perpetual youth who has always one foot in the historic past and one in the future; a scientist, a scholar, an organizer—we hope

that his health will be such that he will be with us for a number of years to come.[5]

In the beginning of our Society's career the *Transactions* appeared in *The American Journal of the Medical Sciences;* the loose sheets were bound at the end of the year for distribution among the members. The first bound volume, which is now very rare, was issued in 1860 and covers the *Proceedings* from 1857 until the date of publication. With Volume IV in 1874 the Society began to publish its own Transactions. In this volume, Dr. James Tyson being the Recorder, the papers were for the first time arranged in systems after the pattern of the *Transactions of the London Pathological Society.* There was, however, much dissatisfaction with the great delay incident to the publication of an annual volume; it was therefore decided to have the papers and presentations appear more speedily in the form of monthly *Proceedings.* The second volume of this new series is noteworthy for having incorporated in it a general index prepared with great labor by A. E. Taylor, for the twenty volumes previously published from 1860 to 1899, inclusive. It should be mentioned that Dr. E. O. Shakespeare in 1886 undertook at his own expense to publish the *Proceedings* of the Society, although at the time he was not an officer. Dr. Shakespeare's *Proceedings* were printed and issued in Wilmington, Delaware, but ceased at the end of the fifth number. The five numbers together contained only twelve pages of text. Of late years the Society has not issued its *Proceedings* in its own fasciculi but has published its reports in the *Archives of Pathology.*

That the *Proceedings* of the Pathological Society attracted attention abroad is proved by the following incident: During a visit in Europe in 1905 I decided to call on Professor Ehrlich, whose laboratory was situated in a suburb of Frankfurt. I sent in my card and within a few moments Professor Ehrlich appeared, gave me a warm but clammy handshake, and said, "Oh, you are the Editor of the *Proceedings of the Philadelphia Pathological Society.*" As he could not possibly have had time to look this point up, he must have taken notice of the *Proceedings,* the title page of which carried my name as Recorder. I have always looked upon this incident as a great compliment to our Society.

The publications of the Society are a mirror of medical progress during the last seventy-five years. In the first quarter century pathological anatomy under the influence of Virchow's great discoveries dominated the activities of the members. With the discovery

[5] Dr. Welch did not live very long after these words were uttered. He died in Baltimore on April 30, 1934.

of the tubercle bacillus in 1882, a second quarter began which might be called the etiologic era. It must be admitted that the Society was a little slow in realizing the value of these discoveries. Bacteriology (the word itself did not appear in medical literature until late in 1884) received very scant attention until 1887, the year of Volume XIII. Seeing that Davaine in 1850 had demonstrated the anthrax bacillus in the blood of animals suffering from or dead of anthrax, that Pasteur's researches on the decomposition of organic solutions were published in 1860, and that references to his researches had appeared in literature even earlier, it is surprising to find no allusion whatsoever to these observations nor even to the discovery of Lister, published in 1867, or to those of Klebs, who in 1872, had expressed himself as convinced that the causes of pyemia and septicemia came from without the body. Even as late as 1887 Dr. John Ashhurst, Jr., ridiculed the claims of bacteriologists, and William Hunt, a well-known surgeon of the Pennsylvania Hospital, compared bacteria to the maggots he had seen in wounds during the Civil War. "Did the maggots cause the wounds?" he asked derisively. Evidently Philadelphia was passing through an unprogressive, contented era at that time. Some inconsiderate person might even now ask the question: "Has it actually passed through?"

The third quarter covers a much wider range than the first two. We begin to read of chemical and metabolic studies, of investigations of the blood along the fruitful lines we owe to Paul Ehrlich. Bacteriology, protozoology, syphilis, immunology, are represented by many articles. Among the most important original communications in the field of etiology are those of the late Leonard Pearson and of M. P. Ravenel on the transmissibility of tuberculosis.

Today the Society is ready to enter the fourth quarter of the century and under a new sign, whatever it may chance to be called by those who sit down as we are doing tonight to celebrate the first centenary of the Society. Perhaps it will be called the hormonic era.

It was before the Pathological Society that Dr. Henry W. Cattell on February 13, 1896, exhibited the first pictures made with the mysterious ray discovered by a previously unknown German physicist, Wilhelm Conrad Roentgen. Those of us who gazed wide-eyed on the incomprehensible photographs of the bones of the hand, of needles stuck in a piece of liver, of the bones of a mouse, had not the faintest idea of the significance of the discovery. We did not dream that the X-ray would rank with anesthesia and with antisepsis as one of the high towers in human progress; that it was destined to reveal the interior of the body during life, to be

a curative agent of immense power, and an open sesame to the hidden structure of matter. It is interesting that in the discussion the prediction was ventured that it might eventually be possible to make pictures in three or four minutes and that a proper X-ray outfit would probably cost $50. The fact is worth mentioning that Professor Goodspeed of the University of Pennsylvania was the first to carry out experiments with the X-ray in this country.

One of the most delightful features of the Pathological Society prior to the Great War was the Annual Conversational Meeting. At these meetings, at first there were two a year, in later years one, an invited guest or a member on invitation read a significant paper which in the earlier days was always freely discussed. Later there was no discussion but a reception to the speaker followed. I still recall the first Conversational Meeting I attended. It was before I had achieved membership in the Society. My late friend Dr. Louis Jurist had invited me to accompany him. He called for me, but as I was leaving the house a man came with a note from the Northern Dispensary, to which I had just been elected, requesting me to see his wife on Ogden Street near 11th Street. I wanted to go at once, it was my very first call, but Dr. Jurist after a few words with the husband concluded that the case was not an urgent one and insisted that I go with him. The speaker of the evening was Dr. John Guiteras. I listened with a divided mind to his address on Yellow Fever and reluctantly went to the University Club to pay my respects to my teacher in pathology. Unable to find peace I decided to leave. Dr. Jurist went with me to Ogden Street. I found the patient sitting at a table drinking beer. When I asked her what troubled her, she told me that her head itched. A quick glance showed that the hair was inhabited by a multitude of tiny greyish denizens. You can imagine my feelings.

An important annual event in the Society's life is the presentation of the William Wood Gerhard medal. This was established at the suggestion of Dr. E. B. Krumbhaar by the descendants of Dr. Gerhard, who as already mentioned was the first president of the earlier Pathological Society. It was fitting that the first recipient of the medal should be William H. Welch, whose address on the occasion of the presentation was appropriately on typhoid fever. The address was a masterly effort, unusual in its command of the history of the subject as well as in the exhibition of a well-nigh unequaled memory.

There has been a tendency during the last two decades to subordinate morbid anatomy as a discipline in medical schools and hospitals. Students seem to be indifferent to it and hospital

internes do not attend autopsies as diligently as in an earlier day. During my residentship, when the indiscriminatingly bibulous Louis the Frenchman went through the corridors of the Philadelphia General Hospital calling "Post, Doctor," we all rushed to the autopsy room to watch Dr. Guiteras or Dr. McFarland perform an autopsy. This "pathological" eagerness continued for a score of years and then gradually disappeared. What are the reasons? One is that the majority of present-day pathologists are not greatly interested in clinical medicine and but rarely in physical diagnosis. They are therefore much less likely to associate the lesions found with the symptoms and signs during life. A second reason is the growing importance of biological chemistry. This prodigious science gives us an ever-increasing insight into normal and pathological physiology and appears to many to render pathological anatomy superfluous. A similar attitude is created by the third factor, namely, the X-ray. Unquestionably we are able to ascertain many anatomic facts by this means during life, and this causes the student to think that it needs no pathologist to come from the dead-house to tell him what he already knows. Notwithstanding these advantages I feel after an early training in pathology and after many years of teaching and practice and observation that no one can become a competent diagnostician who does not test his skill either at the operating or at the post-mortem table. Pathology it seems to me is still the best portal of entry into clinical medicine. Without it physiologic thinking, the best basis for understanding the processes and the course of disease, is impossible. That is why I hope that the Pathological Society while advancing with the times into the biochemical, hormonic and allergic fields will not depart entirely from the principles laid down by its founders, namely, to cultivate morbid anatomy.

I cannot help feeling a sense of regret that we of today, at least in this country, set so little store by a good literary style. Reading over the early volumes of our Society's *Transactions* gave me keen pleasure, for even a trivial report is couched in polished English. What is the reason for this decline in taste observed in our medical journals and in the examination papers and histories prepared by students and internes? There is a distinct difference between an article in an English medical journal and, barring rare exceptions, an article in an American journal of corresponding dignity. The same difference is noticeable in our earlier and later *Transactions*.

There are no doubt many causes for the decadence in style, but one stands out preeminent: the neglect of the teaching of good

English in the primary and secondary schools. The reform so much to be desired must begin at the bottom.

The Pathological Society has always been the young man's Society. Here most of us first dared to appear in public and here we always received a considerate and courteous hearing. Even as internes we occasionally had the opportunity of presenting specimens. Every official meeting at 13th and Locust Streets was followed by an adjourned and unofficial session at the University Club at 1510 Walnut Street and later, when the Society had moved to 22nd Street, the "private meetings" took place at the Rittenhouse Hotel. At these sessions with the frothy infusion of the hop as nectar and with pretzels and cheese for ambrosia, the young aspirants for professional honors discussed medical, scientific and literary subjects for an hour or more and cemented those fine friendships that have given to medical life in Philadelphia its greatest charm.

A number of popular members of the group are dead: Samuel Kneass, highly cultured and a capable but dilettante bacteriologist; Joseph Sailer, honorable, studious and with a refined taste in literature and art; handsome A. O. J. Kelly, one of the most promising of the group, cut off in his prime by diabetic coma in days before insulin. Two other men are no longer with us though still in the land of the living: brilliant Alonzo E. Taylor in whom speech could not keep pace with speed of thought, and gigantic, philosophic David Edsall to whom we looked up in a double sense.

Fame is evanescent. I often refer in my lectures to the great men of my student days, only to find that my auditors look blank. The men who were the giants of our youth are forgotten. Immortality is hard to achieve. It is rarely achieved consciously. The villian who tried to do so by burning the Temple of Ephesus remains unknown. Few of the early members of our Society are now more than names, if that, to the present generation, but while they lived they worked industriously and joyously to advance the young science of pathology and the still younger one of bacteriology. There is just as much to be done now as there was fifty or seventy-five years ago, only the point of departure is changed. The number of things unknown is infinite and no matter how much we take away from infinity, infinity remains. We may wonder and may smile at our "pathological" forbears for not realizing that tuberculosis, diphtheria, malaria and pneumonia were due to living organisms, but what will they who follow us say at the Centenary Celebration of this Society about our own psychic blindness in not

discovering the cause of high blood pressure, of cancer, of leukemia, of pernicious anemia, all of which may lie just around the corner.

Bernard Shaw says in one of his inimitable letters to Ellen Terry: "I like the state of becoming, with a goal in front and not behind." Let that be the motto of our Society—let our future be in front and not behind.

THREE QUARTERS OF A CENTURY OF MEDICAL PROGRESS [1]

Seventy-five years ago the status of medicine was not brilliant. Medicine had not yet fully emerged from the speculative era and lacked the foundations upon which to build a real science of medicine, namely, a knowledge of causes. Pasteur was at work, but his researches had not yet greatly fructified the medical field. Nevertheless, an industrious, reticent Scotch Quaker was thinking and a young German country doctor was also thinking along new lines. These men, Lister and Koch, with Pasteur, inaugurated the new era in which to this day we have our being. We are not content with a mere study of symptoms; we are not satisfied to classify diseases on superficial landmarks as was done by that medical Linné, Sauvages,[2] and by his followers. We look for causes and are rarely willing to call a disease an entity unless we have fathomed its cause, though not necessarily its specific cause. That rational attitude we owe to Pasteur and to Koch.

In the period with which we are concerned many causes of disease were discovered—of anthrax, of wound infection, the septicopyemia of older writers, of cholera, tuberculosis, tetanus, meningitis, pneumonia, malaria, syphilis, African sleeping sickness and a number of others. In the first flush of enthusiasm created by these epoch-making discoveries the germ was raised to an all-important position as practically the sole factor in disease. But in recent times the older idea of constitution has again come into medical consciousness. The germ is necessary, but it can only grow if it falls on proper soil. While much nonsense is written about the soil—the human constitution—nonsense that is reminiscent of the notions of the phrenologists, Gall and Spurzheim, the subject is one of vital importance deserving careful study if we are to understand and to master infectious and other diseases.

In the time under review medicine more than ever has shown its catholicity. It has borrowed from the exact sciences all the discoveries that could help in the study and treatment of disease. The

[1] Reprinted from the Scientific Monthly, February, 1936, Vol. XLII.
[2] Sauvages enumerates 2,400 different diseases arranged botanical-wise into classes, orders, genera and species.

triumphs of chemistry have changed the practice of medicine in a way that was far beyond the dreams of Mendeléeff and Lothar Meyer, when in 1869 they announced their fertile generalization of the periodicity of the elements.

Chemistry has revealed to us facts of enormous importance about the composition of the blood. Blood chemical studies are now routine procedures. In my early days the blood was practically untouchable. We bled patients occasionally for the relief of shortness of breath, of cyanosis, in apoplexy, in uremia and eclampsia, but not for the purpose of ascertaining how much sugar, urea, calcium, phosphorus, etc., might be present. It was first necessary for the chemist to discover methods of making these tests without the necessity of abstracting too large amounts of blood. And, marvels of marvels, in recent times methods have been devised of making these tests with mere drops of blood. Blood cultures and Wassermann and agglutination tests, though of a different genre, may be mentioned in this place.

While organic chemistry may be said to have had its birth in 1828 when Woehler synthesized urea, its greatest triumphs fall largely in a more recent period. At first analytical, chemistry soon became synthetic, its magical activities resulting in the preparation of dyes and drugs and of substances which were supposed to be produced only in the laboratory of nature, like adrenalin and some of the vitamins. Among the triumphs of chemistry is the discovery of hormones, the impetus for which was given by Bayliss and Starling in 1902. Not only are the hormones of great importance in nearly all vital processes, but they also show us with what minute quantities nature can work large results. That amazing little organ, the pituitary body, practically of no known significance in 1860, is capable of secreting at least eight different active substances,[3] among which those concerned in the sexual cycle are the most recently discovered. The discoveries are coming so rapidly that it is difficult to keep them in order in one's mind. How little we dreamt that the pituitary gland played so important a role in the sex life. Perhaps investigators are complicating the subject by postulating so many interacting hormones—nature, after all, may work more simply. The small parathyroid glands, which until 1880 were overlooked, are also marvelous; they control to a large extent the calcium metabolism of the body. The use of hormones as therapeutic agents has been another tribute to the immense power of chemistry. Collip's discovery of antihormones, while at first

[3] Dodds and Noble (Nature, May 11, 1935) have described a new substance obtained from the posterior lobe which is capable of inducing macrocytic anemia and gastric hemorrhage in rabbits.

confusing the picture we had formed, may help us to explain a number of obscure facts.

To the triumphs of chemistry belongs chemotherapy, the synthetic production of powerful therapeutic agents with which the name of Paul Ehrlich is indissolubly connected. That chemistry has also given us poisonous gases and powerful explosives is but another illustration of the Ormudz and Arhiman principles in human affairs.

Some of the great discoveries of chemistry do not seem to have an immediate application to medicine, but that does not prevent their possible usefulness in the future. Heavy water containing hydrogen of atomic weight 2 and 3 may have biologic properties. It has forced us to give up the original idea of the immutability and unitary character of the chemical elements. The 92 are now represented by about 250 isotopes, many of which may play a rôle in life's processes. The last few years have also witnessed the discovery of a number of elements previously missing from the periodic table, so that the list of the 92 is almost complete; and if the work of the young Italian physicist Fermi is substantiated, there may be 93 elements, perhaps more, these last comers being, however, artificially produced.

One other chemical triumph should be mentioned, namely, the discovery of vitamins. Their existence was first suggested in 1841 by Dr. G. Budd, an American physician, but his suggestion bore no fruit. Sir Frederick Gowland Hopkins, Mendel, Eijkman, Fraser and Stanton, Hess, McCollum, Mellanby, Chick, Windhaus, are some of the men and women to whom we owe knowledge of these subtle substances which in infinitesimal amounts exert their indispensable action on the body. One ten-thousandth of a milligram of calciferol added to an inadequate diet will sustain the life of a rat that would otherwise succumb on such a diet. This is a further illustration of nature's sparing ways. One might almost be inclined to think that these facts justified Samuel Hahnemann.

The beneficial effects of sunlight on the human body, known from time immemorial, find their explanation, in part at least, in the power of the ultra-violet rays to activate certain vitamins otherwise inactive.

The isolation and synthesis of various hormones and vitamins by laboratory workers has been a steady aid to therapeutic advance. It was only after the chemistry was known that the close chemical relationship of many of these vital substances was fully realized. They seem to be formed in nature, almost as if on some chemist's plan, out of the same molecular brickwork.

Practically within the last year it has been shown that substances no less important to the body than cholesterol, vitamin D, the female ovarian hormone, the male testicular hormone, the embryonic organizer hormone (on which Needham has done such startling work), the bile acids and the cardiac stimulants, such as digitalis, are compounds built around the phenanthrene nucleus. Phenanthrene and its isomer anthracene consist of three linked benzol rings and are common constituents of coal tar. Their interest for us until recently was chiefly as the chemical keystones of the dyestuff industry.

It was not long before an even more provocative discovery was made. By laborious processes of purification and analysis it was found that the potent cancer-producing substances in tar had the same structural foundation as this group of vitamins, hormones and bile-products. These researches make it both easy and attractive to think of cancer as some profound metabolic disturbance of cholestoral and bile-acid chemistry.

Medicine has also made use of the advances of physics, the most important in this field being the X-ray. Perhaps this is the most important of all discoveries applied to medicine in modern times. I need not dwell upon the significance of Roentgen's discovery. In diagnosis it is indispensable; in treatment it is of great service. Since 1913 when its nature as a form of radiation was revealed, it has given us an insight into the atom and enabled Moseley to arrange the elements in regular order and to explain the mystery of the periodic table. The work of Laue, the Braggs and others with the X-ray has shown that nearly everything in nature is in the last analysis crystalline and every substance liquid or solid reveals to the X-ray the characteristic arrangements of its constituent atoms and molecules.

To the great discoveries in physics of which medicine makes use belongs that of radium by the Curies in 1898. In radium and in the X-ray we have two powerful therapeutic agents, the usefulness of which is destined to increase with time. The discovery of radium and of radioactive substances, some of which are now made artificially, has changed completely the course of physics—that science today speaks another language. We may confidently expect that some of its progress will redound to the advantage of medicine.

While the other fundamental discoveries of the physicists, the structure of the atom by Bohr, the mysterious constant of Planck—the quantum—the transmutation of the elements by Lord Rutherford, relativity by Einstein, and wave-mechanics are as yet of no immediate benefit to medicine, no one can say that they may not

be. Witness the radio. The cosmic rays discovered by Wulf, Gockel, Hess and Kolhörster, and intensively studied in this country by Millikan, Compton, Swann, Johnson and others, seem to pass through us without our being aware of it. While the penetrating power of the cosmic ray is greater than that of any other radiation known, only a very few fall upon each individual day by day. Whether or not they produce any effect is beyond our present knowledge.

I shall now take up matters more strictly medical. When Meyer of Copenhagen made the discovery of the significance of adenoids, he thereby laid the foundation not only of children's health but also of many medical fortunes.

I have spoken of the work of Pasteur, Lister and Koch. I need not dilate upon its transcendent importance for medicine and surgery. Although Ephraim McDowell performed the first ovariotomy in 1809, such operations were few and far between until the era of antisepsis. The first appendectomy in this country was done in 1864 by Willard Parker, but not until Reginald Fitz of Boston wrote his classical paper on "Perforation of the Appendix," did the operation of appendectomy, so life-saving and so profitable for the surgeon, come to be an everyday event.

But surgery has other triumphs. The gall bladder is no longer the *noli me tangere* that it was in the days of my youth. The Graham-Cole test of cholecystography has given to the operation a much surer basis than it had before.

Urology, formerly a minor and hardly respectable specialty, has in our time become an important scientific branch of surgery, the devotees of which have cause to be proud of what they have achieved in hardly more than a generation. Here, too, the X-ray has been of signal service as well as several special chemical tests discovered within the twentieth century.

From the end of the eighteenth century onward we find occasional suggestions in the literature that diseases might be conveyed by insects, but it remained for our own time to prove this, with results beyond all expectations. Beginning with Manson's discovery in 1879 of the transmission of filariasis by the mosquito, we have that of Theobald Smith of the tick transmission of Texas fever of cattle, in 1892; three years later Ronald Ross discovered the malaria organism in the mosquito; in 1899 Reed, Carroll, Lazear and Agramonte demonstrated the mosquito transmission of yellow fever, the ulterior consequences of which were the Panama Canal and the disappearance of yellow fever from Central America and from the islands to the south.

The part played by the louse in typhus transmission so dramatically portrayed by Zinsser is a fact acquired at a somewhat later time. In a number of other diseases such transmission is suspected but not proved.

Viruses as a cause of disease were not known fifty years ago. They were discovered at the end of the nineteenth century. To the virus diseases belong smallpox, vaccinia, psittacosis, infantile paralysis, lethargic encephalitis, foot and mouth disease, also probably chicken-pox, yellow fever and herpes, as well as a number of diseases of animals. There is still a good deal of discussion as to the nature of viruses. They are much smaller than bacteria—the virus of poliomyelitis is estimated at 10 mμ, which approximates the size of a protein molecule.[4]

The viruses are filtrable and with few exceptions are invisible with the microscope. So small are they that the question has arisen whether they are really organisms at all. Some believe that they originate in the host, but the best recent authorities are of the opinion that they are self-propagating microorganisms.

A filtrable agent in many respects resembling viruses of animal diseases is the bacteriophage discovered independently by Twort and by d'Herelle.

Great advances have been made in our knowledge of the physiology of muscle and nerve. Since DuBois Reymond it had been customary to regard a nerve as a mere wire, passively transmitting electrical impulses to various organs and muscles. Its only intrinsic property was thought to be resistance to this current, as shown by a wire. Since the turn of the century the work of Parker, Hill, Gasser, Gerard and others has changed this notion completely. The nerve is not passive, but has a very small but essential metabolic activity. It exhibits no resistance to impulses but indeed propagates these electrical waves itself. Dale and Cannon have amassed much evidence to show that these impulses act only indirectly on a muscle or gland, through the liberation of some chemical substances, acetylcholine and sympathin, at the site of the nerve endings. Accordingly, as the nerve fibers produce acetylcholine or adrenalin-like substances, Sir Henry Dale speaks of them as cholinergic and adrenergic.

Not only has the newer nerve physiology revealed electrical activities and chemical changes in nerves carrying impulses that were scarcely suspected a few years ago, but lately by ingenious apparatus electrical forces have been revealed in the living brain.

[4] One mμ equals one millionth of a millimeter. The smallest bacteria have a diameter of 750 mμ.

It would appear as if all vital processes were in the last analysis electrical.

Cerebral localization has been greatly advanced since the days of Broca. This has led to earlier diagnosis of brain lesions and the more successful surgical treatment where such treatment is indicated.

A striking reversal in ideas has also occurred in our explanation of muscle contraction. The energy for muscle activity was produced, so our fathers thought, by the burning of sugar to lactic acid and carbon dioxide. Now we know that the energy of these reactions is produced as heat several seconds after the actual contraction is over. Where, then, does the energy come from which we can transform into muscular work? A large number of substances take part in the process. The following polysyllabic compounds have been found: Hexose diphosphoric and monophosphoric acids, glycerophosphoric acid, phosphoglyceric acid, adenylic acid, phosphoric and pyrophosphoric acids, phosphagen or creatine phosphoric acid, pyruvic acid, methyl glyoxal, glyceraldehyde, dihydroxyacetone, and the end is not yet.

Great advances have been made in our knowledge of the ductless glands; I have already mentioned the pituitary and the parathyroid. It is a revelation to read a text-book of today and compare its chapter on the ductless glands with one of fifty years ago. In the case of the thyroid, the adrenals, the pancreas and the sex glands, as well as in that of the pituitary and the parathyroid, our knowledge has been revolutionized. We have hypo-, hyper- and dysfunctioning with characteristic clinical pictures and we have methods of treatment that were not dreamt of fifty years ago. I would not deny that some enthusiasts are "a-babbling of green fields," justifying perhaps David Marine's saying that "endocrinology is endocriminology," but on the whole we are on solid ground.

From the point of view of public health several facts are of transcendent importance: Filtration of water, which has reduced and almost eliminated typhoid fever and the intestinal diseases of childhood; control of hookworm disease, of malaria, of pellagra and yellow fever. Nothing is more inspiring than the campaign against tuberculosis. In the case of typhoid fever and diphtheria, vaccinations, immunization and the Schick test have added themselves to the general hygienic measures to reduce these diseases almost, if not quite, to the vanishing point.

The health of the school child has become the concern of the community. Prenatal care likewise is an advance that has come within the memory of men now living. It seems that we have advanced immensely in everything that concerns the protection and

prolongation of human life, except in our political economy and in the abolition of war. The political doctors in control of our national health up to a recent time have neither correctly diagnosed nor adequately treated the sick body-politic. Nor have these same statesmen used prophylactic measures they might well borrow from medicine for the prevention of war.

The Spanish-American war brought in its train a terrible epidemic of typhoid fever but also and as a consequence a totally altered status of the army doctor. Line officers who had looked with contempt upon the "Saw Bones" of the Army realized that the modern doctor knew more of sanitary science than the General, and that by accepting his advice the health of the army would be preserved. This change in attitude was certainly noticeable in the Great War.

In treatment the advances have also been breath-taking. I have alluded to antitoxins; many coal-tar products have been discovered that are useful in relieving pain—we can scarcely do without them. We have salvarsan and other chemotherapeutic agents, insulin for diabetes, and liver therapy in pernicious anemia, a disease that until 1926 had proved invariably fatal. It would appear that the active principle or principles upon which the efficacy of liver depends will soon be isolated—another triumph of modern chemistry.

Blood transfusion should be mentioned in this connection. It is an old method, but it fell into disuse because of its dangers. But since Landsteiner's fundamental discovery of blood groups and through a number of technical advances, the dangers have been so minimized that blood transfusions are daily occurrences in large hospitals.

One of the most important contributions to scientific treatment is the concept of focal infection. While there are obscure references to the subject in the writings of the French surgeon Petit and in those of our own Benjamin Rush, it was not until Frank Billings and Edward C. Rosenow developed the idea that it became part of medical consciousness. It must be admitted that millions of sound teeth have been sacrificed on the altar of focal infection and many other unnecessary operations and procedures have been done, but that does not lessen the value of this great American contribution to medical practice.

There is one therapeutic advance which came about so gradually, so undramatically, that it might easily be overlooked. It is the disappearance of the nauseous polypharmacy that had been bequeathed to us by the Middle Ages. To be just I must give credit for this largely to the disciples of Samuel Hahnemann. Homeopathy has had a totally negligible share in the progress of scientific medicine,

but the palatability of its drugs, whatever their actual efficacy, has greatly influenced the art of prescribing of the regular profession.

Technical advances are legion and have redounded to the special advantage of medical diagnosis and of surgery. There are, for example, the methods of removing foreign bodies from the air passages, means for the inspection of internal cavities, the blood pressure apparatus, the electrocardiograph, the basal metabolism apparatus, and many others.

The study of reflexes, which is of incalculable value in the diagnosis of nervous diseases, is something that has come into use in the last half century.

Advances that can scarcely be overestimated have been made in anesthesia. In my early days the anesthesia was nearly as dangerous as the operation itself. Now all that is changed. In addition to ether and chloroform, the latter rarely used in this country, we have new chemical anesthetics as well as gas anesthesia, spinal anesthesia, local anesthesia with cocaine and its derivatives, and infiltration anesthesia, which since it was first proposed by Schleich in 1890, has come into greater and greater use.

Unfortunately there remain a number of diseases that are as recalcitrant to treatment as ever—leukemia, multiple sclerosis, paralysis agitans, cancer of internal organs and Hodgkin's disease.

I am not sure whether the addition of new diseases can be considered an advance. Nevertheless, the recognition of such diseases is creditable to medicine. It is not necessary to mention all the diseases that have been added to our nosology in the last seventy-five years. I shall name only a few—Vincent's angina, trench fever, infectious jaundice, paratyphoid fever, botulism, undulant and abortus fever, lethargic encephalitis, tularemia, psittacosis, pneumoconiosis, agranulocytosis, infectious mononucleosis, coccidioides granuloma, and acromegaly.

Psychiatry or the study of diseases of the mind was one of the last branches of medicine to feel the beneficial effects of modern science. Living in a cloistered atmosphere the psychiatrist was concerned mainly with classifying mental diseases and administering such meager treatment as he knew. On the outside, *fuori le mura,* men were busily studying the mind by new methods, and these methods have done more to clarify the activities both of the normal and of the diseased mind than all the studies since the days of Benjamin Rush, the first American to concern himself with mental aberration. The work of Freund, Jung, Adler, Alexander, whatever one may think of its therapeutic value, is beyond doubt of enormous significance for the understanding of the normal and

abnormal human psyche. And the terminology created by psychoanalysis—complexes, inhibitions, frustrations, superego, sublimation—has become an integral part of all civilized languages. General literature has absorbed the newer ideas and industry has applied them to its workmen, the army to its soldiers, and colleges to their students.

Perhaps the greatest advances of all have been in the domain of medical education. The extension from a two years' course or the apprentice system to a three years' course and eventually to a four years' course, the disappearance of proprietary schools run for profit, the internship, the laboratory, state boards of examiners—all these advances have been of immeasurable benefit to medicine and to the public weal. Belonging to the same category are the great research institutions of which the Rockefeller Institute for Medical Research is an example. The Mayo Clinic, a typical American product and deserving to rank as the eighth wonder of the world, has also been an important factor in medical education.

In the education of medical men the medical journal occupies a prominent place. There are too many journals, but on the whole that is a lesser fault than too few. The American Medical Association and its *Journal* have been important factors in improving medical schools and in educating students and physicians.

I have one complaint to make with regard to medical education—it takes too long. I do not mean to say that the medical course itself is too long or that one or two years' internship should be shortened or abandoned; it is the pre-medical course that takes too long. At the present time a student rarely enters the practice of medicine before he is twenty-eight or twenty-nine years of age and it takes a few years thereafter for him to make a livelihood. This imposes a great burden upon the parents. The principal way of shortening this is to speed up primary and secondary and college education. The study of medicine should be begun at not later than twenty—Laënnec began at fourteen and a half years. There is no reason why the college course could not be shortened to three years, and the high-school course also.

I can not refrain from saying a word about the full-time system of clinical teaching, the introduction of which into medical education we owe to Abraham Flexner and the late William H. Welch. The ideal underlying this plan is certainly correct, namely, that the teachers of medicine should give a large part of their time to the job of teaching. When many of us were in medical schools, the professor of medicine and the professor of surgery were busy practitioners and had little time for their pedagogical duties. It is

a question, however, whether the extreme academic method advocated by some educators is the best. At any rate, there should be on every faculty a group of clinical teachers who are practicing extramurally and can bring to the student a point of view that no intramural teacher can bring. Such clinical teachers should have proper faculty standing and academic honors as well as salaries commensurate with their abilities. Such men whom we might call part-time teachers are necessary if the student is to get a complete picture of medical practice.

Trained nursing belongs to the advances of medicine. Trained nursing had its origin in Germany, was improved in England and perfected in this country, where it began but little over fifty years ago, yet it has achieved triumphs beyond all expectations. No one can dispute the statement that the American trained nurse has no superior anywhere in the world.

Social service is also a medical advance belonging to our time. It is an indispensable adjunct to medical treatment in hospitals and out-patient departments.

Besides the trained nurse and the social worker there is a third female adjunct to medical practice that did not exist in the last century, namely, the technician. If it were not for her the time-consuming laboratory studies that are now so universally made would not be possible, for the doctors never could find time to do them. Furthermore, much of the research work would be hampered if there were not technicians to do the simpler things.

Seventy-five years ago there were two branches of medical practice—medicine and surgery. The surgeon did everything that could be done with the knife and the medical man did everything else. Both did obstetrics and the surgeon usually also practiced medicine. The first specialist probably was the ophthalmologist and he was looked down upon as being unethical. What a change has come over the picture. Medicine is split up into almost countless specialties, each one organized into a closed society, each one with journals and text-books of its own, each one thinking that it is the most important branch of medicine, and each more and more ignoring every other department of the healing art. While in a sense such splitting up is regrettable in that it narrows medical practitioners, nevertheless it has resulted in great advances. The most recent split-ups are cardiology, allergy and angiology or diseases of the blood vessels. None of them is really a specialty; it should be understood by every practicing physician, but because men have devoted themselves exclusively to them, advances have been made that could not well have been made otherwise. The

analytical process, I believe, will go on, for synthesis is not possible, the individual fields are too vast.

A subject that is probably as old as the practice of medicine itself is that of medical economics. Yet at no time in history has it occupied so prominent a place either in medical consciousness or in the lay mind as now. Should I include it among the advances of medicine? The answer depends on our point of view, whether we are social-minded or individualistic in our *Weltanschauung*. It would carry me too far afield if I were to discuss this subject, which seems to have divided the medical profession as states rights and slavery divided our nation seventy-five years ago. Perhaps it will require something like a civil war—of words and ideas—to settle the question, and when settled the outcome may perhaps be ranked by future historians among the greatest advances of all in medicine.

THE OLDEST MEDICAL SCHOOL IN AMERICA[1]

History is a continuous process, and just as we human beings all go back through countless generations to remote and remoter ancestors, so institutions have their parents, grandparents and great-grandparents, until we come to a past that is unrecoverable. Our American institutions of learning have a European ancestry. Where that begins history rarely tells us. There was to be sure Salerno, Bologna, Paris, Oxford, Cambridge,—to them our own hark back, losing much picturesqueness and power in the descent but gaining some things needed for a new country. It can be said truthfully that Paris is the Mother of European and American universities. Our American medical schools, however, can trace their ancestry more immediately to the University of Edinburgh, which was taken as the pattern for the first American school of medicine.[2]

Before the founding of medical colleges in North America young men desirous of learning physic either went abroad to Edinburgh, London, Leyden, etc., or when they did not have the means, apprenticed themselves for a number of years, usually six, to some practitioner of repute in the colonies and at the expiration of the term of their indenture began practice on their own account. There were practically no laws as to who could or could not practice. It has been estimated that at the outset of the War for Independence there were upward of 3500 practitioners of medicine in the colonies of whom not more than 400 had received medical degrees.

The earliest law in which a distinction is made between those who had received a diploma in medicine and those who had no degree was passed by the Virginia Assembly in 1736. "Surgeons and apothecaries who have served an apprenticeship to those trades" were to charge at one rate, and "those persons who have studied physic in any University, and taken any degree therein," were permitted to charge at a higher rate.

[1] Address delivered by invitation before the Medical Society of the County of Kings, Brooklyn, New York, December 20, 1932.
Reprinted from the General Magazine and Historical Chronicle, April, 1936.

[2] The University of Mexico antedates any other American institution of learning. It was established in 1555.

Colonial medicine probably was at a higher level in Philadelphia than elsewhere, Boston alone excepted, because William Penn had brought with him, or had caused to follow him, a fine group of medical practitioners largely belonging to the Society of Friends. The first one was Dr. Thomas Wynne, who was on the *Welcome* and during the voyage had a difficult task as smallpox broke out among the crew and passengers shortly after their embarcation. Wynne apparently did not practice medicine after his arrival but entered public life, becoming Speaker of the First Provincial Assembly. His son-in-law Edward Jones, was a famous physician and the latter's son and grandson in turn distinguished themselves as medical practitioners.

Another passenger on the *Welcome* was Griffith Owen, like Wynne, a Welsh doctor. Penn speaks of him as "tender Griffith Owen who both sees and feels." Owen was the chief medical practitioner in Philadelphia and also acted as a preacher among Friends.

Dr. John Kearsley, who arrived in 1711, not only was an active practitioner and medical preceptor, but he had much to do with the building of Christ Church and perhaps also with St. Peter's Church in Philadelphia. Among his medical pupils were a number of distinguished men—Lloyd Zachary, Thomas Cadwalader, William Shippen, Senior, the two Bonds, Cadwalader Evans, John Redmond, John Bard and John Kearsley, Junior, his nephew. These were the first native-born physicians of importance and played, one and all, a leading role in developing medical education in this country. They learned medicine by long apprenticeship which was no sinecure, but often involved the hardest kind of work. The pupil usually lived with his master and was constantly subject to his orders. Dr. John Bard (1716-1799) was often heard to say that he would never have submitted to the indignities of the apprenticeship (he was apprentice to John Kearsley, Senior) "but from apprehension of giving pain to his excellent Mother and the encouragement he received from her particular friend Mrs. Kearsley." Dr. Bard, a native of Pennsylvania, subsequently settled in New York, where his son Samuel Bard became one of the founders of the medical school of King's College, the precursor of the College of Physicians and Surgeons of Columbia University.

Dr. Thomas Graeme, who arrived in 1717, was an English Episcopalian whose coming, as Middleton (*Annals of Med. Hist.*, vol. 3, 391) points out, marked essentially the passing of the Welsh Quaker regime in Philadelphia medicine. Graeme after a long career in medicine became a Justice of the Supreme Court of the State.

There were no systematic courses of lectures or demonstrations for young apprentices unless they happened to live in Philadelphia, Boston or New York. It appears that Dr. Cadwalader Colden made the first attempt to establish systematic courses of lectures in the colonies in New York, about 1717—with what success is not recorded.

The first course of systematic anatomical lectures was announced by Dr. Thomas Wood on January 17, 1752, in the *New York Weekly Postboy,* but whether this course was actually given and if so for how long is not known.

As early as 1730, however, Dr. Thomas Cadwalader (1708-1779), who had studied anatomy in London under Cheselden, gave a series of practical demonstrations in anatomy to a number of physicians in Philadelphia. Cadwalader is also remembered as the author of one of the first medical publications in America. In 1745 appeared his famous essay "Of The West India Dry Gripes with the Method of Curing that Cruel Distemper to which is added an extraordinary Case in Physic. Printed and sold by B. Franklin, 1745." The extraordinary case referred to in the title was one of osteomalacia; the dry gripes, very prevalent in Philadelphia at the time, was lead poisoning, acquired by drinking Jamaica rum. This beverage had become contaminated with lead derived from the leaden pipes used in its distillation.

A more ambitious and historically more significant effort was begun in 1762 by William Shippen, Jr., with a course of lectures in anatomy. Shippen's announcement in the *Pennsylvania Gazette* of November 25, 1762, soon after he had returned from Edinburgh read as follows: "Dr. Shippen's Anatomical Lectures will begin tomorrow evening, at six o'clock at his father's house in Fourth Street. Tickets for the course to be had of the Doctor, at five Pistoles each, and any gentlemen who incline to see the subject prepared for the lectures and learn the art of Dissecting, Injections, etc., are to pay five Pistoles more." [3] The number of students who attended his lectures was twelve.

On one occasion Dr. Shippen was nearly mobbed by an angry crowd that suspected him of body snatching. This occurrence led to the following announcement in the *Pennsylvania Gazette* of October 31, 1765:

"It has given Dr. Shippen much pain to hear that notwithstanding all the caution and care he has taken to preserve the utmost decency in opening and dissecting dead bodies, which he has persevered in chiefly from the motive of being useful to mankind, some evil-minded persons, either wan-

[3] Six pistoles were equal to $20.

tonly or maliciously, have reported to his disadvantage that the has taken up some persons who are buried in the Church Burying Ground, which has distressed the minds of his worthy Fellow Citizens. The Doctor, with much pleasure, improves this opportunity to declare that the Report is absolutely false, and to assure them that the bodies he dissected were either of persons who had wilfully murdered themselves, or were publickly executed, except now and then one from Potter's field, whose death was owing to some particular disease, and that he never had one body from the church or any private Burial Place."

The lectures in anatomy by Shippen were in full operation when in 1765 there returned from Europe a man whose name should be remembered above all others in the history of medical schools in America, John Morgan.

On account of his historic importance a few biographic data will not be amiss. Morgan was born in Philadelphia in 1736 and received his A.B. degree in 1757 from the College of Philadelphia, in the first class graduated. He studied medicine with Dr. John Redman and afterwards entered the provincial army as a surgeon. This was at the conclusion of the French war which terminated by the expulsion of that nation from Canada. In 1760 he sailed for Europe with a view of perfecting his medical education. In London he studied under the Hunters and Hewson. He was graduated with the degree of M.D. from Edinburgh in 1763 with a thesis on the formation of pus which was dedicated to the Medical Society of Edinburgh. He was elected a member of the Royal Society of London, a Licentiate of the College of Physicians of London, and a member of the College of Physicians of Edinburgh. While traveling in Italy he visited the great pathologist Morgagni at Padua who inscribed for him a copy of his works fully believing, according to a doubtful legend, that Morgan was one of his relatives. These books are now in the Library of the College of Physicians of Philadelphia.

While in Edinburgh and studying under the famous Dr. Cullen, he conceived the idea of establishing medical teaching in the colonies. In a letter written on November 6, 1764, to Dr. Cullen he remarks: "I am now preparing for America, to see whether, after fourteen years' devotion to medicine, I can get my living without turning apothecary or practitioner of surgery. My scheme of instituting lectures you will hereafter know more of. It is not prudent to broach designs prematurely, and mine are not yet fully ripe for execution."

It is necessary that I say something about the school of which the medical department became an integral part.

The Academy and Charitable School was one of the many institutions created by Benjamin Franklin in Philadelphia.[4] In 1749, with a distinguished Board of Trustees, he launched forth the enterprise that subsequently became the University of Pennsylvania. Among the trustees were four physicians who evidently were men of wealth, for they subscribed liberally to the undertaking—Lloyd Zachary promised 20 pounds per annum for five years, Thomas Bond 15 pounds, William Shippen 10 pounds, and Phineas Bond 10 pounds. The building in which the school was started had originally been erected on Fourth Street near Arch Street for the eloquent preacher, the Rev. George Whitefield.

On May 3, 1765, shortly after his return from abroad Morgan appeared in person before the Trustees of the College of which he was an Alumnus and presented letters from Thomas Penn and other notables urging the Trustees to accede to Dr. Morgan's request that a Medical College be established. As there were five physicians on the Board, Thomas Bond, Phineas Bond, Thomas Cadwalader, William Shippen, Senior, and John Redman, it was natural that the Trustees should approve the scheme suggested by Morgan. They unanimously elected him Professor of Theory and Practice of Physic, the first medical professorship created in America, May 3, 1765.[5]

At the public Commencement of the College which took place on the thirtieth of May, 1765, Dr. Morgan, who was then but twenty-nine years old, delivered his famous inaugural address, "A Discourse Upon the Institution of Medical Schools in America." It is worthy of note that at the time this was uttered the population of Philadelphia was about 25,000 and that of the colonies less than 3,000,000. The discourse or address is remarkable for its frankness and courage.

In a lengthy introduction Morgan announces that he will confine himself to the practice of Physic and will do no surgery nor put up medicines.[6] As his contemporaries nearly all practiced both

[4] Franklin, although Master of Arts of Harvard, Yale, and William and Mary, Doctor of Laws of St. Andrews, Doctor of Civil Law of Oxford, was never enrolled by the University he founded for any sort of honorary degree.

[5] Much credit for the creation of the school is due Thomas Penn. In his letter of February 15, 1765, to the Trustees, commending to them young Morgan's plans, is found the influential germ from which it grew. An equal share of the honor in this paternity must be given to Dr. Fothergill, the ever faithful friend of the College and of the Pennsylvania Hospital, who in a letter of 1762 to his friend James Pemberton advising him of sending by Dr. Shippen a gift of anatomical subjects and drawings to the Hospital, says "he recommends to Dr. Shippen to give a course of anatomical lectures to such as may attend. He is very well qualified for the subject, and will soon be followed by an able assistant, Dr. Morgan, both of whom, I apprehend will not only be useful to the Province in their employments, but if suitably countenanced by the Legislature, will be able to erect a School of Physic amongst you, that may draw students from various parts of America and the West Indies, and at least furnish them with a better idea of the rudiments of their Profession, than they have at present the means of acquiring on your side of the water."

[6] For this latter purpose he had brought with him from London Mr. David Leighton, a skilled pharmacist and surgeon.

medicine and surgery and compounded their own medicines or had them compounded upon the premises by their apprentices, Morgan's departure was looked upon as highly radical. However, he defends himself most ably. After he had received his appointment he wrote: "As far as I can learn everybody approves of my plan for instituting medical schools, and I have the honor of being appointed a public professor for teaching physic in the college here. Can any man, the least acquainted with the nature of that arduous task, once imagine it possible for me to acquit myself in that station in an honorable or useful manner, and yet be engaged in one continued round of practice in surgery and pharmacy as well as physic?"

"To prepare for a course of lectures every year requires some leisure, and a mind undisturbed with too great variety of pursuits. So that my usefulness as a professor makes it absolutely necessary for me to follow that method of practice which alone appears to be calculated to answer that end." He thus became the first internist in America.[7] He was elected Physician to the Pennsylvania Hospital in 1773 but resigned in 1783, owing to a difference of opinion with the Board of Managers over the charging of fees to patients suffering from venereal disease who were sent to the Pennsylvania Hospital from the Philadelphia Almshouse.

It may be interesting to mention the fact that Dr. John Morgan in 1766 received a gold medal established by John Sargent, Esq., Merchant of London and Member of Parliament, for the best written essay on the reciprocal advantages of a perpetual union between Great Britain and her American Colonies.

In October, 1775, Congress appointed Morgan Director-General and Physician-in-Chief to the General Hospital of the American Army, which proves that despite his loyal prize essay he had cast his lot with the Revolution. Partly because his reforming spirit was in advance of the times, partly because of the machinations of rivals, in particular of William Shippen, Morgan became the subject of hostile criticism which led to his removal by Congress in 1777. He never recovered fully from this humiliation, although Congress in 1779 declared the complaints against him without foundation and accorded him an honorable acquittal. He died childless in 1789 at the age of 54.

Morgan soon after his appointment as Professor of the Theory and Practice of Medicine received a coadjutor in the person of his

[7] Morgan also instituted the English plan of charging a definite fee at each visit, which however failed to meet with popular approval. (Packard, *How London and Edinburgh influenced medicine in Philadelphia in the eighteenth century*, Trans. College of Physicians, 1931, vol. LIII, 151.)

friend William Shippen, Jr., who in September, 1765, had sent a communication to the Trustees reciting his earlier labors and asking to be joined in the new effort. A loyal son of Princeton, he had not before thought of asking to form a new Faculty for the Philadelphia College; but Dr. Morgan as an alumnus and with the powerful endorsement of the Penns had succeeded. Dr. Shippen wrote:

"It is three years since I proposed the Expediency and Practicability of Teaching Medicine in all its branches in this City in a public oration read at the State House introductory to my first course of anatomy. I should long since have sought the patronage of the Trustees of the College, but waited to be joined by Dr. Morgan, to whom I first communicated my Plan in England, and who promised to unite with me in every scheme we might think necessary for the Execution of so important a Point. I am pleased however to hear that you, Gentlemen, on being applied to by Dr. Morgan, have taken the Plan under your Protection and have appointed that gentleman Professor of Medicine. A Professorship of Anatomy and Surgery will be gratefully accepted by, Gentlemen, your most obedient and very humble servant, W. Shippen, Jr." On this being read at a Special Meeting on September 23, 1765, "the Trustees by an Unanimous Vote appointed him Professor of Anatomy and Surgery in this Seminary." He thus became the second member of the Faculty.

William Shippen, Jr., born in Philadelphia 1736, was educated at the celebrated Academy of Nottingham, Maryland. He was graduated from the College of New Jersey, then established at Newark and now known as Princeton University, in 1754. After studying with his father, he went to London in 1757. There he became a pupil in anatomy of John Hunter and was also associated with Dr. William Hunter and Mr. Hewson. He took an interest in obstetrics, attending the lectures of a celebrated accoucheur, Dr. McKenzie, which were delivered at St. Thomas's Hospital. He finally received the doctor's degree at Edinburgh with a thesis on Adherent Placenta. He met Morgan abroad and they both together discussed the plan of establishing a medical school in Philadelphia. It seems that he resented somewhat Morgan's direct negotiations with the Trustees, claiming that three years before he had made the original suggestion for a medical school in the colonies.

To return to the young Medical School. The Medical School of the College of Philadelphia having been founded, announcement was made to the public in the *Pennsylvania Gazette,* September 26, 1765 as follows:

"As the necessity of cultivating medical knowledge in America is allowed by all, it is with pleasure we inform the public that a Course of Lectures on two of the most important branches of that useful science, viz., Anatomy and Materia Medica, will be delivered this winter in Philadelphia. We have great reason, therefore, to hope that gentlemen of the Faculty will encourage the design by recommending it to their pupils, that pupils themselves will be glad of such an opportunity of improvement, and that the public will think it an object worthy their attention and patronage.

In order to render these courses the more extensively useful, we intend to introduce into them as much of the Theory and Practice of Physic, of Pharmacy, Chemistry, and Surgery as can be conveniently admitted.

From all this, together with an attendance on the practice of the physicians and surgeons of the Pennsylvania Hospital, the students will be able to prosecute their studies with such advantages as will qualify them to practice hereafter with more satisfaction to themselves and benefit to the community."

William Shippen, Jr., M.D. "Professor of Anatomy and Surgery in the College of Philadelphia."

John Morgan, M.D., F.R.S. etc. "Professor of Medicine in the College of Philadelphia."

In addition to this general announcement, each professor advertised his own lectures. For two years lectures were delivered by these two professors under the sanction of the College.

In connection with the labors of Shippen and Morgan, Dr. Thomas Bond, one of the physicians of the Pennsylvania Hospital, commenced a course of Clinical Lectures in that institution. These were begun in 1766 and are the first clinical lectures in the history of American medicine.

This brings me to the point where a brief reference to the Pennsylvania Hospital is necessary. By common consent of qualified historians the Pennsylvania Hospital is considered the oldest hospital in what is now the United States of America. Like so many pre-Revolutionary enterprises it was promoted by Benjamin Franklin who had as his associate Dr. Thomas Bond from whom indeed the idea of a hospital originally emanated. Established in 1752, the Pennsylvania Hospital still occupies its original site between 8th and 9th and Spruce and Pine Streets. The first physicians were Thomas Bond, Lloyd Zachary and Phineas Bond.

Arguing in behalf of bedside training for the medical students, Bond says: "There the clinical professor comes in to the Aid of Speculation and demonstrates the Truth of Theory by Facts," and in words that a century and a half later still warrant repetition he declares "he meets his pupils at stated times in the Hospital, and when a case presents adapted to his purpose, he asks all those

questions which lead to a certain knowledge of the Disease and parts Affected; and if the Disease baffles the power of Art and the Patient falls a Sacrifice to it, he then brings his Knowledge to the Test, and fixes Honour or discredit on his Reputation by exposing all the Morbid parts to View; and Demonstrates by what means it produced Death, and if perchance he finds something unexpected, which Betrays an Error in Judgment, he like a great and good man immediately acknowledges the mistake, and, for the benefit of survivors, points out other methods by which it might have been more happily treated." Dr. Bond's advertisement of his lectures contains the following paragraph: "Dr. Bond is requested by the Trustees and Professors to continue his Clynical Lectures at the Hospital, as a Branch of Medical Education judged to be of great importance and benefit to the students." We cannot find, however, that he was formally appointed professor, although he signed the diplomas. He continued to execute the duty of clinical instructor until his death in 1784. Thereafter clinical medicine had no special representative until it was united with the Institutes of Medicine in 1792.

For the further advantage of medical students a course of lectures on natural and experimental philosophy was provided. The lectures were delivered by the Rev. Dr. William Smith, D.D., LL.D., the Provost of the College. The announcement issued at the time explains their nature.

"College of Philadelphia, December 17th, 1767.

At the request of the Medical Trustees and Professors, the subscriber having last winter opened a course of Lectures on Natural and Experimental Philosophy, for the benefit of the Medical Students, which he hath engaged to continue this winter on an extensive plan, notice is hereby given that on Monday, the 28th inst., at 12 oc., it is proposed to deliver the Introductory Lecture at the College. As these lectures are instituted and given gratis, with the view to encourage the medical schools lately opened, and to extend the usefulness and reputation of the College, any gentlemen who have formerly been educated in this Seminary, and are desirous of renewing their acquaintance with the above mentioned branches of knowledge, will be welcome to attend the course."

The next addition to the Faculty was in the person of Dr. Adam Kuhn who was born of German parents in Germantown, Philadelphia, in 1741. He studied in Upsala, Sweden, under the famous Linnaeus, and in Edinburgh, where he received the degree of Doctor of Medicine in 1767. On his return in 1768 he was appointed Professor of Materia Medica and Botany, a chair he held for 21 years, until he assumed the chair of practice.

On May 12, 1767, the Trustees of the College of Philadelphia established the following requirements for the Degree of Bachelor in Physic and for that of Doctor in Physic:

1. Bachelor's Degree in Physic: It is required that such students as have not taken a Degree in any College shall, before admission to a degree in Physic, satisfy the Trustees and Professors of the College concerning their knowledge in the Latin tongue, and in such branches of Mathematics, Natural and Experimental Philosophy as shall be judged requisite to a medical education.

2. Each student shall attend at least one course of lectures in Anatomy, Materia Medica, Chemistry, the Theory and Practice of Physic, and one course of Clinical Lectures, and shall attend the Practice of the Pennsylvania Hospital for one year, and may then be admitted to a Public Examination for a Bachelor's Degree, provided that on previous examination by the Medical Trustees and Professors, and such other Trustees and Professors as choose to attend, such Students shall be judged fit to undergo a public examination without attending any more courses in the Medical School.

3. It is further required that each student, previous to the Bachelor's Degree, shall have served a sufficient apprenticeship to some reputable Practitioner in Physic, and be able to make it appear that he has a general knowledge in Pharmacy.

Qualifications for a Doctor's Degree in Physic:

It is required for this Degree that at least three years have intervened from the time of taking the Bachelor's Degree, and that the Candidate be full 24 years of age, and that he shall write and defend a Thesis publicly in the College, unless he should be beyond seas, or so remote on the contitent of America as not to be able to attend without manifest inconvenience, in which case, on sending a written thesis, such as shall be approved of by the college, the candidate may receive the Doctor's Degree, but his thesis shall be printed and published at his own expense.

Regarding fees the following rules were adopted by the Board of Trustees on May 17, 1768:

The following Rules brought forward by the Medical Committee of Trustees and Professors were agreed to, viz:

Such Medical Students as propose to be Candidates for Degrees, and likewise such other Medical Students as shall attend the Natural Philosophy Lectures now given by the Provost, and whose names have never been entered in the College, shall enter the same, and pay the usual sum of Twenty Shillings Matriculation Money.

Every student on taking the Degree of Bachelor of Physics shall pay not less than one Guinea to each Professor he has studied under in the College, from time of his entering the Medical Classes; and likewise the usual Fees for the seal of his Diploma, and for the increase of the Library.

Each Medical Student who shall pay one Dollar for the use of the Library (exclusive of the Fee of Commencements), shall have his name entered, and have the free use of the Books belonging to the Medical Library of the College during his continuance of the same and attendance of lectures under the Medical Professors.

The price of tickets for a single course, i.e. to each professor, was determined not to exceed six pistoles ($20), and after two courses the students had the privilege of attending gratis.

June 21, 1768, is an important date in American medicine for it marks the first medical graduation in this country.[8] The College of Philadelphia on that memorable day conferred the degree of Bachelor of Medicine on ten graduates: John Archer, Benjamin Cowell, Samuel Duffield, Jonathan Potts, Jonathan Elmer, Humphrey Fullerton, David Jackson, John Lawrence, James Tilton and Nicholas Way.[9]

At the commencement on June 30, 1769, eight students received their degrees of Bachelor of Medicine: James Armstrong, Josias Carvill Hall, John Hodge, John Houston, Thomas Pratt, Alexander Skinner, John Wynder, and Myndert Veeder. The Commencement of June 5, 1770, conferred but one of these honors, on Thomas Parke. At the Commencement of June 28, 1771, seven of these degrees were conferred, viz: Benjamin Alison (of the class of 1765), Jonathan Easton (1768), Frederick Kuhn, John Kuhn, Bodo Otto, Robert Pottenger, and William Smith. But this occasion was chiefly notable for the conferring of the first degrees of Doctor of Physic, Messrs. Elmer, Potts, Tilton and Way, the Bachelors of Physic in the class of 1768, being the recipients of this honor.

In the year 1768 the Trustees added to the Medical Faculty the most eminent man in the first fifty years of the history of the medical school, perhaps in the history of American medicine, namely, Dr. Benjamin Rush. Born in 1745 near Philadelphia, he was graduated from Princeton, then known as the College of New Jersey, at the age of 15. After spending six years studying medicine with Dr. John Redman, he went to Edinburgh in 1766, receiving the degree of M.D. in 1768. His ambition was to become Professor of Chemistry in the young school in which desire he had the support of the great Fothergill and of Thomas Penn. On August, 1769, at the early age of 24, he was duly elected to the chair of his choice.

Benjamin Rush's life was eventful. An ardent patriot at the time of the Revolution, although antagonistic to General Washington and a member of the notorious Conway Cabal, a member of Congress, a signer of the Declaration of Independence, a public spirited citizen, Professor in the Medical School and a busy practitioner—his life was a very full one. That he was a gifted man

[8] Provost Smith called the year 1768 "the birthday of medical honors in America."

[9] The first man to receive a medical diploma in North America was Daniel Turner who obtained the gift of an honorary degree of Doctor of Medicine in 1723 from Yale College, apparently in return for some books given to the College; hence the wags said that Turner's M.D. stood for *multa donavit*.

and a forceful personality cannot be denied but whether he is entitled to the fame in medicine that has been given to him is a question. Dr. Victor Robinson tears away every shred of originality from him and considers him an enormously over-rated man. I believe, however, that the last word about him has not been said and that in addition to Dr. Joseph McFarland's admirable study of Rush and his connection with the yellow fever epidemic in Philadelphia a much more extensive research is necessary.[10] The Rush Library in Philadelphia alone has 14 bound volumes of Rush's letters that still await the commentator.

Rush is known as the first American psychiatrist. While his classification of mental diseases is outmoded, his descriptions may still be read with pleasure and profit. He was an opponent of capital punishment and of alcohol and favored the education of women. His son was minister to England and his descendants are still active in the business and social life of Philadelphia.

When John Morgan died, Rush was elected Professor of the Theory and Practice of Medicine in the College. At the same time Adam Kuhn relinquished his chair and cast his fortunes as Professor of the Practice of Medicine with a rival school, the University of the State of Pennsylvania. Rush's successor as Professor of Chemistry was Caspar Wistar who was also Professor of the Institutes of Medicine.

Upon the death of Benjamin Rush in 1813 the Chair of Practice was filled by the appointment of Dr. Benjamin Smith Barton, who was born in Lancaster, Pa., his mother being a sister of David Rittenhouse, the celebrated astronomer. Barton had been a student of Natural History and especially of botany, and had been Professor of Natural History in the College of Philadelphia and afterwards in the University. An excellent draftsman, he claimed that he had acquired the art of drawing from Major André while the latter was a prisoner of war in Lancaster. He was able to illustrate his writings with a high degree of skill. Barton founded the *Philadelphia Medical and Physical Journal,* which eked out an irregular existence until 1809. He was also elected in succession to Dr. Benjamin Rush, President of the short-lived Philadelphia Medical Society.[11]

Dr. Barton's successor in the Chair of Practice was Nathaniel Chapman, while that of Natural History was filled by Charles Caldwell. These two men were real characters whose lives after

[10] Since this was written an excellent biography of Rush has been published by Nathan Goodman.

[11] There was a Philadelphia Medical Society as early as 1765—the first medical society founded in this country. In 1768 it united with the American Society for Promoting Useful Knowledge, afterwards called the American Philosophical Society.

more than a century make interesting reading. Chapman was born in 1788 in Virginia. He began the study of medicine under Dr. Weems of Georgetown, from whom he transferred to Dr. Dick of Alexandria, remembered as the attending physician in General Washington's last illness in 1799. On coming to Philadelphia Chapman entered the office of Dr. Rush; he was graduated from the University of Pennsylvania in 1800. In 1816 he became Professor of the Theory and Practice of Medicine,[12] of the Institutes of Medicine and of Clinical Medicine in the University. Chapman was a great believer in sympathy and in the importance of the stomach as a cause of all manner of diseases. In 1820 he assumed the editorship of the *Philadelphia Journal of the Medical and Physical Sciences,* which in 1827 became the well-known and highly-respected *American Journal of the Medical Sciences.*

In the early years of the Medical School, the Professor of Anatomy also acted as Professor of Surgery. It was not until 1805 that the two disciplines were separated through the appointment of Physick to the chair of Surgery. Philip Syng Physick was born in Philadelphia in 1768. After a course of study with Adam Kuhn he went to London in 1788 and became a pupil of John Hunter. He took his degree at Edinburgh in 1792. While not a voluminous writer he was so great a teacher that he has ever since been known as the Father of American Surgery. After only fourteen years he relinquished the Chair of Surgery and assumed the Professorship of Anatomy, in a sense a retrograde step, the motives of which are not altogether clear. He continued in active practice and in 1831 he cut the aged Chief Justice Marshall successfully for stone.[13]

The Chair of Anatomy in the University occupied by Physick has had a very interesting history. Its occupants besides being men of great distinction, were unusually long-lived, so that only a few men have filled the chair from its beginning until now. After William Shippen, Jr. came Caspar Wistar, Physick, William E. Horner, Joseph Leidy and the late George M. Piersol—six men in 156 years. Of these the most distinguished was Joseph Leidy, probably America's greatest naturalist.

King's College, New York, was not long behind the Philadelphia enterprise; and from a letter of Dr. Morgan's we get a glimpse

[12] His rival for this chair was Dr. Charles Caldwell, a North Carolinian, born in 1772, of North of Ireland parentage. He was of an intense and ambitious nature, educated himself through great difficulties, began the study of medicine in 1791, and in 1795 finished his course in the University medical school. He was among the greatest controversialists in a day of unrestrained personalities, and quarreled with nearly every one of his contemporaries, including his preceptor Rush.

[13] Physick and Rush were enemies. The day after the latter's death a burly negro knocked at night at Physick's door. "What do you want?" asked Physick. "I can let you have Dr. Rush for twenty shillings." This so affected Physick that he left a request in his will that his grave be guarded night and day for three months.

of the friendly rivalry between the two. He wrote to his friend, Mr. William Hewson, of London, 20 November, 1767: "I have twenty pupils this year at about five guineas each. Next year we shall confer the degree of Bachelor in Physic on several of them, and that of doctor in three years after. New York has copied us and has six Professors, three of whom you know, to wit: Bard, Professor of Physic; Tenant, of Midwifery; and Smith, in Chemistry; besides whom are Dr. Jones, Professor of Surgery; Middleton, of Physiology; and Clossy, of Anatomy. Time will show in what light we are to consider the rivalship; for my part, I do not seem to be under great apprehension."

There has been some discussion as to which school, that of New York or that of Philadelphia, has priority in the bestowal of degrees. Dr. Hosack claims the distinction for New York. The facts are that the College of Philadelphia at the first commencement held in this country bestowed the degree of Bachelor of Medicine; but the first conferring of the degree of Doctor of Medicine took place in King's College, New York City, in 1770. The first degree of Doctor of Medicine by the Philadelphia School was awarded in 1771. The first degree of Bachelor of Medicine in King's College, New York, was conferred in 1769, one year after the commencement in Philadelphia. The occupation of New York by the British Army during the War prevented the continuance of this school. After the peace of 1783 the former medical professors being separated by death or accident, never as a body were reinstated in their former positions.

In 1792 Columbia College which had superseded King's College instituted a Medical Faculty at the head of which was Dr. Samuel Bard. The effort did not meet with such success and between 1792 and the year 1811 only 34 students completed their courses of study.

During the Revolution when passions ran high in Philadelphia, the Whigs on the Board of Trustees of the College of Philadelphia, deeply insensed against the Tories, although the latter were in the minority, obtained from the Legislature an Act repealing the Charter of the College and conferring all the powers and privileges stipulated therein upon a new institution, the University of the State of Pennsylvania. Disrupted by the War and deprived of its Charter, the College had difficulty in maintaining its Faculty. But a few years later, political passions having sufficiently cooled, the friends of the College obtained repeal of the bill abrogating the original Charter. In March 1783 the Charter became again effective, a happy outcome in which Benjamin Franklin had a large share. The old professors resumed their chairs, except William

Shippen, Jr., who continued to hold his position in both institutions. This local rivalry, ominous as the first of its kind, as Abraham Flexner says, continued until 1791, when by the Act of Legislature the two institutions were united in the University of Pennsylvania, the first of the many mergers in American history.

In 1789 the College decided to abolish the custom of bestowing the degree of Bachelor of Medicine which had been followed since 1768. Thereafter only that of Doctor of Medicine was to be conferred. It was ordered at that time that a candidate for the degree of Doctor of Medicine must be 21 years of age and must have applied himself to the study of medicine for at least two years. Those Students who reside in the City of Philadelphia, or within five miles thereof, must have been the pupils of some respectable practitioner for the space of three years, and those who may come from the country and from any greater distance than five miles must have studied with some reputable physician for at least two years. Every candidate must have regularly attended the lectures of the following Professors, viz., of Anatomy and Surgery; of Chemistry and the Institutes of Medicine, of Materia Medica and Pharmacy; of the Theory and Practice of Medicine, the Botanical lectures of the Professor of Natural History and Botany; and a course of lectures on Natural and Experimental Philosophy.

From that time on the Medical School which now had two daughters, the feeble College of Physicians and Surgeons of New York and Harvard Medical School, founded in 1783, had an unbroken development as an integral part of a University.[14]

For more than a century the Medical School overshadowed all other departments and enjoyed a large degree of autonomy. At various epochs it had the most distinguished faculty in America, none more distinguished than that of the late eighties. During the era of textbook writing, it probably was more productive in that respect than any other school of medicine in the country. It was among the first to change from a two-year to a three-year school and then to a four-year school. It was the first to have its own University Hospital, as early as 1873. And in 1894 it opened the first purely clinical laboratory in the country, the Pepper Laboratory. Its teaching throughout its long history has been characterized by a sense of harmony and proportion. It has neither over-

[14] First and last, the United States and Canada have in a little more than a century produced four hundred and fifty-seven medical schools, many of course short-lived, and perhaps fifty still-born. Of these, Illinois was the prolific mother of thirty-nine medical colleges. Forty-two sprang from the fertile soil of Missouri, the Empire State produced forty-three, Indiana twenty-seven, Pennsylvania twenty, Tennessee eighteen. The city of Cincinnati brought forth about twenty, the city of Louisville eleven. At the present time there are seventy-seven approved medical schools.

emphasized the scientific side of medicine nor stressed unduly the clinical. During the Great War its graduates gave a good account of their well-rounded training and were highly regarded at home and abroad.

It has not yet adopted the full-time system in clinical departments in its entirety, but will as in the past follow a pragmatic plan. The daughters, at least some of them, are now as lusty, as strong and as handsome as the Mother—they will agree, I trust, that their ancestress bears her age well and if no longer in a class by herself is equal *inter pares.*

DECEASED DISEASES *

Diseases, at least many of them, are like human beings. They are born, they flourish and they die. Some may be eternal or at least coeval with the race, but seeing how many have disappeared or are in the process of disappearing, it would hardly be a wise prophecy to predict eternity for any of them.

Diseases may die from a variety of causes—thus the agent causing them may disappear, as in the case of the sweating sickness of the Middle Ages. Some have become rare or nearly extinct through efficient sanitary measures of various kinds, as is true of leprosy. In some cases the disappearance is only apparent, having been brought about through a change in name. Others have disappeared because they were really not diseases at all but symptoms wrongly interpreted as clinical entities. This has been a rather frequent cause of disappearance. Some were entirely fanciful and had to give way before increasing technical knowledge, and some have disappeared as the result of a general enlightenment of the people.

The greatest triumphs have undoubtedly been achieved in the infectious diseases. Theoretically these are all conquerable and we may hope to banish most of them in time. Leprosy and plague, yellow fever and cholera, have lost their terrors; typhus fever, relapsing fever, smallpox are now rare in civilized countries under civilized conditions, but war may revive them.

Of the diseases that have died because their causal agent has become spontaneously extinct, the sweating sickness is one of the most interesting examples. As far as we know this disease has disappeared utterly. Also known as the English sweat, it was a devastating pestilence, of whose symptomatology, however, we have little knowledge. One of the best descriptive accounts is by Dr. John Caius or Kaye. Nor have we any ideas as to its etiology. Some have identified it with influenza, but I believe on insufficient grounds. On the Continent, especially in France, the disease was accompanied by an eruption, hence the names *suer miliaire, suette migliare.*

The sweating sickness appeared first in England after the battle

* Read at the meeting of the History Section of the American Medical Association, Atlantic City, N. J., June 13, 1935.

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of Bosworth, August 22, 1485. After a short rigor the body's powers were prostrated as with a blow. Headache, stupor and epigastric pain were present and the whole body was suffused with a fetid perspiration. All this took place in the course of a few hours and the crisis was over within the space of a day or a night. The people were seized with consternation when they saw that scarcely one in a hundred escaped. Many who had been in perfect health at night were on the following morning numbered among the dead. The physicians could do little or nothing for the people in their extremity.

Several epidemics swept over England, one in the reign of Henry VIII, when Cardinal Wolsey had the disease. Erasmus, then a resident of England, also seems to have passed through an attack.

It was remarkable that the disease did not spread to Scotland, Ireland, or Calais, which then belonged to Britain.

Hamburg was visited by the sweating sickness in 1529. Within the space of twenty-two days 1100 inhabitants died "for such was the number of coffins which were at this time manufactured by the undertaker." In Augsburg within six days 1500 inhabitants were attacked of whom about 800 died. Cologne, Strassburg, Frankfurt had similar experiences.

As I have said, nothing is known of the cause of the malady and the speculations of contemporary writers are of no value.

The petechial fever of Italy is another curious disease about which little is known. It is described by Fracastoro as the first plague of the kind to occur in his country. It was not a very contagious disease and did not seem to be carried by fomites. The sick "lay upon their backs with an oppressed brain, blunted senses, delirious, with blood-shot eyes." The urine, clear and copious at the beginning, became red and turbid or resembled pomegranate wine. The pulse was small and on the fourth or seventh day red and purple spots like flea bites or larger, resembling lentils (lenticula—which also became a name of the disorder) broke out.

Of the diseases that have yielded to improvement in sanitation the best example is leprosy. This disease, terrible in its social implications and its destructive effects, has disappeared from the civilized world. At one time there were in France and Germany nearly 10,000 leper houses or leprosaria, and in France alone 20,000 lepers. Now in order to see the disease one has to go to outlying places in the world, particularly to China, where in the province of Kwangtung there are from 50,000 to 100,000 lepers. Only rarely does an accidental circumstance bring a case to our doors.

While the disappearance of leprosy is largely due to the strict isolation practiced in the Middle Ages and later times, it must be

remembered that the word leprosy in all probability designated a variety of unrelated diseases—syphilis in its destructive forms being one of them. The extensive use of mercury is therefore another factor in the disappearance of what was called leprosy.

The plague, both bubonic and pneumonic, is a disease with which only physicians in certain areas in Asia have any real acquaintance, although sporadic cases may from time to time be seen in other parts of the world. For all practical purposes plague is one of the deceased diseases, yet at one time it was the greatest scourge of mankind, killing during one of its visits to Europe one-quarter of the population. Hardly anything has happened in the world that has made an equally profound change in the general social structure. In England in the fourteenth century through the death of the majority of teachers, who were largely French, the French language, until then widely spoken, died out and gave place to English.

In an indirect way the plague was also a factor in the creation of Italian as a spoken language. It happened in this way. When the plague broke out in Florence, Boccaccio fled with his humanistic friends and in his voluntary exile wrote the famous "Decameron," which soon acquired an extraordinary popularity. Being widely read by all classes of people, it helped to fix the Italian language which has undergone less change in six hundred years than any other European tongue. Petrarch with his sonnets and Dante with his "Vita nuova" also had a share in popularizing the *lingua volgare*.

Plague was practically the first disease recognized as infectious, and for the first time in history methods of isolation and disinfection were employed by the public authorities. At Ragusa on the Dalmatian coast, ships and travelers were detained for forty days (*quaranta giorni*), whence our word quarantine.

A different group of disease is represented by tarantism and the dancing manias of the Middle Ages.

Tarantism got its name from Tarentum, the town in Apulia where the malady had its chief center, and from which the spider, the Tarantula, also derives its name. Baglivi [1] writes of the disease as follows:

> The tarantula attacks persons asleep as well as awake without any provocation as well as when 'tis irritated and in both cases its bites are venomous A few hours after the bite the patient is seized with great difficulty of breathing, a heavy anguish of heart, a prodigious sadness, his voice is sorrowful and querulous. his eyes disturbed. The symptoms vary, however, different tarantulas producing different symptoms. After the violent symptoms of the first days are over the disease ends in a peculiar kind of melancholy which continually hangs upon the sick person until by dancing or singing or change of air those violent impressions are quite extricated from the blood and the fluid of the nerves. A person once stung

very rarely is perfectly cured. Some are never well but among graves and solitary places. They lay themselves along as on a bier as if they were really dead. They throw themselves into a pit. Modest women otherwise chaste enough, without any regard for modesty, fall asighing, howling and into very indecent motions discovering their nakedness. They love to be tossed to and again into the air. There are some that will roll themselves in the dirt like swine. Others again you cannot please unless they be soundly drubbed on the breech, heels, feet, back, etc. There are some that take a great pleasure in running.

That the tarantula itself does dance at the sound of music is what some have believed. A wasp being stung by the tarantula fell into dancing with it and a cock happening to be in the way was by the same means brought in for company. With regard to the dancing of the tarantula, Baglivi is willing to believe it, only he thinks "the matter needs a little further proof."

Professor Sigerist has advanced the interesting suggestion that tarantism was a revival of the Dionysiac cult of Magna Graecia.

The best treatment in the popular mind was music, a special melody for special cases or special spiders. Hecker in his book on "The Epidemics of the Middle Ages" gives some of these tunes. The Italians even today apply the word Tarantella to a special dance and to the music of this dance.

There is no evidence that tarantism was ever caused by the bite of the tarantula. This spider is no more poisonous than any other spider.[2]

A convulsive disease also appeared in Scotland. It was noticed first in Forfarshire. It was called leaping ague and bore so close an analogy to the original St. Vitus' dance or to tarantism that it seemed only to want the "foull fiend" or the dreaded bite as a cause and a Scotch reel or Strathspey as a cure to render the resemblance quite complete. Cold bathing was found to be the most effectual remedy but when the fit of dancing, leaping or running came on nothing tended so much to abate the violence of the disease "as allowing them free scope to exercise themselves till nature was exhausted." It seemed to be hereditary in some families. A similar disease prevailed for a time in the Shetlands.

The Dancing Mania. The great plague of the fourteenth century was followed by a curious expression of the terror that had seized humanity. First in the Rhenish towns of Germany and in the Netherlands people, gathered together in crowds, would without warning fall to the ground in convulsive seizures and panting for breath. Frothing at the mouth and suddenly springing up, they began a mad dance amid strange contortions. A curious tympany of the abdomen accompanied the seizures for which relief was obtained by tight bandaging or more often from the kicks and blows given by

willing bystanders. The dancers rapidly increased in numbers and soon took possession of the religious houses and intimidated the clergy, who resorted to exorcism to arrest the spread of the evil. In a short time the St. John's dance, as it was called, lost its religious or devotional character and degenerated into wild revels: "peasants left their plows, mechanics their workshops, housewives their domestic duties, girls and boys quitted their parents to take part in the orgies." The outbreak of the St. John's dance which, I take it, was a form of major hysteria, lasted nearly four months. A similar mass dance appeared in Strassburg and other cities about fifty years later, in the early part of the fifteenth century. It differed from the St. John's dance in that it was more joyous, less contrite, the dancers being accompanied by musicians playing on bagpipes. As during this outbreak St. Vitus was first called upon in prayer or was held actually responsible, the dance became known as St. Vitus' dance.

Plica Polonica, a strange chronic disease called *Weichselzopf* by the Germans, no longer figures in our textbooks but there was a time when it loomed quite large and achieved a considerable literature. It is a chronic contagious filth disease of the hairy parts of the body and of the nails in which through the gluing together of the hair with a glutenous lymph the hair is transformed into unsightly braids; the nails also undergo a peculiar degeneration. It may come on gradually over a period of months or years or more or less abruptly, being precipitated by actual catarrhal and rheumatic disturbances and by bone pains resembling those of syphilis. Headache, dizziness, tinnitus, tearing eyes, diminution of vision and hearing, mania, convulsions, shortness of breath, vomiting, hemorrhoidal attacks, skin eruptions, glandular and joint swellings, ulcers, leukorrhea, blood spitting, and finally pneumonia are some of the bizarre manifestations attributed to plica polonica. Some considered it a syphilitic manifestation; others looked upon it as an acute metastasis, whatever that may mean. Joseph Frank maintained that it was a form of leprosy. Mercury had no beneficial effects, but the disease was curable by general measures.

A disease of ancient lineage that is practically extinct, at least no cases are seen in this country, is ergotism, in the literature called most frequently St. Anthony's fire, *ignis sacer* or *feu sacré*. There are over forty names in different languages for this disease. It was widely prevalent in Spain and in Germany, twenty-eight epidemics being recorded between 857 and 1547. There were two principal types of the disease: the gangrenous and the nervous. In the first the limbs, particularly the legs, after a period of intense tingling and burning, became black and gangrenous. If death did not super-

vene, the limbs gradually became detached from the body. Pictures of St. Anthony usually show one or more mutilated individuals praying to him for relief. Because of the tingling and burning the disease was known in Germany as *Kriebelkrankheit*. The nervous forms were characterized by spasmodic contractures, stupor and convulsions. The Medical Faculty of Marburg in 1597 expressed the opinion that the disease was due to the use of bread made from spurred rye, and the Royal Academy of Medicine of Paris in 1776 arrived at the same conclusion. As the toxic character of spurred rye is due to the presence of the well-known fungus ergot, the disease was also known as ergotism.

The term St. Anthony's fire has also been applied to erysipelas. It was probably the latter disease to which Sir Walter Scott refers in his poem "Marmion" when he makes the impatient Blount address his fellow squire Eustace, who was patiently listening to a long tirade of the Abbess:

> Saint Anton fire thee! wilt thou stand
> All day, with bonnet in thy hand,
> To hear the lady preach?

Another fanciful disease, now totally extinct in medical literature, is canina appetentia or dog-like appetite, which was an immoderate desire of meat and when

> . . . they cannot refrain their appetite they devour in meat without measure. Then being heavy with a multitude of meats and the stomack being not able to bear the same, they turn to vomiting; then afterwards they fill themselves and turn again to vomiting like dogs. The cause is a bad gnawing or biting of the mouth or of the stomack like unto a sucking. Sometimes it happeneth through the cold distemper of the mouth or stomack, sometimes it proceedeth through certain kinds of worms which do devour the meat as it is taken into the stomack as fast as it is received.[3]

Milk sickness was conveyed by milk, cheese and butter and the flesh of animals infected with the trembles. In man it was characterized by indifferent premonitory symptoms: lassitude, pain in the head and limbs, anorexia and slight nausea. The nausea became more pronounced and vomiting supervened accompanied by intense thirst, obstinate constipation and a burning pain in the epigastrium. The surface temperature was low and the internal temperature not much elevated. The breath was offensive and so characteristic that by means of its peculiar fetor the disease could be recognized. Somnolence, coma and convulsions were frequent in the fatal cases. Death usually was preceded by the typhoid state with low muttering delirium. Mild cases hardly passed beyond the premonitory stage; severe cases often terminated fatally in two or

three days. Most frequently the duration of fatal cases was between five and fourteen days.

According to Austin Flint,[4] it was endemic in Indiana, Ohio, Illinois, Tennessee, Missouri and Michigan; it was known to have occurred in Pennsylvania, Virginia and West Virginia. It was not observed east of the Alleghenies or west of the Great American Desert or in the countries of the Old World, but as it seems to have disappeared with the disappearance of the trembles, we can only guess at its cause—perhaps it was an organism belonging to the paratyphoid or abortus group.

Infantile remittent fever, also called worm fever, has disappeared from our nosography. Whatever the disease was, it was not due to worms but to some form of infection. I am reminded in this connection of another vanishing disease, namely, infestation by tapeworm. In my early years of practice not many months would pass without my seeing some one who had a tapeworm. One of the longest I obtained from a prominent lawyer in Philadelphia. Although lawyers have multiplied, tapeworms are now a great rarity.

Some of the conditions that were considered diseases have disappeared through being relegated to the position of mere symptoms; thus the older textbooks considered frenzy a disease which was treated by opening a vein in the foot or the salvatella vein in the hand.[5] Today we look upon frenzy not as a disease but as a severe delirium common to many affections.

Many diseases have disappeared because of a change in nomenclature. Until the latter part of the nineteenth century the word peripneumonia was frequent in medical literature. It is natural to think that peripneumonia meant pneumonia around or on the surface of the lung. That is, however, not the meaning of the word. Laënnec has clearly shown that the prefix *peri* as used by Hippocrates and later writers does not mean around but indicates importance or intensification. The word, therefore, is nothing more than a synonym of pneumonia.

Peripneumonia notha and bastard pneumonia are also names that are no longer in use, but the disease they designated, bronchopneumonia in the aged, is a common enough affection.

Acute hydrocephalus is the old name for tuberculous meningitis, a disease that still prevails.

Typhlitis is another disease that no longer exists *de nomine*, but it exists *de facto* as appendicitis. Earlier writers called it iliac passion; it is referred to by Sydenham whose treatment was the application of the warm body of a living puppy to the right iliac fossa.

Although the first operation for appendicitis in this country was done by Willard Parker in 1864, it took twenty-five years before typhlitis disappeared from our medical textbooks; yet there were writers who had the correct idea long before Reginald Fitz published his classical paper. Thus Bristow [6] in 1876 wrote as follows: "The most frequent form of fatal typhlitis is no doubt that which results from perforation of the vermiform appendix, an accident which occurs mainly in early life, and apparently more frequently in males than in females."

Cholera morbus is not mentioned by recent writers, yet it was a name frequently heard in my youth and occupied considerable space in textbooks. Austin Flint, who devotes four pages to it, objects to the absurdity of appending the Latin word *morbus* to the Greek word *cholera,* for *morbus* expresses no more than is implied in the name of any affection, that is, the existence of disease. Cholera morbus has nothing to do with real or Asiatic cholera and is, as Flint says, indigenous in America as it is in the countries of Europe. In all probability the disease represents a form of food poisoning which has become rare.

Among diseases that have disappeared through correction of faulty diagnosis I might mention ptomaine poisoning which was a very comfortable blanket diagnosis a generation ago. Sometimes it was mistakenly applied to gallstone colic and in practically all conditions it was a misnomer for the disease was not due to ptomaines. Ptomaine poisoning, as we now know, is a form of food poisoning due either to bacteria or to their toxins. The name has vanished from medical literature and the condition that it wrongly designated, food poisoning, has become rare. Outbreaks of botulism and paratyphoid infection, the best studied representatives of food poisoning, are no longer common.

In my earlier years in practice one of the commonest "diseases" diagnosed by doctors and also by superior laymen was autointoxication. No longer is this a respectable diagnosis. Like ptomaine poisoning it covered with a convenient mantle a multitude of diagnostic errors. In some recent works on medicine the word autointoxication does not even appear in the index, in others it is given merely as a symptom which after all is the only thing that autointoxication should imply. As a symptom it is common to many conditions as is fever or headache. Its disappearance from medical literature is due therefore not to the disappearance of a disease but to a change in concept.

Hydrophobia has always been one of the most terrifying diseases of mankind for when once established it leads to death

through frightful torture, but it now belongs to the vanishing diseases. Personally I have only seen one indubitable case, that in a boy of fourteen years.*

Scrophula was a condition which in my early years was very common. Children with glandular swellings, often suppurating, were a daily sight in hospitals and in doctors' offices, but the King's evil has almost vanished and the Royal Touch that caused it to disappear was the campaign against tuberculosis, inspection of school children and, in general, better conditions of living.

At one time smallpox was so common that an unmarked face was a rarity. Not only did it mark the face but it killed a large proportion of those attacked. Vaccination and general hygienic measures have made the disease so rare that there has been no death in Philadelphia in many years and the total death-rate for the United States is almost infinitesimal. It is possible that some share in this happy result must be attributed to a change in the virus itself for in many other parts of the world only a mild type of the disease prevails (variola minor, also called alastrim). Perhaps the virus has become attenuated by having only an immunized population to feed upon.

Chlorosis is one of the most interesting of the deceased diseases. The disappearance of the green-sickness is due to a variety of causes: to a change in our habits of living—a healthier, freer mode of life, in which women have their full share; shorter working hours, athletics, the disuse of the tightly laced corset, modes of dress and outdoor life giving sunlight a better chance, and a better balanced dietary.

With the disappearance of chlorosis has come the disappearance of gastric ulcer in chlorotic young women.

Scurvy as a disease of adults has become so rare that many mature physicians have never seen a case, yet it was one of the commonest diseases 150 years ago. It also prevailed extensively during the Great War but now it is totally negligible in Western Europe and America.[7] We know since the latter days of the eighteenth century that lemon or lime juice prevents it and cures it, although the explanation of how these juices act, as in the case of so many other conditions in which empiric knowledge outran scientific knowledge, had to wait until our own time. We are now aware of the indispensability of accessory food factors, the vitamins.

Ptosis, especially gastroptosis, was not only a recognized disease but also one that the surgeon thought he could treat successfully by a dramatic operation. In a recently published textbook

* Dr. Riesman has seen one other case since this was written.

of medicine neither gastroptosis nor visceroptosis is accorded a place, and where is the surgeon who today would operate for these conditions? They belong to the deceased diseases; their extinction is, however, not due to improved hygiene, vaccination, vitamins or sunlight but to a better understanding of physiology.

Gout in its tophaceous form has become a very rare disease not only in this country but even in England.

Popliteal aneurysm was formerly second only to aortic aneurysm. It is now a very rare disease.

A. F. Hurst[8] calls attention to the rarity of mucomembranous colitis which was a common disease up to the time of the Great War. Those who have read Axel Munthe's book will remember that he found it a very profitable disease to diagnose.

A number of years ago Philadelphia was agitated by the presence of the so-called "kissing bug." A curious swelling of the face had appeared in many persons and they attributed it to the bite of this mysterious insect. I saw a case and concluded that the young woman had not been bitten by a bug but was suffering from angioneurotic edema.

Hypochondriasis constituted a very important disease in an earlier day but it no longer appears in modern textbooks. "The hypochondriac," says Tanner, "is ever walking under the petty despotism of an imaginary evil." I am not sure that we have improved upon either the concept or the word by substituting for it neurasthenia, nervous prostration or other portmanteau words.

I have by no means exhausted the list of deceased or dying diseases; it is, however, sufficiently large to justify great optimism for the future. The conquest of the infectious diseases is almost in sight; that of cancer is within the realm of the possible. Only a few diseases remain or are likely to remain unconquered and then old age and the hazards of transportation will be the principal executioners of the human race. No, I am afraid the greatest of all man's enemies will remain—his own brother; but even that blood-born disease, War, may come to an end. Let us hope!

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2. Legends seem now to be growing up around the black widow spider of the West and South.

3. Bayfield, R. Enchiridion Medicum. London, 1655, p. 45.

4. Treatise on the Principles and Practise of Medicine. Ed. 7, rev. by F. P. Henry, Phila., 1894, p. 1047.

5. Baglivi. The Practise of Physick. London, 1723, p. 82.

6. Treatise on the Principles and Practice of Medicine. 1876, p. 626.

7. Two cases of scurvy have come under my observation within the last two months.

8. Brit. M. J., p. 629 (April 8), 1933.

DR. RICHARD MEAD AND THE MOTTO OF THE COLLEGE OF PHYSICIANS OF PHILADELPHIA [1]

One day last spring I accidentally discovered that the motto of our College, "Non Sibi Sed Toti," was used as his personal motto by a famous eighteenth century London physician, Dr. Richard Mead. I was intrigued and made an effort to trace the origin and history of the motto. Did the College borrow it from Mead? Was it originated by the College or was it taken from a common source? The search naturally led me to a study of the life of Richard Mead who in his day occupied in London a position not unlike that occupied a little later in Philadelphia by Benjamin Rush, although Mead was personally far more popular than the autocratic Rush.

While pursuing my studies in the life of Mead I came across some interesting historic facts which though not directly connected with the motto seem to be of sufficient importance to recount.

Mead was physician to George II, and held many other distinguished offices and was elected President of the Royal College of Physicians but for unrecorded reasons declined to serve.

He was one of the five historic characters who carried the Gold-Headed Cane. Those who have read the deligthful tales which the wise Cane tells either in the rare early editions (1827, 1828) or in the more recent ones edited by William Munk (1884), Francis R. Packard (1915), George C. Peachey (1923), or Herbert Spencer Robinson (1932), will remember that John Radcliffe was the first owner of the famous Cane. Who the Cane's ghost-writer was is nowhere indicated in the text or on the title page of the original editions. The modest author, Dr. William Macmichael, preferred to remain anonymous.[2]

Radcliffe was an eccentric bachelor who held the fashionable practice of London in the hollow of his hand. In his declining years he took a fancy to Richard Mead, gave him rooms in his own house

[1] Address delivered at the Anniversary Dinner of the College of Physicians on December 15, 1934.

Reprinted from Medical Life, April, 1935.

[2] The author's name appears on the title-page for the first time in Packard's edition, also in the recent one of Robinson

in Bloomsbury Square and pushed him forward in practice. Unlike the rather crude but shrewd Radcliffe, Mead was a well-rounded scholar, familiar with Latin and Greek, and a gentleman in bearing.[3] He soon acquired a lucrative practice that brought him in as much as £7000 a year, equal to about $85,000 in our present-day currency.

Mead did much of this prescribing in coffee houses where apothecaries would come to him with their difficult cases and he would prescribe at a half guinea, or even a guinea, for each consultation without ever seeing the patient. Nevertheless Mead was no quack as can be deduced not only from what we know of his exceptional education but from other facts in his life. I have already mentioned, in proof of his distinguished place, some of the professional positions he held. Alexander Pope, the Wasp of Twickenham, who was not a respecter of persons, immortalized him in the lines:

> "I'll do what Mead & Cheselden advise
> To keep these limbs and to preserve those eyes."

Mead had studied medicine under the great Boerhaave in Leyden and had taken his degree in physic and philosophy like so many other Englishmen in Padua, apostrophized by Shakespeare as "nursery of arts."

On returning to England in 1695 Mead began the practice of medicine in his native town of Stepney. Soon however he moved to London and became physician to St. Thomas' Hospital and a Fellow of the Royal Society. Oxford gave him the degree of M.D. in 1707.

When the Plague broke out in Marseilles in 1719, the British Government, fearful of its spread to England, appealed to Mead for advice. He declared the disease contagious and wrote his famous book, "A Short Discourse Concerning Pestilential Contagion, and the Methods to Be Used to Prevent It." Seven editions appeared in one year. It is, as Sir George Newman says, the first record[4] of epidemiological advice produced by a medical practitioner at the request of the State.

For the prevention of the disease Mead recommended: "(1) the preventing of its being brought into our island, (2) if such a calamity should happen, the putting a stop to its spreading amongst us." For the first he advised a system of quarantine and considered that "the best method of stopping infection is to separate the healthy from the diseased." He advocated the establishment of a Council of Health, notification of infected cases, early visitation by official medi-

[3] Radcliffe one day found Mead reading Hippocrates in the Greek. "What! my young friend, do you read Hippocrates in the original language? Well, take my word for it, when I am dead you will occupy the throne of physic in this great town." Mead, "No sir; when you are gone, your empire, like Alexander's, will be divided amongst many successors."

[4] The Rise of Preventive Medicine, London, 1932, 157.

cal advisers, separation of the healthy and the diseased, isolation of infected families, the non-infected to be stripped of all their clothes and washed and shaved before going into new lodgings, cleansing of the houses, goods to be burned or buried deep. Mead stoutly maintained that all expenses should be paid by the public and a reward be given to the persons who first discovered the infection.

In the same book he chides the French doctors for opposing the common opinion that the Plague is contagious. And he writes further: When the profession of physick came to be founded upon the knowledge of nature, Hippocrates strongly opposed the opinion that some particular sicknesses were divine or sent immediately from the Gods and affirmed that no diseases came more from the Gods than others, all coming from them and yet all owning their proper natural causes. Contagion is no more than the effect of volatile offensive matter drawn into the body by our smelling.

The people of Marseilles, writes Mead, tried to clear themselves of the Plague in a different manner. Some poor man offered himself to be maintained at the public expense with delicate food for a whole year. After this he was led across the city dressed in consecrated garments and herbs and being laden with curses as he went along that the evils of the citizens might fall upon him, he was at last thrown into the sea.

Mead was the author of many works on medical subjects. His book on Poisons had an extraordinary vogue during the eighteenth century and was reprinted many times in England and on the continent. Among other subjects he discusses hydrophobia, the disease he says should have been called Dyscataposis, difficulty in swallowing, rather than Hydrophobia, a dread of water. The injudicious jumbles of Theriacas, specific antidotes, etc., whether old or new, deserve no notice. That ridiculous preservative, the liver of the mad dog which Pliny says should be eaten rather raw than boiled, is neither good food nor physic. Galen observed that it availed nothing.

"There are two or three remedies recommended, I think, upon rational ground; the first is the Ceneres cancrorum fluviatilium, ashes of the river crawfish. These were prepared by burning the fish alive upon a copper plate with a fire made from the cutting of twigs of the white briony. This Galen avers that nobody ever made use of without success and before him Dioscorides assured that it is a medicine which might be relied on."

Mead's own method of treatment is as follows: "Let the patient be blooded at the arm nine or ten ounces. Take of the herb, called in Latin Lichen cinereus terrestris, in English Ash-colored ground liverwort, cleaned, dried, and powdered, half an ounce. Of black

pepper powdered, two drachms. Mix these well together, and divide the powder into four doses, one of which must be taken every morning, fasting, for four mornings successively, in half a pint of cow's milk warm. After these four doses are taken, the patient must go into the cold bath, or a cold spring, or river, every morning fasting, for a month: he must be dipt all over, but not stay in (with his head above water) longer than half a minute, if the water be very cold. After this he must go in three times a week for a fortnight longer." In some parts of the world, even in America according to Mead, patients with hydrophobia were stifled between two feather beds.

"To conclude, if any relief could be expected in this desperate state, I think it would be from large bleeding, even ad animi deliquium, before the fibres of the membranes and vessels have lost their natural force by convulsions; nitrous medicines; and plentiful diluting with cooling subacid liquors. But after all it will generally happen that death will be the physician that cures."

Mead was the first to advise surrounding the abdomen with a bandage after tapping for ascites.[5] A strong advocate of inoculation against smallpox, he helped Lady Mary Worstley Montagu in popularizing the practice in England.

In his Harveian Oration, Mead maintained that physicians had enjoyed the highest esteem in Greece and Rome, a contention that brought down upon him the abuse of Conyers Middleton, a vituperative, unorthodox divine, who described medical men in Rome as slaves.[6] Mead also wrote a rather fantastic treatise on the diseases of Biblical characters [7] as well as one on the influence of the Moon and Sun on disease. This latter has a distinct astrological tone and is perhaps the illegitimate outgrowth of Sir Isaac Newton's discoveries with which Mead, who attended Newton in his last illness, was familiar. Though a follower and admirer of William Harvey, he seemed to be unaware of the great discoveries made by Mayhow, Robert Boyle, Christopher Wren and others.

Mead was one of the first book collectors on a large scale. His library, consisting of upwards of 10,000 volumes, was disposed of soon after his death in 1754. The sale required 28 days and according to the auctioneer's catalogue of 242 closely printed pages in the library of the College of Physicians, the books brought the sum of

[5] Medical Precepts and Cautions by Richard Mead, Second Edition, London, 1755, p. 164.

[6] After the death of Middleton his third wife consulted Dr. William Heberden about the publication of a manuscript of her husband on "The Inefficacy of Prayer." Heberden advised against its publication as it would be injurious to her husband's reputation but as the matter was pressing, he would find out what the publisher would give for the copyright. This proved to be £150 and accordingly Heberden paid to the widow £200 and consigned the manuscript to the flames. (Rolleston, Ann. of Med. History, 1933, N. S. 5, 409.)

[7] Medica sacra, sive de morbis insignioribus qui in Bibliis memorantur commentarius. English Translation by Thomas Stack, M.D., F.R.S., London, 1755.

£730. After his death, it was said of him, that of all physicians who had ever flourished, he gained the most, spent the most, and enjoyed the highest fame during his lifetime, not only in his own but in foreign countries.

To return for a moment to the Gold-Headed Cane. Mead received it from Radcliffe; from Mead it passed to Dr. Askew and from Dr. Askew to Dr. Pitcairn or rather to the two Pitcairns, uncle and nephew, and lastly to Matthew Baillie, a nephew of William and John Hunter and the first to write a pathological anatomy in English. Mrs. Baillie on the death of her husband gave the famous relic to the Royal College of Physicians, in the library of which I had the pleasure of seeing it a few years ago. The Librarian removed the flannel cover and showed me on the rectangular gold handle the names of its five famous carriers—Radcliffe, Mead, Askew, Pitcairn and Baillie—and their coats-of-arms, and then courteously insisted that I hold it in my own hand so that I might be able to say that I had also carried the Gold-Headed Cane.

Mead was destined to play a rather important role at a critical period in English history. Queen Anne, despite the fact that she was pregnant fifteen times—ten miscarriages and five live births—had no living heir. Her royal parents, James II and Anne Heyde, had had eight children of whom but two survived. Little is said in English history about the possible causes of such terrible childhood mortality as befell Anne Heyde and Queen Anne. Such things were taken more or less for granted. Mead himself was the eleventh of thirteen children of whom apparently only one other survived. He had eight children by his first wife of whom four died in infancy. John Colet, humanist, friend of Sir Thomas More and of Erasmus, was the only survivor of twenty-two children. In the case of King James' and Anne Heyde's progeny there was one man who apparently had the correct idea. It is related that the King once asked his physician, Dr. Thomas Willis, for an explanation of the early death of one of the princes. With more truth than tact Willis answered, "Mala stamina vitae"; in other words, "bad heredity." The King was greatly displeased with the answer and dismissed Willis as his physician.

Under William III Parliament in 1701 passed the Act of Settlement which provided that the sovereign of Great Britain must be a Protestant and that in case King William and Princess Anne, subsequently Queen Anne, should die childless the Crown was to pass to Princess Sophia of Hanover and her heirs. Nearer heirs were to be passed over because of their Catholic faith.

Toward the end of the reign of Queen Anne, Princess Sophia

having died, many of the Tory party were unwilling to see the Crown pass to Sophia's son, George the Elector of Hanover, and were inclined to support Queen Anne's half brother, James, who was the nearest heir but who as a Roman Catholic was ineligible. Whatever one may think of James, the Pretender, one must admire his steadfastness. Unlike Henry IV, who said that Paris was well worth a Mass, James would not deny or dissemble his faith for the sake of the British Crown.

As Queen Anne's death was approaching and she lay dropsical in Kensington Palace, secret preparations were made for a revolution by the Tory opponents of George of Hanover. But before these were completed Queen Anne had a stroke of apoplexy. There were six physicians already in attendance when Richard Mead was called in for consultation. The others were: Laurence, Shadwell, Arbuthnot, Sloane, Hamilton and Blackmoore. Mead's name comes last in the public documents.

I might say, parenthetically, that of the other six only Arbuthnot and Sloane have achieved names in history. Arbuthnot was both a popular physician and a poet and, characteristically for the age, a political poet. He was an ardent Tory and the creator in literature of John Bull.[8] Sir Hans Sloane is of course well-known as the President of the Royal Society and as the benefactor, if not the founder, of the British Museum.[9]

The responsibility resting upon Mead and his colleagues at the consultation was tremendous for the death of no British monarch was ever more pregnant with dire possibilities for the future of the Kingdom than that of Queen Anne. Everything depended upon immediate notification of her approaching death to the Privy Council so that it might be ready at the moment of her demise to proclaim the Elector of Hanover as King. Mead in opposition to the opinion of his colleagues gave a bad prognosis and said that the Queen would not long survive. The Privy Council had kept vigil for two days and nights but on the assurance of the other physicians the members had gone to their several homes to meet again on Sunday morning at eight o'clock. But even that early hour proved too late. Dr. Shadwell, evidently the principal in the doctors' conclave, seeing the imminence of death, at six o'clock in the morning dispatched messengers to the sleepy councilors but they arrived too late, for the Queen had died at seven-thirty. We read in English history how prompt action taken by the Privy Council in proclaiming the

[8] He was also the author of "As Pants the Hart."
[9] Despite his hearty Whig sentiments, Mead maintained a strong intimacy with these men and with Dr. Samuel Garth, author of the famous "The Dispensary."

Elector of Hanover King of England prevented a revolution. Miss Strickland says: "It has always been considered that Mead's prompt boldness occasioned the peaceable proclamation of George I."

Professor George Macaulay Trevelyan in his interesting history of the period [10] in giving the names of the doctors in attendance upon Queen Anne in her last days makes the seventh doctor "Read." Believing this to be an error I wrote to Professor Trevelyan. He replied courteously that there was considerable likelihood that it should be Mead not Read but that it might be Sir William Read. Read was the Queen's oculist, an arrant quack, upon whom she had conferred the honor of knighthood. But in a subsequent letter dated October 8, 1934, Professor Trevelyan writes: "I have looked up the document in the Record Office and I find that you are quite right. It is Richard Mead and not Read. I apologize for the error."

Somewhat later Mead had another semipolitical experience. His colleague, Dr. John Freind, had been thrown into the Tower under suspicion of being concerned in Bishop Atterbury's plot to restore the Stuarts. Even after seven months all the exertions of well-wishers to free him had remained futile. At this time the powerful premier, Sir Robert Walpole, Earl of Orford, fell ill and Mead was called to attend him. He refused to go unless John Freind was first liberated. The Government tried to hold out but when Walpole's illness took a turn for the worse, Mead still refusing to come, the authorities yielded and set Freind free. Mead, who had been looking after his colleague's practice during the imprisonment turned over to him the 500 guineas [11] he had collected from Freind's patients. This incident shows, I think, that the sententious motto Mead had chosen was not an empty gesture but a rule of life. I might also mention the fact that it was through Mead's persuasion that the wealthy merchant Thomas Guy was induced to found the hospital that bears his name.

When Mead was 70 years of age he went to Paris to receive lessons from M. Dupre, the famous dancing-master. His explanation is worth noting. "I am not ashamed to say that what the majority of mankind perform for pleasure, I undertake for health; and having found myself every day less able to go through the sedentary drudgery of my profession, I thought the amusement of a journey to Paris, and a little gymnastic exercise under 'Doctor' Dupre, might, by varying the scene, be useful to my constitution; and I already find the advantage."

[10] England Under Queen Anne; The Peace and the Protestant Succession, G. M. Trevelyan, Longmans, Green & Co.

[11] In some books it is stated as 5000 guineas.

It is strange that there is nothing in Mead's voluminous writings to indicate whence he chose his motto; at least I have not been able to find any reference to the subject nor is there any clue in the Proceedings of the College of Physicians why the motto was chosen by the Founders. A study of the records shows that the meeting of the College at which the motto was adopted was held on February 6, 1787, at the "University." By University was meant the College of Philadelphia, also called the Academy, at 4th and Arch Streets. Those present at the meeting were:

John Redman
John Jones
Gerardus Clarkson
Benjamin Rush
Thomas Parke
Samuel Duffield
James Hutchinson
Robert Harris
John Carson
Benjamin Duffield
Sam'l P. Griffitts
William Currie
Benjamin Say
John Morris
Andrew Ross

The Secretary reported that the Constitution of the College had been published agreeably to the Directions of the last meeting and that it had been signed by all the Senior Fellows except Dr. John Morgan, and by all the Junior Fellows.

The Committee appointed at the previous meeting on January 2, 1787—the first meeting of the College in history—to prepare a device for a Seal of the College, consisting of Drs. Benjamin Rush, Benjamin Duffield and Samuel Powell Griffitts, produced a drawing for the purpose—An Ancient Lamp upon a Doric [12] Pedestal, on the front of the Pedestal the Motto—

"NON SIBI SED ALIIS."

Around the whole Device:

SIGILL: COLLEG: MEDICOR: PHILADEL: INSTITUTI: A.D. 1787.[13]

On consideration, the Device for the Seal reported by the Committee was agreed to, with the word "Toti" substituted for the word "Aliis." Unfortunately it is not recorded who moved to substitute toti for aliis. I wonder, was the mover of the motion acquainted with Mead's writings? As Mead was one of the most distinguished English medical authors of the eighteenth century, copies of his works must have been circulated in this country; they were no doubt brought back by some of the Philadelphians who had gone to London and Edinburgh to study. Benjamin Duffield

[12] Was the Doric pedestal chosen because Hippocrates' island of Cos belongs to the Doric group?

[13] It seems probable that the Seal and Motto were prepared by Benjamin Duffield. (See biographical sketch of Benjamin Duffield by Dr. John Neill, Transactions of the College of Physicians, Volume IV, N.S. 1874, p. 449.)

himself had been a student at Edinburgh and must have been acquainted with Richard Mead's writings.

I had hoped that there might be in our Library an early copy of one of Mead's works or of Maty's biography with the name of a Founder in it—that would give a circumstantial clue as to the identity of the man on whose motion aliis was changed to toti. I found two interesting volumes in the Library, one bearing the legend in a bold eighteenth century hand, "From Dr. Mead"; the other, apparently by the same person, the words, "From the Author." The latter volume deals with the influence of the Sun and Moon on the human body and with the diseases produced thereby. The date of the book, which was printed in London, is 1746, eight years before Mead's death. The other contains an account of an invention of Samuel Lutton for ventilating the holds of ships which was communicated to the Royal Society by Dr. Mead and Mr. Watson; also an article on scurvy by Mead himself. The book was published in 1749. It is tantalizing that there is nothing in either volume to indicate to whom Mead gave it, but I believe it was to one and the same person. The astrological book was for a time the property of Dr. S. George Morton (in 1826), and afterwards of Dr. Samuel Lewis; the other has the legend, "Jane Reeve, July 4, 1788." In neither book is there any mention of Mead's motto.

It is interesting that the position of the Motto beneath the Doric column and inside the ribbon on the College Seal is similar to the position of the Motto in the small picture of Mead's Library reproduced in The Gold-Headed Cane.

The finished Seal with the Motto was produced on March 6, 1787, by Dr. Benjamin Duffield, and on August 7th it was reported that a copper plate for striking the certificates had been procured. The Seal and diploma were first discussed in conjunction and it is obvious that the former was primarily designed as an appendix to the latter. Unfortunately the earliest certificate in the possession of the College is that of Joseph Hartshorne dated 1824, but there can be little doubt that those of 1788 bore the Seal and that it was first used on them. The legend on the diploma of 1824 and of other dates differs in its abbreviations from the legend as given in the Minutes of February 6, 1787. In the 1824 diploma the Seal is pasted on the ribbon; later it was stamped directly on the diploma in dark blue.

The Motto without the Seal had its inaugural use in the first volume of the Transactions of the College published in 1793, six years after the founding. Curiously there is neither Seal nor Motto in the volume published in 1846, also called Volume I, and containing the Transactions from November, 1841, to August, 1846,

inclusive. Vol. I, New Series, published in 1853, bears the Motto on the title page in thick black letters. The heraldic device with the Garter ribbon is printed for the first time in Volume I, Third Series, published in 1875, the Seal bearing the words Acta Coll. Med. Philad. Instit. A.D. MDCCLXXXVII.[14] In the book plates of the Library the word "Acta" is replaced by the phrase "Ex Libris." The book plate probably antedates the "Acta Seal," for there is a record, found by Mr. McDaniel, of an entry in 1866—"Labels $7.50"; and in 1867 "There remains unpaid a bill for electrotype plates," while the report of 1868 gives expenditures for book plates hitherto apparently referred to as labels.

Through an amusing inadvertence the noble mahogany desk in Mitchell Hall is carved with the Ex Libris Seal of the Library. One can sit on books but one can hardly read a desk. There are slight differences between the earlier and later book plates. In Vol. I, 1875, and in accessions to the Library of that period, the Lamp of Knowledge burns with a much bigger flame and illuminates a larger area than is the case at present. Whether that means that the College throws less light upon the world now than in the past or has grown more modest, I leave for future historians to decide.

The unknown member of the College who suggested the change in the Motto from aliis to toti could hardly have done so on the score of improving the Latin for the word toti is altogether inappropriate in the manner in which it is used. In truth "non sibi sed toti" is not translatable. Toti is a qualifying adjective and cannot stand alone; it needs a noun for support. If, however, we attempt an English rendition, it is "not for one's self but for the entire . . .", an unfinished sentence that demands a collective noun to complete it. As my own knowledge of Latin syntax is so ancient as to be unreliable, I applied for enlightenment to my friend, Professor Roland G. Kent of the University of Pennsylvania, who writes as follows: The Motto, "non sibi sed toti" can mean only "not for self, but for the whole," the significance of which is clearer in German: "Nicht für sich, sondern für das Ganze." It seems to be an error for "non sibi sed omnibus," which is cited in lists of Latin phrases, and means "not for self, but for all," or "nicht für sich, sondern für Alle." Unfortunately totus does not denote or attach to a numerical plurality, but only to a thing or mass in its entirety: one may say totus populus "the entire people," but must say omnes cives "all the citizens." There is not even an antithesis between sibi and toti, since it would be perfect Latin to say that he

[14] Nearly the whole of this volume is devoted to the autopsy on the Siamese twins, Cheng and Eng Bunker.

found that this treatment was good sibi toti "for all of him" and not merely for the part of him which the treatment was intended to benefit. The only way in which non sibi sed toti can mean what it is evidently intended to mean, is to supply a collective noun such as generi humano, and then translate "not for self, but for the whole, the entire (human race) or for all (mankind)."

I myself looked for the Motto among Standard Latin quotations but was unable to find it there. Several friendly Latinists were equally unsuccessful. It become evident that the Motto as it stands could not be a proverb of Classical or Medieval Latin; hence it appeared to me that it must have been coined either by Mead himself or by someone else whose Latin was weak and that the man who moved its adoption by the College against the better "Non sibi sed aliis", probably did so out of respect for Richard Mead.

I had therefore practically given up all hope of finding the origin of this perplexing phrase when suddenly in continuing my researches in Mead's writings I discovered to my great delight the source of the doubtful motto. At the end of Mead's Discourse on Measles (A Discourse of the Small-pox and Measles, by Richard Mead. To this is subjoined the Commentary of Rhazes, a most celebrated Arabian physician on the same Diseases. Translated from the Latin, by John Theobald, M.D., London, undated, but probably 1747), I found the following quotation:

"Nec sibi, sed toti genitum se credere mundo."

Not to believe himself born for himself, but for the whole world.

Finding it I felt "like some watcher of the skies when a new planet swims into his ken." The line is taken from the second book of the Pharsalia of Lucan (Verse 383) and in its complete state is applied by the poet to the rigid (durus) Cato of whom he also speaks the beautiful and sonorous line:

Servare modum, finemque tenere, naturamque sequi: to hold the golden mean, to keep the end in view and follow nature.[15]

Mead in taking over the phrase from Lucan either did not recognize or calmly ignored the fact that "toti" governs "mundo," thus posthumously laying us open to a charge of having a motto of questionable Latinity. Age cannot hallow nor custom sanctify so grievous a linguistic blunder. Perhaps the College will some day be inclined to rectify it by simply adding from Lucan's original verse the single word "mundo"—"non sibi sed toti mundo"—not for himself but for the whole world. Then will the Motto in spirit and in phrasing be worthy of the traditions and the dignity of our venerable College.

[15] This verse is quoted by Mead in Monita et Precepta Medica, London, 1751, p. 152.

WILLIAM HENRY WELCH, SCIENTIST AND HUMANIST[1]

In my life as a doctor I have met three men and only three who exercised a personal influence of such magnitude that they dominated the medicine of their time. These three men were Osler, Billings and Welch. Differing in mental endowment and in ancestral background, each had a personality that separated him from his fellow men. Osler typified what is still comparatively rare in America, the scholar in medicine. To him is largely due the growing interest in the humanities among medical men, although that is not his only claim to fame. He pointed out in his writings and in his teaching the value as well as the charm of clinical or bedside study. Throughout the land his younger contemporaries and his successors have striven to emulate him as a teacher, to be second Oslers. Frank Billings was not a profound scholar. The humanities attracted him but little. With the magnificent frame of a pioneer in a pioneer region he had time mainly for the practical things of life and left the ornamental to others. Forthright, clear-thinking, generous, a first-rate doctor and a far-visioned educator and organizer, he acquired an extraordinary influence through the length and breadth of the land. His direct personal influence on the host of young men who came within the range of his personality made devoted disciples of them. They became Billings men, keen clinicians, able diagnosticians and safe counselors in the crises of life.

Welch did not come from a raw and sparsely settled country, like Osler, nor from the striving and restless Middle West, like Billings; he was the product of the best stock in an old and long-settled community, a stock that has impressed itself upon our nation as no other. In the little town of Norfolk, Connecticut, and in the immediate neighborhood the Welches had lived for generations, mainly following the profession of medicine. He himself was the tenth Dr. Welch in the family. His father, William Wickham Welch, a beloved practitioner, was to the old citizens of Norfolk the most famous of the entire Welch line. To him his son William

[1] Memorial Address Delivered before the College of Physicians, January 7, 1935. Reprinted from The Scientic Monthly, September 1935, Vol. XLI, pages 251-257.

erected a fountain with the beautiful legend, "Fons sum solati, talis es ipse fuit—I am the Fountain of Comfort as He was Himself." From such an ancestry, in which culture and self-assurance had been at home for generations, Welch inherited the personal dignity and the charm of bearing that were his striking possession. He was at home in any circle—the great men of capital and business, statesmen, the highest military officers, even Presidents were proud to be his friends. His figure was not a commanding one—he was short, stocky, thick-necked and obese; nevertheless, he was the focal point in any gathering, medical or nonmedical.

Welch had the gift of friendship in a rare degree. Courteous, kindly, tolerant, not given to sarcasm, free from the superiority complex, to which more than any one else he was entitled, he had no enemies. In some men that might signify a weak character, one unwilling to assert itself. That was not true of Welch. At scientific meetings he never hesitated to criticize a speaker with whom he did not agree, but he always did it with such fine tact, with such good nature that he did not make an enemy of the man he criticized. At the banquet given in his honor in 1910, Councilman said, "Has any man ever heard Welch speak ill of his neighbor?"

Welch was born in 1850, and was sent to Yale College at the early age of sixteen. At that time the classics still dominated education, so that, together with the sciences, he acquired a knowledge of Latin and Greek which he increased by teaching these languages for a year after graduation. It can perhaps not be proved, but personally I feel that the type of education he received—largely humanistic—made it possible for him to become the all-round scholar that he was. I am not reconciled, and I doubt whether Welch was reconciled, to the elimination of the so-called dead languages from the college curriculum. In truth, they are not really dead, for they are still the sources of the language of science. To Welch Latin and Greek were more than two more languages. They were the key to two more civilizations. It is, I agree, no longer necessary to give them the main place in the college curriculum. Even so sturdy a defender of Greek as DuBois Reymond, after having first pleaded for Greek as a requirement for a medical education, late in life cried out, "more conic sections and less Greek."

After teaching Latin and Greek for a year Welch entered the College of Physicians and Surgeons in New York City. With prophetic vision he soon saw the value and need of chemistry, and this induced him to return to New Haven for advanced studies in that and kindred fields. He took courses both in the Sheffield Scientific School and in the Yale Medical School and was greatly

stimulated by Professor Oscar Allen and by George Frederick Barker, afterwards professor of physics in the University of Pennsylvania. Welch became deeply interested in the new chemical theories propounded by Kekulé, the originator of the benzol ring concept of organic compounds. Within a year he had mastered the exciting theories in the original German. On completing these important studies Welch in 1872 re-entered the College of Physicians and Surgeons, where the course of instruction had recently been extended from two terms of four months each to three terms of five months each. Through the influence of Francis Delafield, one of the founders of pathology in this country, Welch began even as an undergraduate to make autopsies at Bellevue Hospital and to study morbid changes with the microscope. He had won the Seguin Prize, a Varick microscope, for the best report of the clinical and didactic lectures of Seguin, famous professor of nervous diseases. His graduation thesis on goiter not only won for him the first prize, but also taught him in its preparation the use and value of medical bibliography.

Six months before graduation Welch was already acting as intern in Bellevue Hospital. Here he came in contact with a brilliant group of men, such as Francis Delafield, E. G. Janeway and Abraham Jacobi. A number of others also influenced him at this formative period—Charles McBurney, Alonzo Clark, Austin Flint and Alfred Loomis. At the end of a year and a half's internship Welch, accompanied by his friend, Frederick S. Dennis, set sail for Europe. For him and for American medicine this proved to be a momentous step. The Civil War had interrupted the migration to Europe, which in the earlier decades of the century had taken some of the best men to Paris, London and Edinburgh. Germany was just beginning the wonderful work in medicine, in chemistry, in biology that eventually made her the Mecca for eager learners from all parts of the world, a position she lost with other intangible things as the result of the Great War. Strassburg, which the Germans had raised to a university of highest rank, was Welch's first stopping place. Here he worked with Waldeyer in histology, with Hoppe-Seyler and Baumaun in biochemistry, virtually a new science at that time, and with von Recklinghausen in pathology. After a short stay at Strassburg he went to Leipzig, where he found many other foreigners in the famous physiological laboratory of Carl Ludwig. Magendie, Charles Bell, Johannes Müller, Claude Bernard in the earlier part of the century had blazed the way that was now being followed with brilliant results in physiology by Helmholtz, by DuBois Reymond and by Ludwig. Welch discussed

with Ludwig the advisability of working with the mighty Virchow,[2] but Ludwig, who was not completely won over to the cell-doctrine, suggested that Welch instead go to the youthful Julius Cohnheim in Breslau, which was a happy choice and proved of decided importance for Welch's future. As we shall see later, it was Cohnheim's recommendation that largely influenced President Gilman of Johns Hopkins University to offer the chair of pathology in the new medical school to Welch.

In Cohnheim's laboratory Welch was associated with Karl Weigert, to whom pathology owes many important discoveries, including valuable methods of staining tissue elements in preparation for microscopic study. Others in Cohnheim's remarkable institute were Ehrlich, Lassar, Neisser and Salomonson. The atmosphere was electric. Every one was pursuing some individual problem assigned to him by the master. That of Welch was the ascertaining of the causes of acute general edema of the lungs. The result appeared in an essay that is still a classic; it was written by Welch in German and printed in *Virchow's Archiv* essentially as Welch had prepared it. A number of years ago I had occasion to read this article. At that time I thought that some one had translated it from Welch's English into good German. It did not seem possible that any one not a native or long familiar with the German tongue could have written it in the vernacular.

Summer vacations in Europe were used by Welch for walking tours. During one short holiday he walked 210 miles in Switzerland. That was good exercise for a man inclined to be stout and gouty.

While at Breslau Welch had a memorable experience that helped to shape his subsequent career. He was present when Robert Koch arrived to show Cohnheim his bacteriologic discoveries, which consisted at that time chiefly in isolating and growing microorganisms—it was still five years before the discovery of the tubercle bacillus.

On Cohnheim's advice Welch went to Prague to visit Edwin Klebs, who was then engaged in his fruitful studies on acute endocarditis and diphtheria. From Prague he passed on to Vienna. He was disappointed in the opportunities he found there for the object he had in view, the study of embryology. Nevertheless, his stay there in the fall of 1877 proved invaluable. He entered with zest into the cultural activities, into the music and art life of the gay Austrian capital, the gayest then, as it is the saddest now.

[2] Nevertheless, Welch's admiration for Virchow was unlimited. He recognized in him the pioneer, the master—*il maestro di color che sanno*—and put him on a pedestal with Vesalius and Harvey.

After the winter in Vienna he returned to Strassburg to continue his studies with von Recklinghausen, who was one of the leading representatives of the Virchow school of pathologists. As a suitable *Arbeit* von Recklinghausen assigned to Welch the study of the inflammation of the frog's cornea induced by various caustic chemical agents. This study was intended to determine the origin of the pus cells, a question which at the time, the late 70's, was the cause of intense and bitter controversy between the Virchow and the Cohnheim schools. Was the pus cell an emigrated leukocyte of the blood, as Cohnheim contended, or was it the product of the multiplication of the fixed tissue cells? Although Welch's experiments seemed to favor the latter, or Virchow theory, he was not willing to draw any far-reaching conclusions on the basis of his own researches. Indeed, it required many years of further observation and experimentation before the final proof was brought that connective tissue cells under the influence of chemical stimulants become motile and multiply so as to surround and to invade the chemically altered area.

His work at Strassburg being completed, Welch spent a few delightful days in Paris and then paid a second visit to London. Here he found the medical world in a fever of excitement over Joseph Lister's bold surgical exploit of opening the knee joint. We of today can hardly understand this excitement, unless we remember that antisepsis was still in its infancy.

His Wanderjahre being ended, Welch was ready to turn his steps homeward. He had studied under some of the best masters in the world. The phrase that I have just used is rarely heard in this country. We would say a man went to Pennsylvania or Harvard, to Yale, to Johns Hopkins, but in Germany a man studied under this or that professor. The distinction is significant. When our universities become real universities in fact as well as in name, then a man will study under such and such a master rather than at such and such a place.

Welch was back in New York in the spring of 1878, trying to see whether any one prepared as he was could find work in that great city. As he needed to earn a livelihood he was for a time undecided whether to stay in New York or whether to join his aging father in the practice of medicine at Norfolk. At that critical moment he fortunately fell in with Dr. Goldthwaite, a well-known quiz master who persuaded him to take up quizzing. The quiz was, as Welch long afterwards put it, a life-saver. But he abandoned the work after three years because he felt that it injured both the students and himself. The identical conclusion was reached by

many of us in Philadelphia who as students and as teachers had experience with the quiz system.

During this probationary period in New York a little practice came to him from his old teacher Alonzo Clark, but it did not divert him from his main objective, the study and teaching of pathology. His Alma Mater offered him a lectureship in pathology, but as it did not provide a laboratory, he with some heartache accepted the offer of the rival school, Bellevue Hospital Medical College, where three small rooms for the purposes of a laboratory were assigned to him. This constitutes in a sense an historic event, for it was the first recognition in this country of pathology as an independent discipline. Soon however the College of Physicians and Surgeons realized the need of a similar chair and offered it to Welch. He declined, feeling that he could not desert his friends at Bellevue, and suggested T. Mitchell Prudden for the place. With the latter's prompt appointment pathology was definitely established as a branch of medical education coequal in importance with anatomy and physiology. To Virchow belongs the credit of having done this originally, for it was he who raised pathology to a definite science.

Welch's work in New York in teaching and investigation soon attracted attention. One day a man came into the room while Welch was lecturing on syphilis and without making himself known remained throughout the teaching period. The visit had momentous consequences, for the silent visitor, John S. Billings, had come to select a man to fill the chair of pathology at the new hospital and the contemplated medical school in Baltimore. President Gilman, one of the greatest educators in the history of this country and one of the best judges of human nature, planned to create a medical school on new principles. Welch, recommended not only by Billings but also by the influential Julius Cohnheim, received the first appointment to the faculty. In that manner a pathologist became the head and real founder of the Johns Hopkins Medical School. Realizing the growing importance of bacteriology and his own need of knowing it in order to fit himself for his new position, Welch returned to Germany in the summer of 1884. After a year of intensive study he came back thoroughly at home in the newer bacteriologic methods of Robert Koch. He began his work at Johns Hopkins Hospital in 1885, several years before the medical school was opened. His energy and magnetism drew to him a group of men whose names are now household words, Councilman, Abbott, Nuttall, Halsted, and later Flexner, Barker, Mall and MacCallum.

In the choice of the major faculty of the Johns Hopkins Medical School Welch exercised a paramount influence. It was through him

that Halsted was called from New York and Osler and Kelly from Philadelphia. What that remarkable quartet meant for medicine in America I need not discuss. Its influence continues to this day after all but one of the four have died.

Welch was the dominant figure in the new medical school and rapidly extended its reputation far beyond the confines of Baltimore. Everywhere, in all medical schools, Welch's personality began to be felt. His influence upon medical education was manifold and in its totality was unquestionably greater than that of any other man in the history of this country. It is not easy to analyze it, for it was all-pervading and touched on many fields. One outstanding phase was the making of pathology a required fundamental branch in medical teaching. It was natural that in such an undertaking he should emphasize the value of the laboratory. As a result of this emphasis practically every medical school of importance and even many hospitals established pathological laboratories. Some were for research as well. What this meant for the progress of medical science in this country cannot be over-estimated. Compared with Germany, the spirit of research was but poorly developed in this country when Welch established his laboratory in Baltimore.[3] He attracted to himself a group of eager young men who advanced so rapidly in reputation that they were called upon to fill chairs in other medical schools. In that way Welch's influence reached out over the length and breadth of the land. Councilman went to Harvard, Flexner to Pennsylvania, Lafleur to Montreal.

One reason for Welch's remarkable influence was that he better than any one else of his time was aware of the trend of medical education. With unparalleled vision, he sensed instinctively the direction in which medicine ought to go in order to progress, and thus it was that in time he became general educational consultant to medical schools, which rarely adopted a new idea or filled professional chairs without seeking his advice. Welch was the foremost champion in the medical profession of the so-called full-time system of teaching. One may differ about the wisdom of full-time clinical chairs, at least on the plan originally conceived, but it cannot be denied that the academic type of medical teaching is rapidly extending.

In line with Welch's work for medical education were his efforts in promoting the founding of great research institutions, in particular the Rockefeller Foundation and the Rockefeller Institute, whose

[3] A distinguished professor of physiology in a German university once said to Welch, "When America does wake up to the necessity of these things (medical laboratories), then let Europe look to its laurels."

benefactions very nearly reconcile one to the accumulations of great wealth in single hands.

A large share of credit must also be given to him for the phenomenal physical improvement in medical schools, which until the early nineties for the most part were but poorly equipped. In 1890-91 there were only five endowed chairs in medical colleges, and not a single one of these south or west of Philadelphia. On the other hand, there were 171 endowed chairs of theology, many of these being in the West and South. In 1892 the productive funds in the hands of the medical schools were $611,214, for theological schools $17,599,979. While it would be an exaggeration to say that the reversal of this relationship now obtaining was chiefly due to Welch, his powerful far-flung influence was always exercised in the direction of the physical and pedagogic improvement of medical schools.

As a commissioner of health of Maryland, a position he held for many years, Welch set a standard for similar officials in other states; indeed, in all great events of national and state action for public health Welch was the man to whom every one turned for advice both in formulating plans and in selecting personnel. He laid down the lines of action in the great campaign against tuberculosis in this country, and they have been followed throughout the world.

Upon Philadelphia medicine Welch's influence was far greater than is generally known. The Phipps Institute, to whose board of trustees he belonged from the beginning, depended upon him for wise counsel and stimulus. He was consulted upon faculty appointments in the medical schools and upon other matters of educational policy. At the opening of the William Pepper Clinical Laboratory Welch delivered the principal address, which was a masterpiece of historical study of the origin and growth of laboratories.

When Welch reached the age of 66 he resigned his professorship of bacteriology at Johns Hopkins University, not, however, to seek the *otium cum dignitate* to which he was so well entitled; on the contrary, he took upon himself the directorship of the School of Hygiene and Public Health, a position he filled with undiminished ability for ten years. At the ripe age of 76 his friends may have expected that he would decide to retire, but Welch was not the man to rust out. Instead of seeking a life of leisure he began a work which in the future may prove almost as significant for American medicine as anything he did in his life. Supported by generous benefactors he created out of nothing an Institute of Medical History and the wonderful library bearing his name. After

he was appointed to the new position he spent two years abroad gathering rare books in all parts of Europe. His unequaled bibliographic knowledge made it possible for him to collect a significant library such as was never collected before in so short a time. The institute, modeled after the famous Leipzig Institute of Professor Sudhoff, is destined under Welch's successor, Dr. Henry E. Sigerist, to play an important role in the cultural life of America.

The appointment of Welch to the directorship of the Institute of Medical History was not a mere gesture to a deserving man but a proper tribute to one who knew the history of medicine as well as any man in the field. William Osler once said, adding to a phrase of Oliver Wendell Holmes, "In addition to a three-story intellect Welch has an attic on top." In that attic was stored a vast amount of cultural knowledge. And what was as remarkable as the contents of his multi-storied brain was the fact that on the spur of the moment he could call upon his memory for details that often gave the impression of careful, lengthy preparation. His memory was truly colossal. He could lecture for an hour or more on historical subjects without making a mistake in dates or sequence. I heard him give the first William Wood Gerhard address before the Pathological Society of Philadelphia. It was, appropriately to the occasion, on the history of typhoid fever. Without notes he began at the beginning, went through the early nineteenth century to Gerhard and then down to modern times without an error and without halting for a word. It was a phenomenal performance that no one present can ever forget.

When Welch reached his eightieth birthday a celebration of truly cosmic proportions took place. In Washington President Hoover attended, and speaking to the 1,600 assembled guests he called Dr. Welch "our greatest statesman in the field of public health." Nearly all large cities of the world held simultaneous celebrations. Welch's address on this occasion was a model of modesty and charm. One of the speakers said, "Dr. Welch waded knee-deep in honors unsought and aroused no shadow of envy or enmity on the way." To the truth of this all who knew Welch personally can testify. No man in medicine was ever so deep in the hearts of his contemporaries.

Welch's enormous influence upon his generation, indeed upon two generations, was due to a combination of gifts. First and foremost was that of good health, with its accompaniment of zeal and vigor, and the second curiosity; curiosity that was not satiated by the triumphs of medicine but extended to literature, to art and to music. His interest in the intangible things that we call the

humanities kept pace with his scientific interest. With the scholarship of an Erasmus, the integrity and tolerance of a Contarini, the scientific zeal of a Virchow, we may, I believe, call him the finest exponent of humanism in the history of medicine.

Dr. Welch left no children in the flesh, a disappointment to the eugenist, but no man in the history of American medicine has left a larger number of spiritual offspring, a form of immortality, beyond theology and dogma, reserved only for the greatest of men.

If now, in conclusion, we place William H. Welch before our mental eye to see why he had such a colossal influence upon men and events, we find that he was an all-around personality—not only a doctor, not only a scientist, not only a historian, not only an educator, not only a scholar in literature and languages—he was all these at one and the same time.

Nature unfortunately is parsimonious in such men.

A PHYSICIAN IN THE PAPAL CHAIR [1]

A few years ago while reading Sedgwick's "Italy in the Thirteenth Century," I found it stated there that one of the Popes had been a physician. This intrigued me, and I corresponded with Mr. Sedgwick, and eventually began a bit of research in the hope of learning something of the man who, starting from the modest ranks of doctor, had risen to the highest elective office in the world. In our day the loftiest office attained by one of the medical profession was that of the premiership of France (held in a very critical time by Georges Clemenceau). The British Ambassador to the United States, who fills a distinguished post with distinction, is also a doctor.

I have said that the office of Pope was the highest elective position in the world; I ought to say that in the age of which I am speaking the headship of the Holy Roman Empire was also elective, the office not becoming hereditary until centuries later. Inasmuch, however, as the German Emperor in the person of Henry IV had gone to Canossa and had knelt penitently at the feet of Hildebrand, Gregory VII, Christendom had come to look upon the Pope as suzerain and overlord of all temporal rulers.

Let us see now who this man was that exchanged the doctor's hood for the papal tiara, the waterglass and scalpel for the ring and keys. For a better understanding of the subject it is necessary to delve a little into the thrilling story of the thirteenth century, to some scholars the greatest of all since time began. According to taste, scholarship and dogma men differ in their views as to the preeminence of centuries. Professor Breasted, the Egyptologist, thinks that the twenty-ninth century B. C. is the greatest. I wonder what he will say on his return from Egypt where he was with Lord Carnarvon at the tomb of Tutankhamen. Paul Shorey and Gilbert Murray would probably choose the fifth century B. C.; J. J. Walsh puts none above the thirteenth. Many in whom the spirit of the Renaissance has entered contend that the palm belongs to the quattrocento. I shall not stop to discuss the relative merits of these diverse predilections, but shall content myself with saying that the

[1] Read before the Section on Medical History, College of Physicians, Philadelphia, March 29, 1923.

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thirteenth century was a wonderful epoch, a time of intellectual awakening, and that by preparing the way for the Renaissance, it has high claim to our admiration.[2]

In the political field important things happened in that century. It witnessed the gigantic struggle between the papacy and the temporal sovereigns of the Holy Roman Empire. Frederick II, King of Sicily, was Emperor. He looms against the background of his epoch as a colossal figure, valiant, brilliant, liberal, progressive. Stupor Mundi his contemporaries called him. Descended from Frederick Barbarossa, the Hohenstaufen, on his father's side, and from the Normans on his mother's, the blood of two domineering races was so mixed in him that he could not accept, as his predecessors had done, the suzerainty of the bishops of Rome.

Frederick's court at Palermo was the seat of the highest culture of the time. All races were tolerated; all languages were spoken there. To the great disgust of the orthodox, Frederick received and respected the Saracens and even adopted some of their customs. "When he realized how each great religion reviled the other, he concluded," says H. G. Wells,[3] "that all religions were imposters." Thus by his doctrinal heresy on the one hand and by his political independence on the other, he brought upon himself the undying hatred of the church.[4] To medical men he is interesting because he laid down in precise fashion a five-year curriculum for the education of physicians at the University of Salerno.

There is a certain analogy between Frederick II, who was of Swabian descent, and the last of the Hohenzollerns, also of Swabian extraction, but now an unwilling resident of Holland. Both concerned themselves with everything under the sun; and there is a further resemblance in that both at the height of their glory undertook the impossible and failed utterly.

Frederick's conflict with the Popes is a sad and bitter tale; a tale of heroic courage on the part of the Emperor, and of unbelievable perfidy on the part of both Emperor and Pope. In the end Frederick succumbed to that irresistible papal weapon, excommunication, hurled against him by Innocent IV at the Council of Lyons. His admirable son Manfred and his grandson Conradin took up the hereditary fight, but in vain, for the Pope had now won a great ally, the sinister Charles of Anjou. With Conradin perished forever the brilliant and attractive race of the Hohenstaufens.

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[2] Funck-Brentano. The Middle Ages, N. Y., 1923, p. 49, states that for the French the eleventh century is the greatest.

[3] Wells, H. G. Outline of History, N. Y., 1921.

[4] Allshorn, Lionel. The Life and Times of Frederick II, Emperor of the Romans; King of Sicily and Jerusalem, 1194-1250. "If a temple should ever be raised to the memory of those who have struggled for the freedom of man, then Frederick should find a high place in the sanctuary."

As soon as Charles of Anjou became King of Sicily he reached out to get control of the papacy, and when Pope Gregory X died on January 12, 1276, the king succeeded in procuring the election of a Frenchman, Peter of Tarentaise, a pupil of the great Thomas Aquinas. This Peter, who took the name of Innocent V, was the first Dominican to become Pope. Although a great scholar, he was a weakling, and became the ready tool of Charles to the detriment of the influence of the papacy and of the freedom of Italy. He endowed Charles with great political power, making him senator of Rome and vicar in Tuscany. The Roman climate, however, was too much for Innocent V. He succumbed six months after attaining the Chair of St. Peter.

Unfortunately, the second Council of Lyons had entrusted Charles of Anjou with supervision of the conclave. Charles was naturally eager for the election of another French Pope, and with that end in view, treated the Italian cardinals who formed the majority with extreme rigor. The cardinals were locked in; their food was restricted to wine and bread and although it was July, all the windows and openings were walled up so that, as Suba Malaspina says, not even a bird could have penetrated into the conclave. Nevertheless, Charles failed. The cardinals chose an Italian, Ottoboni Fieschi, Adrian V, as Pope. Poor Adrian, however, had suffered so much through Charles' cruel treatment that he died at Viterbo on August 18, 1276, thirty-eight days after his election.

A new conclave was assembled at once. Fortunately for the much tried cardinals, chiefly men of advanced age, Adrian, a few days after his election, had rescinded the decrees of the Lyons Council regarding conclaves. The cardinals waited more than the stipulated ten days in order to give the absent members of the college time to arrive. This delay and the inability to reach a rapid decision prolonged the conclave to a point beyond the endurance of the excitable Viterbians. They assaulted the emissaries of the conclave and made much noise and disturbance. Under such pressure the cardinals reached a unanimous decision sooner than they had intended and elected somewhere between the 13th and 20th of September, 1276, the Cardinal Bishop of Tusculum, Petrus Hispanus, a Portuguese physician, as Pope John XXI. Of him this essay treats.

The choice really should have fallen on the great Cardinal Deacon John Cajetanus Orsini, but the conclave was afraid of offending Charles of Anjou by electing an Italian, a Frenchman they would not choose, so they picked a man from the neutral country of Portugal. John Orsini had, however, not long to wait. He soon succeeded the man whose election he himself, with a

remarkable degree of self-effacement, had just brought about. As Nicholas III he followed John XXI in the chair in 1277.

To return to John XXI. This Pope was before his election not only a high church dignitary, but also a physician. His name, Petrus Hispanus, was a medical household word in the Middle Ages. He is the only one of the profession that has ever sat in the Chair of St. Peter. Some writers, it is true, speak of another Pope as having been a physician, Paul II (Pietro Barbo). Paul, however, never studied medicine. The legend, if so it can be called, arose from the fact, as I found in the delightful chronicles of the naïve Platina, that Paul like many laymen was fond of prescribing for his friends. When any of the cardinals or anyone of his personal entourage was ill, he would send drafts and potions to the helpless patient. In that way the belief arose that Paul was a doctor of medicine.

Something ought to be said in the beginning regarding Petrus' papal name, John XXI. According to nearly all writers he should have been called John XX, as there were apparently only nineteen Johns before him. On one of his seals he is designated as John XX and in his epitaph as John XXI.[5]

Various explanations have been given for the discrepancy. It seems that the pontificate of John XIV was by some chroniclers divided into two parts, the one preceding, the other following his imprisonment in Castel Sant'Angelo. In that way he is both John XIV and John XV.

Another explanation is that the anti-Pope of Gregory V was designated (by John of Piacenza) as John XVII.

A third explanation is the one given by Gregorovius, namely, that the belief in a Popess Joanna influenced the count. It may not be without interest to give a brief account of this legend. A woman, in order not to be separated from her lover who was a monk, entered a Benedictine monastery under the name of John Anglus. Later she accompanied her lover to Athens, acquired the Greek language and afterwards returned to Rome where she soon gained great fame for her learning and piety. Eventually, from Professor of Greek she was raised to the papacy, there being no suspicion of her sex. She exercised the power of the Church to the admiration and respect of all. Meanwhile she became suddenly overwhelmed by an unmistakable intimation that her secret relations with the monk were about to bear fruit. An angel appeared to her one night as her term approached, and announced to her that she might choose

[5] An amusing reference to this discrepancy is found in Cabell's "Jurgen." The hero in order to get into Heaven from Hell pretends to be Pope John XX and uses the "Cantrap" given to him by the "Master philologist," namely, "At the death of Hadrian V, Pedro Juliani, who should be named John XX, was, through an error in the reckoning, elevated to the papal chair as John XXI."

one of two alternatives; either to hide her condition, suffer in silence, conceal her offspring, continue to rule the Church, and finally lose her soul; or to endure the unspeakable humiliation and disgrace of a public disclosure, be overwhelmed with infamy, be thrust from the Church, and in the end be admitted to Heaven. The poor woman had a great and noble soul. She chose the better part and in token that her expiation was acceptable to Heaven, it was granted to her to become a mother while the public procession in which she took part was returning to the basilica of St. John Lateran.[6] [7]

This remarkable legend has, of course, no basis in fact. The chroniclers living at the time of John XXI do not speak of it; so that either it sprang up afterwards or they did not consider it of sufficient importance to mention it in their chronicles.

In the magnificent church of San Paolo fuori le Mura in Rome, there are medallion portraits of all the Popes since St. Peter. To my surprise I found twenty Johns preceding our John XXI. As no dates are given on the medallions, only the length of reign, it was not possible to tell precisely the time in which the various Johns lived. The Church, evidently, sees no discrepancy in the Johannesian enumeration.

Petrus Hispanus, Pope John XXI, was a native of Portugal. The name Hispanus was due to the fact that in his age little distinction was made between Portugal and Spain. He was born near the beginning of the second decade of the thirteenth century, the son of Julianus, a physician. Little is known of his early life. He first appears as a student in the University of Paris where as a fellow pupil of Roger Bacon he came under the influence of the great English logician, William Shyreswood. The latter must have been a man of extraordinary attainments, for Roger Bacon ranks him above Albertus Magnus, the dominant scholastic of his time.

As medicine was not then sharply separated from the other branches of learning, it was not a great step for Petrus Hispanus to pass from logic, including, as it did, Aristotle and the Arabian philosophers, to medicine. Some believe that Petrus studied logic as well as theology at Paris and medicine at the more famous faculty of Montpellier. It seems more probable, however, that he was made *magister* of medicine at Paris.

The University of Paris at this time was passing through a period of reaction. The reading of Aristotle in public as well as in private was forbidden.[8]

[6] Chisholm, Recreations of a Physician.

[7] Rhodis, P. J., Leipzig, 1904. A biting satire in which the father of Popess Joanna is an English monk, a pupil of Scotus Erigena, and the mother, a Saxon goose girl named Jutta.

[8] The University of Toulouse, on the other hand, by direct edict, permitted the study of Aristotle and prided itself on that fact.

It would be interesting if we could, through a supposed manuscript of Roger Bacon's,[9] recently discovered, get a sidelight on the life of his fellow pupil, the subsequent Pope. Intellectually, Bacon was infinitely greater than Petrus. Far in advance of his time he insisted that the renewal of the sciences could be brought about only by a return to investigation of original sources; in the case of philology to the Greeks, of nature to observation and of theology to the Bible. The foundation of natural philosophy, he insisted, was mathematics; the only way to a knowledge of nature, experiment. Small wonder that these ideas brought Bacon into conflict with the Church and led to his persecution and eventually to his imprisonment at the hands of the ecclesiastical authorities.

I have not yet touched upon an important phase of the story of Petrus Hispanus, and that is the dispute regarding his real identity. While by my title I have indicated that Pope John was indeed the physician Petrus Hispanus, some scholars have held that the Pope was another Petrus Hispanus, a certain Dominican friar.

Owing to the meagerness of transmitted data, the identification of medieval personages is often difficult; this is especially true in the case of Petrus Hispanus since that name occurs with great frequency in the literature of the Middle Ages. Thus the single order of the Dominicans counts no less than six men of the name of Petrus Hispanus, one of whom has been claimed by some to have been Pope. A work entitled Summulae logicales[10] figures largely in the controversy. This was written by Petrus Hispanus, unquestionably the one who became Pope. Arguments have been advanced to show that he was not the doctor but the Dominican friar. But since monkish writers are always known as *fratres*, never as *magistri*, and as Petrus Hispanus is always called *magister* and never *frater*, he could not have been a member of a monkish order. Thus in 1312, Ricobaldus of Ferrara, Canon of Ravenna, writes: *Hic* (i. e., John XXI) *magnus magister . . . cui nomen fuit magister Petrus Hispanus, qui tractatus in logica composuit.*[11] Moreover, as Pope Petrus Hispanus showed himself inimical to the monks, particularly to the Dominicans. In view of these facts prominent modern Dominicans[12] admit that Petrus Hispanus was not one of their sect.

In 1597 a Greek manuscript was discovered in Augsburg (it is now in Munich) the text of which corresponds almost word for

[9] The Voynich MS. which Professor Newbold of the University of Pennsylvania is engaged in deciphering.

[10] Franck, A. Dict. des sciences philosoph., Paris, 1875, p. 1333, called John XXI one of the most celebrated logicians of the school of Paris.

[11] Quoted by Stapper, Papst Johannes XXI, Muenster, 1898, p. 14.

[12] Quétif-Echard, Scriptores ord praed., I, 485 *et seq.*; Denifle, quoted by Stapper, *loc. cit.*

word with the "Summulae" of Petrus Hispanus. As author of the Greek work the title names Michael Psellus, a Byzantine writer who lived between 1018 and 1079, nearly two hundred years before Petrus. This discovery seemed to prove that the "Summulae logicales" of Petrus Hispanus was nothing more than a copy from a Greek original. But both by internal evidence and by the discovery of numerous other manuscripts, it has been demonstrated that the synopsis of Michael Psellus is a Greek translation made in the fifteenth century by Georgios Scholarios from the "Summulae logicales" of Petrus Hispanus.

In the "Monumenta Germanica," in three places, the names of Petrus Hispanus and John XXI are used synonymously; once the term Petrus Physicus is employed; once John XXI; once John XX. In practically all the manuscripts of the fifteenth and sixteenth centuries, Petrus Hispanus the logician and physician and John XXI are identified as one.

The Pope has also been confused with yet another Petrus Hispanus, the philosopher logician, Petrus Hispanus. Nicolao Antonio [13] has, however, straightened out this difficulty by showing that the logician was not even a contemporary of the Pope. He was a professor at Paris (perhaps also at Siena) and a Dominican. Another Petrus Hispanus, at times confounded with our Pope, was a professor of canonical law at Bologna. He likewise was not an actual contemporary, being engaged in teaching as early as 1223.

Each of these items, while not in itself conclusive, added to the others forms a fairly decisive body of evidence showing that Pope John XXI was a physician as well as a logician and the author of the famous "Summulae logicales."

The "Summulae logicales" enjoyed great popularity throughout the Middle Ages and later was frequently reprinted, and always as the work of Pope John XXI. Prantl found no less than forty-eight imprints made in the first century after the invention of printing.

It is to this work that Dante refers in his "Divina Commedia." Meeting John in the seventh circle of glorified souls, Dante's guide, the Franciscan Bonaventura, points out Petrus Hispanus, saying:

E Pietro Ispana.
Lo qual giu luce in dodici libelli.[14]
("And he of Spain in his twelve volumes shining.")[15] [16]

About the year 1247, we find Petrus Hispanus as a teacher of medicine at Siena when that ambitious town was about to establish

[13] Henschel, Janus, I-II, 526, 1851-1853.
[14] Canto XII, V, 135-136.
[15] Cary's Translation, New York, 1897.
[16] John XXI is the only one of the contemporary popes whom Dante meets in Paradise.

a university of its own. It was there that he wrote his first medical work: "A Dietetic Treatment of Surgical Patients" at the request of his colleague, the surgeon, John Mordentis of Faenza. There is also a record in the archives of Siena of a stipend paid to him for services to the community.

As a native of Portugal where at that time the Moors were still a power, he probably understood Arabic, which readily accounts for the fact that we have from his pen commentaries on Avicenna and on Isaac Judaeus. Commentaries on Hippocrates and on Galen are also attributed to him. His greatest medical work is, however, the "Thesaurus pauperum" (the Treasury or Pharmacopeia of the Poor). This famous treatise, printed for the first time in Antwerp in 1476, was composed either in Italian or in Latin, and was in all probability written at the court of Gregory X to whom *qui pater pauperum nuncupatur,* it is dedicated.

Because printed in an early Spanish edition, some have attributed the work to Petrus Julianus, the father of the Pope; but the Spanish is a translation, not the original. Moreover, all references by the medieval chroniclers are against such a view. In the "Practica" of Serapion, printed in 1525, occurs the following sentence: "Here begins the 'Thesaurus pauperum' of John XX, pontifex maximus whose name formerly was Petrus Hyspanus: In which thou findest absolutely the theory and practice of curing diseases." There is a striking similarity in style between the "Summulae logicales" and the "Thesaurus pauperum." Platina,[17] the archivist of Leo X, says of John XXI:

> "He wrote many Tracts in his life, especially certain Rules relating to Physick; for he was counted a very good Physician. He wrote also another book and called it Thesaurus pauperum or the Poors' Treasure, and set out Problems in imitation of Aristotle."

The Thesaurus is a collection of recipes for every disease under the sun. It had an enormous vogue in the Middle Ages. Being copied and recopied before the discovery of printing, every copyist added his own favorite prescriptions until the work finally became a hodge-podge of medical treatment and magical formulas of the most grotesque sort.[18]

In addition to the Thesaurus pauperum, John composed another medically famous work, "Liber de oculo" (Book on Diseases of the Eye). First printed in 1476, the "Liber de oculo," which has recently been edited by Dr. A. M. Berger of Munich, enjoyed a high degree of popularity for several centuries. The great Guy de

[17] Platina, Baptista. Lives of the Popes, London, 1685.

[18] The Thesaurus pauperum of Petrus Hispanus must not be confounded with a work of the same title written a little later by Arnald of Villanova.

Chauliac in his "Chirurgia" refers to it, and Michelangelo copied its prescriptions for his own use. In the Vatican Library I saw this precious document in the handwriting of the great Florentine. Arnald of Villanova in his "Breviarium" also reproduces some of the remedies and prescriptions, especially the famous *aqua mirabilis*. This "Wonder Water" of Petrus Hispanus consisted of filings of silver, copper, gold, etc., in a boy's urine. "It elevates the physician who can prepare it to the rank of prophet."

Judged by our standards, the "Liber de oculo" is of little scientific value, but will not the physicians of 700 years hence be likely to say that of many of our own works?

Petrus Hispanus places the seat of vision in the lens, which is of course false since the lens can be removed, as in the operation for cataract, without destroying vision. Vision is brought about by a *spiritus visibilis* or visual ether. In this hypothesis, adopted from Empedocles and Galen, Petrus departs from the theories of Aristotle who had assumed the motion of some medium between the eye and the object and thus had laid the foundation of the undulatory theory of light.

The first to form a clear notion of light rays in the eye was Kepler, who held that an inverted image was produced on the retina.

Petrus Hispanus deserves great credit for one fact in particular, namely, he tried his best to exclude superstitious and sympathetic remedies from his work,[19] which is the more noteworthy as the somewhat later Arnald of Villanova, already mentioned, includes in his book remedies against demons and evil spirits.

But with all his skepticism, Petrus was a child of his time and believed firmly in astrology, holding that the human body was under the influence of planets and zodiacal signs. In this respect the great medieval philosopher and physician, Moses Maimonides, who preceded him by seventy-five years, was far in advance, for he wrote as follows:

> Man should only believe what he can grasp with his intellectual faculties, or perceive by his senses, or what he can accept on trustworthy authority. Beyond this nothing should be believed. Astrological statements not being founded on any of these sources of knowledge must be rejected.

I have as yet said nothing of Petrus' positions and experiences in the Church about which we must be informed in order to understand his transfer from the ranks of physicians to the highest pinnacle in the Roman hierarchy.

His first ecclesiastical office was that of canon of Leon. Soon after receiving this appointment he attracted the attention of Car-

[19] *Redeamus ad naturalia,* he writes.

dinal Ottoboni Fieschi, later Adrian V, and accompanied him as personal physician on his journeys as papal legate. About the same time he was made deacon of Lisbon with the unusual privilege, testifying to his importance, of non-residence. In the service of Cardinal Ottoboni he came into contact with Cardinal Thedaldus Visconti and when that dignitary became Pope Gregory X, he made Petrus Hispanus his body physician or archiater. From now on Petrus' ecclesiastic preferment was rapid. He was elected Archbishop of Braga in 1273 and in the same year Cardinal Bishop of Tusculum. His consecration as cardinal took place in 1273 at the Second Council of Lyons, simultaneously with that of the lovable Bonaventura, the Minorite, and of Peter of Tarentaise, the Dominican. Medieval historians make much of this triple consecration.

After ascending the papal chair, one of John's first acts was to confirm his predecessor's edict suspending the Lyons Decrees regarding conclaves. His enemies criticised him for his audacity in rescinding a decree of an Ecumenical Council and had a certain measure of right on their side in doing so. They remembered that prior to the election of Pope Gregory X in 1271, the Holy See had been vacant for three years because the wrangling cardinals could not agree upon a Pope.

Pope John was most approachable, particularly to poor scholars. It was this trait in his character that made him unpopular with the higher clergy who contended that such conduct lowered the dignity of the papacy. The ignorant chroniclers speak of him as "learned and silly; a wise fool upon the sacred chair; a man without presence or dignity who loved learning and hated monks." Platina [20] writes in a similar vein: "He did many things that argued him to be guilty of folly and levity; and does not deserve commendation unless it be for one thing; and that was, that he assisted young scholars especially the poorer sort with money and preferment."

Some of the calumnies against the Pope can be traced to the Dominicans, whose special enmity he seems to have incurred. As I have already stated, John never belonged to any of the monkish orders and was a *Magister* and not a *Frater*. His knowledge of medicine and astrology in their eyes bordered on magic; as one of them wrote: *Joannes Papa magus, in omnibus disciplinis instructus, religiosis infestus.* If John showed preference for any of the monks it was for the Franciscans, the Minorites. This was due partly to the fact that his sponsor at the conclave that elected him, John Cajetanus Orsini, was the Protector of the Franciscan Order, and partly to the other fact that the principles of poverty and humility of the

[20] *Loc. cit.*

order of St. Francis appealed to him. He had determined, as proof of his goodwill, to make John of Parma, general of the order of the Minorites, a cardinal; but died before he could carry out his plan.

The Dominicans and the Franciscans hated each other with a most unclerical hatred. Even the beatific Fra Angelico, whose pictures prove him to have been one of the sweetest souls of the Renaissance, was not free from anti-Franciscan rancour. He painted Christ being welcomed by Dominicans "as only Dominicans can welcome Christ," and in his painting of the Last Judgment he sends the Dominicans to Heaven and the Franciscans to Hell.

In his political relations John XXI showed strength and independence; much more indeed than he is credited with by some of the later writers.[21] He first of all insisted that Charles of Anjou should renew his previous oath that he would not combine the crown of Sicily with that of the Roman Empire or of Lombardy. With the recently elected German Emperor Rudolph of Hapsburg, who ascended the throne in 1273 after an interregnum of twenty-two years, he carried on negotiations in which he insisted, against Rudolph, upon his rights in the papal states, the suzerainty of which the Emperor had claimed for himself.

One of his greatest problems was the collection of the tithes. The Council of Lyons, in order to raise money for another crusade, provided that one-tenth of the income of the churches should be sent to Rome. It had also ordered a revaluation of the ecclesiastical properties as a basis of the new taxes. Scotland was the first to rebel against the imposition of the tithes, at a convention of the clergy held at Perth in 1275. Soon afterwards England began to murmur. The English clergy did not object to the taxes so much as to the new valuation. They wanted to retain the old more liberal valuation established in 1263 by the Bishop of Norwich. To bring the matter to a climax, they sent a delegation to John XXI, complaining that the official tax collectors lived luxuriously in London while low clerics did the collecting for them; further that taxes had been imposed on leprosaries, poor-houses and hospitals.

In a solemn consistory at Viterbo the Pope heard the complaints of the English delegation. He agreed to all they asked except to the matter of valuation. The basis of the Bishop of Norwich, he insisted, could no longer remain in force.

John had much trouble with the ruling kings and princes, who under promises of embarking upon a crusade had asked that the tithes might be allocated to them so that they could equip their

[21] Platina, Henschel, Milman and others. Some maintain that he entrusted the cares of government largely to Cardinal Orsini, subsequently Pope Nicholas III.

armies. Philip III, The Bold, son of St. Louis, who had led the previous crusade, swore in the presence of all his nobles to lead an army against the infidels. Through the Pope's faith in his protestations, the king was able to secure large sums with which he organized a great army; but instead of leading it against the Saracens, he made war against another Christian Prince, Alfonso of Castile and Leon. One and all thus broke their solemn promises. They pocketed the tithes and forgot about the Holy Sepulchre.

An historically interesting phase of the Pope's activities was his negotiation with the Greeks for a union of the Eastern and Western Churches. Michael Palaeologus had sent delegates to the Second Council of Lyons for the avowed purpose of bringing about a formal union with the Roman Church. In the name of Michael and of his son and heir, Andronicus II, the Greek delegate swore to accept the Latin *symbolum*. But he swore verbally and possessed no written authorization from his sovereign to show to the Council. Soon it became clear to the leaders of the Roman Hierarchy that the Greek Emperor was shamming adhesion to the Pope for the sole purpose of enlisting his help against the wily Charles of Anjou who was preparing to make war on Michael Palaeologus on behalf of the deposed Latin Emperor, Baldwin II.

In order to test Michael's sincerity and to bring about actually a union of the churches, John sent delegates to Constantinople with more explicit instructions. They were to make the Greek Emperor, his son and the Greek clergy swear publicly to accept the Roman doctrine and to make as many manuscript copies of the proceedings as possible. Should it not be feasible to bring about such wholesale public conversion, the delegates were to attempt conversion even if but few of the clergy were present. If the clergy objected to swear obedience and reverence to the Pope, the delegates were to yield this point for the time being in the expectation that the priests would acquiesce another time. Nothing, however, came of these negotiations, for the Greek Emperor and his clergy had no thought of submitting to the Roman Pontiff.

Another opportunity for union presented itself under John Palaeologus and Pope Eugenius IV, at the Council of Florence in 1439, just before the fall of Constantinople. Although the union was actually decreed, nothing ever came of it; hence the Eastern or Greek church and the Western or Roman church are separate and distinct today.

Pope John had another contact with the East, curious and not cleared up entirely. The Tartar Khan Abaga sent delegates to John to inquire when the next Council would take place and prom-

ising his help against the Saracens. The delegates reported that Kublai Khan, an uncle of their chief, had embraced Christianity, and that both uncle and nephew were eager to have missionaries sent to their country.

Enthusiasm ran high at this prospect of a great accession to the Pope's spiritual dominions. After having been feted at the Papal See, the delegates were sent to the Court of France, where they were well received and lavishly entertained until the Easter Festival of 1277, then the discovery was made that the delegates were Nestorian Christians and not Romanists. From that moment their mission was a failure.

While these more or less external questions were pressing upon the Pope he was called upon to take action with regard to certain heretical doctrines that were spreading from the universities of Paris and Oxford and were rapidly making converts. He was busily engaged in the study of these problems when a sudden and mysterious accident cut short his career. Just behind the papal palace at Viterbo, erected on an old temple of Hercules, John had built himself a study chamber. On May 14, 1277, the Pope had gone into this room, which had just been finished, when suddenly the ceiling crashed down upon him and crushed him. He died six days later.

His enemies, who had disapproved of his learning, propagated the legend that the Pope had been engaged in black magic and had just given his soul to the Devil when the ceiling fell. Others, however, pointed out that he died *munitus sacramentis ecclesiasticis.* He was buried at Viterbo in the Church of San Lorenzo and rested there forgotten until 1886, when, at the cost of the Portuguese Ambassador at the Holy See and of Pope Leo XIII, a new monument was erected to his memory, which bears the inscription: "*Maxima lux,*" of Portugal.

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LIFE IN A MEDIEVAL UNIVERSITY *

If it were possible I should like to transport you to the University of Paris in the year 1400. Or if you prefer a bluer sky and a warmer climate, to Bologna or perhaps to Padua, the university that interested Shakespeare so much more than Oxford or Cambridge. But time is not reversible, at least not on our tiny planet. What we see today is what is today.

So I shall attempt to take you back in spirit and let you see how life was lived in a medieval university half a millenium ago.

But before we engage on our retrospective visit I must say something about the founding of these old institutions of learning, compared with which those in our country are so young.[1] Unfortunately our knowledge of their origin is for the most part meager, very different from that for example of the University of Virginia, whose illustrious creator is so well known. Did he not consider his part in the founding more important than being President of the United States?

Throughout recorded history there have been compact places where learning was fostered. Learning attained a high level—some think one never reached again—in Athens. Later a notable cultural center arose in Alexandria. Lin Yutang, in his remarkable book, "My Country and My People," shows the antiquity of learning and its continuity in China. Such continuity was not known anywhere in Europe although the cloisters constituted restricted areas of a self-perpetuating type of culture. Monte Cassino and Bobbio in Italy, St. Gall in Switzerland, and others kept alive the spark of learning without, however, greatly fanning it.

The study in cloister schools was limited to theology with occasional excursions into philosophy and physics or medicine. The monks, however, were assiduous copyists and helped to preserve many important works that otherwise might have been lost, and for that posterity owes them a debt of gratitude.

Through the influence of Alcuin, Charlemagne's Yorkshire teacher, schools were established in connection with cathedrals and

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became eventually more important centers of learning than the cloisters. They had, however, no permanency since they generally depended upon a single teacher through whose fame students were attracted to the school.[2] When the teacher died the school languished or died also.

Matters stood thus until about the twelfth century, with Paris, Orléans, Tours, Chartres, Canterbury, Fulda, the principal centers of instruction in what was called Studium generale. Paris led all the rest, largely through the influence of a number of great dialectical teachers. The most famous was Peter Abelard, a bold, skeptical philosopher. The tale of his tragic love for the noble Heloise, a greater soul than he, has been told by himself in the lugubrious "Historia calamitatum," and in the letters of Heloise included in George Moore's beautiful story of Heloise and Abelard.

The course in the Studium generale consisted of two parts, the Trivium, which comprised grammar, rhetoric and dialectic, and the Quadrivium, dealing with arithmetic and astrology, which was in part astronomy, geometry and music. These together composed the so-called Seven Liberal Arts.

As there were no printed books prior to the middle of the fifteenth century the students depended in part on the rare and costly manuscripts that passed from hand to hand, and to a much greater extent upon lectures and disputations conducted by the masters somewhat after the manner of Socrates and Plato in the ancient Hellenic Academy. This method of teaching led to the cultivation of the art of dialectic, an art that reached its height in the scholastic period. Although sterile as far as adding to the sum total of knowledge, it undoubtedly sharpened men's wits and prepared the way for the great flowering of the intellect known as the Renaissance.

The "Chronica Jordanica" says:

> The Church needs three powers or institutions, the priesthood, the empire and the studium, and as the priesthood has but one seat, Rome, so the studium has but one, Paris. Of the three chief Nations each has but one institution. The Italians have the priesthood, the Germans the empire and the French the studium. The studium was first in Athens, was transported thence to Rome and from Rome Charlemagne translated it to Paris.

This legend, one of many connected with the name of Charlemagne, has been used to explain the origin of the University of Paris, but it has no basis in fact. The university evolved in the twelfth century as the result of the presence in Paris of great masters and their hordes of students. No precise date can be given, but it happened soon after the death of Abelard (1142); at any rate

by 1200 King Philip Augustus laid down certain favorable regulations for the university.

But for several decades the young school of learning had no fixed abode, the teaching being done in the private homes of masters or in rented places, even in houses of prostitution. The students sat on the floor, upon straw, that they might not be proud—hence the street where the school was located was known even in Dante's time as Vicus Straminis or Straw Street.

In speaking of the University of Paris I have used the word university in our modern sense. In the Middle Ages it had a different meaning; it meant a corporation of persons and was usually followed by a genitive noun or nouns, as *universitas magistrorum et scholarium,* university of masters and scholars; it was also applied to the members of a single faculty. It was likewise employed in the sense of craft or trade-union or guild.[3]

Paris originally had only two departments or disciplines, those of arts and theology, but medicine and law were soon added. The university was dominated by the masters, *magistri,* who owed allegiance to a rector, usually chosen from the faculty of arts. Above him was the Chancellor of Notre Dame who represented the Pope, the latter being the real university sovereign. The relations established in that way between the university and the Church gave to learning an element of consecration which it had never known before and has not known since.[4]

Being clerics, the students and masters were not permitted to marry, but in 1452 Cardinal D'Estouteville abrogated this law in the medical faculty, but only for the masters; students had to follow the rule of celibacy.

The students and masters were a polyglot group coming from all parts of Europe. So that the masters might teach and the students learn it was necessary to have a common language and that common language was Latin. Not only was it the vehicle of intercourse in the classes, but also by statute on the campus and even in the students' lodgings. Although all students were encouraged to report infringements of the rule, a spy, the "wolf" (*lupus,* sometimes called *signator*), was especially appointed for this purpose. Those who spoke the vernacular were called *vulgarisantes.*

In Leipzig, where a penalty was exacted from students speaking in the vernacular, it was ordered "if the Proctor shall have been neglectful and not exhibit diligence in the matter of the offence, let him be punished by a penalty to be imposed according to the degree of the fault committed."

I have said that the University of Paris was governed by the

masters, by the faculties, as the church, within limits, allowed the greatest possible academic freedom. This gave to the life of the medieval student, master and scholar, a sense of independence that does not obtain today in our American universities in which the governing body is usually a board of trustees composed of successful business men rather than of scholars. The difference to some extent is due to the fact that the medieval university had little real property and no rich endowments requiring financial experts for their management. As C. Stanley Hall says, the university was a republic very different from our present universities with their unprecedented concentration of power in the hands of the university president.

Would it not be an advantage to our American schools of learning if the finances were put in the keeping of a small committee of trained men while the educational policy, appointments, and everything else pertaining to education and research were left in the hands of the faculties with supreme power?

In contrast to the University of Paris, that of Bologna was in a large measure governed by the student body who conducted the affairs of the university with a high hand. The professors had to obey a variety of rules that to us today seem obnoxious and *infra dignitatem.*

Thus a doctor who refused to take the oath of obedience to his pupils could not collect his lecture fees and was liable to further punishment at the will of the rector. The ultimate penalty was *deprivatio* which involved boycott of the master's lectures and discontinuance of all social intercourse with him. A professor could not be absent without leave even for a single day. If he desired to leave town he had to make a deposit to insure his return. If he had an audience of less than five at his regular lecture he was fined as if he were absent. He had to begin at the sound of the bell and had to quit one minute after the sound of the next bell. He was not permitted to skip a chapter or to postpone a difficult text to the end of the hour.

Nevertheless Bologna was a great university,[5] especially famous for its school of law. Law was divided into two parts, canon law, also called *decretum,* and civil law, which explains why we confer today the degree of Doctor of Laws instead of Law. During its period of greatest renown as many as eighteen different countries were represented in the student body. These students divided themselves into two groups, the Cismontanes and the Ultramontanes. Foreigners always enjoyed greater privileges than the Bolognese; the German students in particular had rights not pos-

sessed by others. They were permitted to take oath before their own procurators; they also had the exclusive right to elect the rector of the ultramontane students.

By reason of student control the lay influence was greater in the University of Bologna than in other universities. Some of this student predominance persists to this day in the Italian universities.

The medieval towns were well aware of the pecuniary advantages and the prestige conferred through the possession of a university and hence did everything in their power to prevent the university from moving elsewhere, which was easy when there was no real property.[6]

In 1231 Pope Gregory IX conferred one of the choicest of university privileges, viz., that of suspending lectures. This involved not only sealing up the fountains of wisdom but often a still more dreaded withdrawal of the university to another city, as indeed often occurred. The King of England in 1229 invited the University of Paris, when it happened to be in revolt, to migrate to his country; but the very threat of secession usually brought town authorities to terms and often to their knees.

The University of Padua, which owed its existence in large measure to groups of students that had emigrated from Bologna, formulated an extraordinary series of persuasive statutes reminding one of the promises and concessions of western boom towns to factories and business during their first period of growth.

> The town of Padua binds itself to make loans to scholars, according to the quality of the scholars, upon good and sufficient securities or bonds worth a third more than the loan, and upon the oath and promise of the scholars that they accept the loan on their own account and for their own use in meeting their personal expenses and not for any other person or for the use of others [1260 A.D.].
>
> Every six months the Chief Magistrate of Padua shall appoint two money lenders for the scholars—judges or laymen at the will of the Rector of the scholars—who shall have charge of the town's money that is to be loaned to the scholars. And they shall, in the name of the town, make loans to the scholars in accordance with the statutes and the agreement of the scholars, and at their own risk entirely, so that the town of Padua shall not incur loss. And the money lenders shall themselves deposit in the town treasury good and sufficient security as to this [1268].
>
> Scholars shall be considered as citizens with regard to matters advantageous, but not with regard to matters disadvantageous to them [1261].
>
> Scholars shall not be required to pay the tolloneum [i.e. taxes on imports, collected at the city gates].[7]

That the practice of granting liberal privileges did not die out with the Middle Ages is shown in the following excerpt from the Charter of Brown University in Providence, Rhode Island:

And, further, be it ordered by this Court and the authority thereof, that all the lands, tenements, or hereditaments, houses or revenues, within this jurisdiction, to the aforesaid President or College appertaining, not exceeding the value of five hundred pounds per annum, shall from henceforth be freed from all civil impositions, taxes, and rates; all goods to the said Corporation, or to any scholars thereof, appertaining, shall be exempted from all manner of toll, customs, and excise whatsoever; and that the said President, Fellows, and scholars, said President or College appertaining, not exceeding ten,—viz. three to the President and seven to the College belonging,—shall be exempted from all personal civil offices, military exercises or service, watchings and wardings; and such of their estates, not exceeding one hundred pounds a man, shall be free from all country taxes or rates whatsoever, and none others.

The earliest privileges definitely on record, the *Authentica habita,* were promulgated by Frederick I, Barbarossa, at the Diet of Roncaglia in 1158. They were: freedom of travel and freedom from civil jurisdiction and from taxes or extortion on going to or returning from the university. It was in Bologna that these privileges were first put into practice.

Doctors of medicine in most universities were exempted from military service.

One of the most valuable privileges enjoyed by university professors or masters was bestowed in 1292 in a Bull of Pope Nicholas IV; it was *jus ubique docendi*—the right to teach anywhere. This applied to masters of theology, of canon law, of medicine and of the liberal arts. No passport, no naturalization, no further examination was necessary for a master to migrate to a foreign country to assume a professorship. His diploma was all-sufficient.

The spirit of nationalism as we see it today in all its baneful consequences did not exist in the Middle Ages. The scholars felt themselves as members of a world apart and that feeling was shared by the citizens who recognized in the university or association of scholars a new organism, a new intellectual force to which they paid deference and respect not seen in later ages.

It was the absence of nationalism that made it possible for a man to teach or, if qualified, to practice a profession anywhere in the European world. How different things are today! In Philadelphia, for example, the mayor by tradition is virtually compelled to appoint only Philadelphians to office, even if abler men are available elsewhere.

The freedom of travel, first granted by Frederick Barbarossa, made it feasible for a student to go wherever he could find the greatest master in his field of study. Even today the wandering scholar is found in Continental universities whereas in this country the student usually takes his entire course, whether as under-

graduate or in the professional schools, in the same place and comes out with the stamp of the college indelible upon him. The European is less inbred, less machine-made, not molded into a definite characteristic and recognizable form which the American student shares with hundreds or thousands of others. I should like to see the wandering scholar become a feature of academic life in this country. A little in this direction has been done in the University of Pennsylvania, in the Surgical Department of the Medical School, which exchanges students with several Eastern universities. The Rhodes scholarships are also an attempt in that direction.

In Paris the students, mainly for social reasons, grouped themselves into "The Four Nations," the French, the Picard, the Norman and the English, these nations supplying the largest contingent of students. When the English became unpopular during the Hundred Years' War, the name of their nation was changed to German. Each nation exhibited in an exaggerated degree the virtues and the vices of its homeland but all seemed to be especially solicitous, as one writer puts it, "in drinking up the surplus." Shelden maintains, with justice I think, that the corps or *Burschenschaften* of the German universities and the fraternities and other student societies of our own country are genetically the offspring of the four nations of the Middle Ages.

As I have already indicated, the medieval student was by no means the paragon of conduct his modern descendant seems to be. Conflicts between students and townspeople were frequent and bloody. Some of the conflicts between town and gown eventuated in liberal privileges for the students.

As early as 1200, as the result of a tavern brawl between students and citizens, the provost of Paris was commanded by the king to swear loyalty to the students, and they were given a charter of exemption from civil court jurisdiction and supplied with a court of their own. In the same year all chattels of students were exempted from seizure by the civil power, for whatever cause. Students must not be interfered with on any pretext, and every plaintiff against them must appear before the university court; even church courts could not try students.

Besides being a frequent disturber of the peace, the medieval student would descend to cheating or bribery at examinations. In "The Secret History of the University of Oxford" (London, 1726),[8] one may read the following:

> Several ingenuous candidates have confess'd to me, that they never studied an hour, nor looked into any system of the sciences, 'till a month before they were examined. How well the examiners perform their duty,

I leave to God and their own consciences. . . . It is also well known to be a custom for the candidates either to present their examiners with a piece of gold, or to give them an handsome entertainment, and make them drunk; which they commonly do the night before examination, and sometimes keep them till morning, and so adjourn, Cheek by Joul, from their drinking room to the school, where they are to be examined—Quare, whether it would not be ungrateful of the examiner to refuse any candidate a testimonium, who has treated him so splendidly over night?

In some of the universities (this was true of Paris) the student had to swear before entering upon his examinations not to avenge himself on the master if he failed.

Hazing was more elaborate and rubricized in the Middle Ages than at any other time. C. Stanley Hall believes that this apparently ineradicable custom can be traced back to classical antiquity, perhaps to the ancient cults of Dionysus, Apollo, Isis and Osiris.

The students were often determined to extend their vacations on their own account and would do strange things in order to achieve their purpose. In Pisa, for example, it was the custom to cut up the books of the masters so that they might not be able to hold lectures.

The universities concerned themselves with the clothing of the scholars. The authorities at Heidelberg, for example, in 1469, issued the following:

The university decrees that indecent and irregular clothing should be avoided by every student. First, as to hoods, that they be made in proper and honorable lengths. . . . Concerning collars, it is ordained that they shall not be made as they are now seen, scarcely a half, but they shall go about and completely surround the neck. . . . In shoes also they shall observe decency, especially as regards the beaks, which shall not exceed the length of the toe joint. . . .

The character of students, especially of medical students, did not undergo much change for hundreds of years. In a letter of Dr. McClurg's, written in 1778, he says:[9] "A more licentious youth are hardly to be found anywhere than I remember to have seen in Edinburgh."

Walter Jones in 1776 wrote the following illuminating comments:

The students here, denominated medical, may be referred to three ranks or orders.

1st. The Fine Gentleman, or those who give no application to study, but spend the Revenues of Gentlemen of Independent Fortunes.

2ly. The Gentlemen, or Students of medicine strictly speaking, these live genteely and at the same time apply themselves to study.

3ly. The vulgar, or those who, if they are not indolent, are entirely devoid of everything polite and agreeable. I believe you will not doubt for a moment with which of these orders I ought to associate. . . .

During the Middle Ages the division between medicine and surgery which harks back to very early times became greatly accentuated. It was undignified for a medical man to use his hands; hence he would not dissect and would not perform such a simple operation as bloodletting. Surgery was left in the hands of wandering quacks and barbers. Gradually a higher grade of men took up the work of surgery but they were not recognized by the faculty of medicine. In Paris, for self-protection and also to abolish unseemly professional quarrels, the surgeons united themselves in a society known as the Confrèrie de St. Côme, the pattern of later associations. The instruction given by the surgeons to their pupils was in French, not in Latin, as was the case in the faculty of medicine. Not only was there jealousy between the physicians and surgeons but also between the surgeons and the barbers, the latter being more or less under the protection of the faculty of medicine.

As for the texts, the medical students from the commencement of the thirteenth century onward had the words of Constantine, of Joannitius, the Aphorisms and Prognostics of Hippocrates, and the treatises of the School of Salerno. A little later the Arabian writers were added: the treatises of Avicenna and of Averroes, as well as the writings of the Conciliators, especially of Pietro D'Abano, and the Natural Philosophy of Aristotle. These texts, ranging in age from a few hundred to nearly two thousands years, and a few later ones, continued to be used almost to the end of the seventeenth century. This strikes us today as truly remarkable, for a modern textbook rarely outlasts a decade (Gray's Anatomy is one of the few exceptions).

The course of instruction in the University of Paris, which I have said became the prototype of virtually all universities in the world, was very long and arduous. Work began at six in the winter and at five in the summer. By work I mean reading of lectures and discussions. There was in medicine no clinical teaching in any form until the end of the sixteenth century. The length of study was usually six years but it could be shortened for one who had the degree of Master of Arts. The formal examinations lasted many hours; one known as the Cardinal Thesis began at five in the morning and continued until noon. Refreshments were then served at the expense of the candidate. The questions asked were often fantastic, such as:

Is the loud voice warm?
Is air, food or drink the greater necessity?
Is woman an imperfect work of nature?
Is it healthy to get drunk once a month?
Does a libertine life lead to baldness?

The first degree obtainable was that of Bachelor. This was followed by the diploma of Licentiate, which required a special course dealing with some particular books. The bachelor had to give testimony that he had studied in Paris for fifty-six months if he was a master of arts, sixty-eight months—five years and eight months—if not a master of arts. A candidate who had failed could not come up again for a degree. The licentiate before being allowed to practice had to accompany a doctor in private practice or in hospital for two years. In that way he made up for the purely theoretical instruction he had had in his five years' course.

The doctorate was not obligatory but without it one could not obtain membership in the faculty. The examination required was largely a formality and consisted of further argumentation on some set topic.

After the candidate had passed his examination and observed various ceremonies both costly and exacting, among them visits to all the professors, generally with gifts, he had to take an oath containing among others the following characteristic paragraphs:

1. To observe faithfully the secrets, honor and practice, customs and duties of the Faculty with all his power and no matter what may happen, never to go against them.
2. To render honor and respect to the Dean and to all the masters of the Faculty.
3. To aid the Faculty against any one who undertakes anything whatever against the statutes or the honor of the Faculty and especially against those who practice illegally and to submit to the punishments inflicted by the Faculty in case of default.

It is apparent from this oath that the faculty was concerned more with its own dignity and privileges than with the good of the patients, for there is nothing in the oath that enjoins proper conduct in the daily life of the doctor. How far superior was the oath of Hippocrates to the arrogant and selfish demands of the medieval medical faculty.

The student was obliged to attend a large number of masses, one being for the souls of those whose bodies he had dissected. Masses were, however, not the only functions that encroached on the students' time. There were many banquets in the course of the year, in fact nearly every step in the progress of the student to the end of his university career was marked by a banquet, so that this particular custom weighed heavily both on the digestion and on the purse. The banquet habit, so prevalent in medical associations today, thus has an ancient and honorable lineage.

But banquetomania is not the most important inheritance be-

queathed to us moderns by the medieval university. More important are the following:

1. A curriculum, evolving out of the Seven Liberal Arts.
2. Examinations, an institution new to the world.
3. Academic degrees and the ceremonials used in conferring them. These features have been taken over with little change from the earliest universities.
4. The modern academic vestments are practically those worn by university scholars as early as the fourteenth century. They were of course of ecclesiastical origin. The pleat down the back of the standard academic hood today was once a veritable hood to be drawn over the head, while the rudimentary pocket in it is what is left of the pouch in which the medieval student carried his breakfast or lunch. The costume meant both distinction and immunity.[10]

It can be said truly that university life with its ceremonies, degrees and official costumes, its proctors, deans, provosts, rectors, chancellors, has undergone very little change; the greatest innovation is the athletic movement.

While due allowance must be made for the fact that the background of history always seems more picturesque than the foreground, it is nevertheless true that life in a medieval university had the charm of the morning.

REFERENCES

1. Harvard, the oldest in the United States, was founded three hundred years ago; the University of Mexico is older, dating back to 1555. There are today in Europe forty-nine universities founded before 1500.

2. The Middle Ages were conscious of "the central importance in education of the distinguished teacher," a fact that many boards of trustees of universities and colleges fail to appreciate.

3. The word *Universitas* acquired its present sense in 1261. The phrase *Alma Mater* apparently arose first in Oxford about the year 1300, and a little later in Cambridge. Both alma mater and alma universitas were used. The statutes of the University of Vienna of 1389 speak of the University of Paris as alma mater.

4. Hall, C. S. The Medieval Universities and Some of Their Lessons for Us. Pedagogical Seminary, June, 1915, p. 275.

5. "Bononia docet" was on the coins of the city. Bologna was also called Bononia mater studiorum.

6. While the universities possessed no property in the beginning, the Middle Ages could show many charitable foundations, especially for asylums, hospitals and shelters. One of the earliest charitable asylums was the Hôtel Dieu of Paris, to which was attached a foundation for poor clerics, the first students' college of the world. In 1257 the most famous perhaps of all foundations, now known as the Sorbonne, was created by Robert de Sorbon, almoner of King Louis IX, Saint Louis. Oxford also had charitable foundations from an early day; University, Merton and Balliol arose in the thirteenth century, and the three colleges still dispute as to priority.

7. Norton. Readings in the History of Education. Cambridge, 1909.
8. Quoted by Munroe. Manuale scholarium, p. 70.
9. Quoted by Blanton. Medicine in Virginia in the Eighteenth Century. Richmond, 1931.
10. Hall, C. S. *Loc. cit.*[4]

BOURDELOT, A PHYSICIAN OF QUEEN CHRISTINA OF SWEDEN[1]

Bourdelot plays so important a role in the life of Queen Christina of Sweden, one of the most interesting women of all time, that his name should be preserved both in general and in medical history. The biographies of Christina as a rule state that he was the son of a barber, perhaps of a barber-surgeon, that he himself was an apothecary, and that he probably never had a medical education. Guy Patin called him a mere "joueur et pipeur." However, in the "Biographie Universelle" he receives a totally different treatment. There it is stated that he was born at Sens in 1610, that he was the son of a surgeon, and that his real name was Michon. He studied in Paris under two uncles, Jean Bourdelot, a hellenist, and Edme Bourdelot, physician of Louis XIII. The uncles, both unmarried, were flattered by Michon's success and obtained authorization for him to change his name to Bourdelot.

Whether the Biographie is correct or the histories of Queen Christina, it is apparent that Bourdelot possessed a certain native shrewdness which made him a better counsellor to the Queen in her illness than all her pompous medical advisers, who might have served excellently well as prototypes for Molière's doctors.

The Queen was ill from overstudy. She was the world's greatest bluestocking and lived an altogether irrational and irregular life. It is probable but not proved that she was a Lesbian. When Bourdelot came he saw to it that the court doctors were dismissed and that all their nauseous potions were thrown away. He prescribed frivolity and play, and played with her. The result was extraordinary. Christina rapidly recovered her health and threw herself into the affairs of state with masculine energy. Bourdelot was eventually sent home to France for reasons not altogether clear. It may have been that he made improper advances to the Queen. She could not, however, have been very resentful, for she sent him off laden with presents. Some hold that the germ of Christina's apostasy from the Protestant faith was implanted by Bourdelot, albeit that he himself was an avowed atheist.

[1] Reprinted from Annals of Medical History, New Series, Vol. IX, March, 1937.

Toward the end of her life Christina again entered into correspondence with Bourdelot. She begged him to send her the newest scientific books from Paris and expressed a great interest in a new medical discovery of injecting healthy animal blood into anemic human beings:

> I think the invention of injecting blood is all very fine, but I should not like to try it myself, for fear that I might turn into a sheep. If I were to experience a metamorphosis, I should prefer to become a female lion, so that no one could devour me; I am feeling quite well . . . but if I should need this cure, I have decided to be injected with the blood of a German, for the German animal is less like a human being than is any other animal I know.

Bourdelot on his return to France received the Abbey of Mace on condition that he practiced free of charge among the poor. This advancement is strange for he was not in holy orders and must have concealed successfully his atheistic tendencies. He died of opium poisoning through a mistake of his valet.

ADDRESS ON THE HISTORY OF GASTRO-ENTEROLOGY[1]

1897 to 1927

Once upon a time the pious Hillel was accosted by a youth who said, "Can you teach me the Law while I stand on one foot?" Hillel replied, "Love thy neighbor as thyself."

Dr. Hemmeter has asked that I compress the history of American gastro-enterology during the last thirty years into an after-dinner speech, while he is standing on one foot. Unfortunately there is no single terse sentence that can epitomize that history. To attempt it is like trying to square the circle.

In order to simplify the matter Dr. Sailer and I sometime ago agreed to divide the field, he taking the appendages of the alimentary canal, and I the digestive tract proper.

The American Gastro-Enterological Association was formed by a small group of men meeting in Philadelphia on June 3rd, 1897. During the thirty years that have elapsed since then the Society has had an incalculable influence upon the development of the science and practice of gastro-enterology in this country; as our former president, Dr. Chase has said, no other Medical Division can show a like advance.

Perhaps the most signal event, gastro-enterologically speaking, that coincided with the founding of our Society in the year 1897, was the appearance of the first American textbook on Diseases of the Stomach. It was published in Philadelphia, then as now the center of medical bookmaking, and its author was the youthful Hemmeter, now in his late adolescent years. True, biologic investigations at Woods Hole and ardent wooing of the historic muse in the watches of the night have changed the color of his hair to that of snow, but his outlook on life is still rosy. Not long after Hemmeter's book appeared, Einhorn began to publish his standard works on Diseases of the Stomach and Intestines. Since then American writers have been active in the production of textbooks, not all of which have enjoyed longevity or reached the distinction of a second edition.

[1] Reprinted from Gastro-Enterology number of Medical Life, December, 1927.

With regard to contributions other than textbooks, I was first inclined to take our Transactions and review them chronologically, pointing out all the important discoveries made in the last thirty years, but on reflection it seemed to me better to review the period from the point of view of subject matter, so as to see not what each man had done, but how each phase of gastro-enterology had been advancing by successive steps.

Taking first the physiology of the gastro-intestinal canal it seems that no single man's work can rank with that of William Beaumont on his patient patient, Alexis St. Martin. It is the outstanding physiologic contribution to American medicine. Nevertheless, a number of highly important advances are to the credit of the last thirty years. Cannon was the first to demonstrate the peristaltic wave in the esophagus and antiperistalsis in the large intestine (1902), and the churning movements in the proximal colon, which, driving the food into the closed cecum, again thoroughly mix the food with the digestive secretions brought down from the small intestine and expose the digested food to the absorbing wall. Much other information on the movements of the intestinal contents we owe to Cannon's ingenious use of the X-ray. Cannon also gave us an explanation for the opening and closing of the pylorus, which the stomach performs as if it possessed intelligence. He ascribed the opening to cispyloric and the closing to transpyloric acidity. This explanation has been questioned and it must be admitted that opening and closing take place in achylia gastrica, in the absence of acidity. McClure and Reynolds also question Cannon's hypothesis.

Carlson's studies on hunger contractions are of great importance for the full understanding of gastric motility and the subjective sensations of hunger.

Antiperistalsis can occur in any part of the gastro-intestinal tract, even, as Carlson has shown, in the esophagus.

Ivy's recent investigations (1927) show that gastric secretion exhibits three distinct phases: cephalic, gastric and intestinal, the first being reflex, the second due to distension and the stimulating action of foodstuffs, and the third probably due to hormones or secretagogues.

Garbat's work has shed light on the type of gastric secretion obtained by duodenal feeding.

The theory of hormones—based on the work of Starling and Edkins—has had a wide bearing not alone upon gastro-intestinal physiology, but also upon endocrine function in general, although some of the hypotheses regarding secretin and gastrin have not

been confirmed. As I have said before, according to Ivy the intestinal phase may be hormonic or secretagoguic.

On looking over the Transactions, I find that the salivary glands and their secretions have been somewhat neglected. It is true that Cannon and others have shown that as the food in the stomach tends to arrange itself in more or less concentric layers, salivary digestion may go on for some time in the stomach, but the full significance of salivary secretion is not yet understood.

We have learned a little about the digestibility of the different foodstuffs and the length of time that they remain in the stomach, but the knowledge has not been put to much use in dietetics. In fact, dietetics is one of the most neglected subjects in the whole realm of medicine. No wonder the laity make fun of us, since it is possible for them to obtain from very good authorities absolutely contradictory dietetic instructions. Complete harmony is no doubt impossible, but a little more scientific concordance should exist.

The importance of the ileocecal valve in the mechanism of intestinal digestion has received considerable attention through the work of Kantor. Ileocecal regurgitation has been described by Bryant.

Kantor has also dwelt upon the nerve control of the intestinal canal, referring it to developmental factors, while Alvarez finds a gastric pace-maker in the lesser curvature of the stomach near the cardia.

From the anatomic point of view the work of Bensley on the finer structure of the cells of the gastric glands, as well as of the pancreas, constitutes a landmark. Likewise the great work of Mall on the anatomy of the stomach.

John Bryant has made an important contribution through his study of the growth and length of the human intestine.

The gases of the stomach and intestines have not received a great deal of attention, either as to their chemical composition or as to their origin. I found one article by Seymour Basch, whose death two or three days ago has been a shock to all of us.

The birth and life of the Society coincides with the use of the stomach tube, supplemented latterly by the employment of the duodenal tube. I shall not enter into a discussion of priority claims. It is too ticklish a subject, as my friend, Dr. Lyon, can testify. The knowledge gained has been of enormous value in understanding normal and pathologic processes of digestion. Rehfuss and his school have shown the great variability in composition of the gastric juice from individual to individual and the great changes in composition at different periods of digestion in the same indi-

vidual. Fractional gastric analysis, which we owe very largely to this school, has become an indispensable procedure in gastro-enterologic practice.

Duodenal feeding, ocasionally a life-saving measure, has been made possible through the discoveries of Hemmeter, Turck and Kühn. Its value has been discussed before our Association by Clement Jones and others.

Important studies in the function of the colon have been made by Soper and Restor and by the late Walter Mills.

The advances made in the pathology of the intestinal tract are truly phenomenal and while other countries have done their share, America in certain fields has been pre-eminent.

In the first edition of his book on Diseases of the Intestines, published in 1900 and in the second, published in 1904, Einhorn expresses himself as follows regarding the treatment of appendicitis, endo-appendicitis or scolecoiditis, as he calls it: "The remedy par excellence in the treatment of appendicitis is opium." How far we have traveled in those 23 years!

Regarding the pathology of the stomach an important contribution was made five years before the founding of this Society when Einhorn published his first paper on achylia gastrica. The condition was not a new one. It had been recognized as early as 1877 by Fenwick in its relation to pernicious anemia. Friedenwald and Pilcher give credit to Austin Flint (1860) for calling attention to this relationship which was afterwards emphasized by Fenwick, by Henry and Osler, by Kinnicutt and recently by Faber. It was Einhorn, however, who clarified and classified the various conditions producing gastric achylia. Since then there have been numerous papers on this subject in our Transactions. I would mention those of Stockton, Brown, Sailer, Friedenwald and Morrison. Gompertz and Vorhaus in their interesting work on histamine have made a novel contribution to the subject of gastric secretion that may be of some significance in the study of the achylias.

The greatest advances have undoubtedly come through the X-ray—a subject that will be touched upon by others. Whether the debt we owe for the opaque meal is to Riegel, or, as Friedenwald claims, to Benedict, I do not know. Certain it is that since its introduction into medical practice the diagnosis of ulcer, hourglass stomach, cancer, ptosis, colitis, diaphragmatic hernia, etc., has been given an accuracy never dreamed of before. To name the men of our Society and others not affiliated with it who have contributed to our knowledge, is impossible. It would be a roster of the roentgenelogists, the clinicians and the surgeons of this country. It is

but fair to say that the Mayo Clinic, Sippey, Case, Smithies, White, Meyer, Einhorn, Mills, Friedenwald, Cole, Baetjer, Roberts, Pfahler, Pancoast claim our gratitude.

The history of duodenal ulcer is a comparatively recent one, dating back scarcely twenty years. Our Association has had a large share in spreading the knowledge of that long-neglected lesion. Great credit belongs to the Mayos, to Deaver and to Sippey in this country, and to Moynihan in England, for making knowledge of the symptoms, diagnosis and treatment of the disease universal property.

A special word of tribute is due to Sippey. By painstaking work he elaborated a procedure for the medical treatment of peptic ulcer that has been adopted as a standard in all parts of the world. Sippey's untimely death is to be greatly regretted.

I do not know that therapeutically anything of equal importance has come from thirty years' work except that latest American discovery—the liver treatment of pernicious anemia, which is rapidly displacing all other forms of treatment of that terrible disease.

It is true that there has been criticism of the Sippey meal, both within the ranks of the Society and outside of it. The dangers of alkalosis have been emphasized at various times. Alvarez has pointed a way to a rational ambulatory treatment of the disease. But there are many treatments, each one having one or more defects—that of Sippey is the most popular; then there is Smithies' carbohydrate and alkaline treatment, that of Lenhartz, and that of Alvarez just mentioned. I believe that if a Martian should read our Transactions he would come to two conclusions: (a) That we know nothing about the cause of peptic ulcer; (b) That we do not know how to treat it. But as I have never had much faith in the Martians, I should say that these plausible conclusions are not altogether justified.

The work of Rosenow on the Causation of Peptic Ulcer by well-trained, wandering streptococci, has attracted great attention and also a good deal of criticism. The time is not yet ripe for a final opinion.

An interesting suggestion was made several years ago by Kaufmann to the effect that the lack of a normal amount of mucus (amyxorrhea gastrica) prepared the way for hyperacidity and ulcer.

Crohn, a great student of the structural changes of peptic ulcer, will soon add another leaf to the laurel wreath of American gastro-enterology by the publication of a book.

Not only do the medical men disagree about the treatment of

ulcer, but the surgeons have started to fall out with each other. That, however, is a healthy state. It shows that the surgeons are seriously thinking about the physiology of the stomach and duodenum. Whether the Bergian method of subtotal gastrectomy or the traditional procedure of gastro-enterostomy, will triumph in the end, I do not know. Both operations strike me as being too coarse, too brutal, to be the last word of surgery.

I cannot leave this phase of the history of our Society without calling attention to the fact that Kaufmann, who has always emphasized the physiological or functional side in disease—to my mind the most important—has cautioned very wisely against the use of tobacco and alcohol in cases of peptic ulcer. Blackford and Dwyer share the same view.

The question whether ulcer of the stomach can be transformed into cancer has agitated the Society at different times. MacCarthy and Smithies each claimed that 70 per cent. of cancers had their origin in chronic ulcer, but I think that lately their view has undergone a change. Friedenwald's statistics show such a transformation is but 7.3 per cent. of cases, while Clement Jones comes to the decidedly heterodox conclusion that transformation into cancer is difficult to prove.

Since speaking of ulcer and cancer of the stomach brings to mind the tremendous advances in the surgical treatment of this disease, it is interesting to recall what Kussmaul wrote in 1869: "Whether in the most daring ages of the distant future an attempt may be made to produce radical results by gastrectomy or to perform a gastric fistula and dilatation of the stricture (at the pylorus) by the knife or sound no one can today positively assert. We fear that even the proposal of such a method of relief may expose to silent or expressed ridicule." Eight years later—I quote from Friedenwald's presidential address—Billroth published his first case of successful partial resection of the stomach.

With regard to the esophagus, the historic contributions in the last thirty years are: Chevalier Jackson's work on the esophagoscope, cardiospasm, and the methods of dilating strictures developed by Plummer.

Diverticulitis of the esophagus, diaphragmatic hernia, diverticulitis of the duodenum and of the small intestine and perhaps the best studied, diverticulitis of the colon, are subjects known before, but emphasized especially within recent years by Portis, Sailer, Pancoast, Boles, William J. Mayo and many others. It is but just to say that it was William J. Mayo who first attracted attention to acquired diverticulitis of the large intestine.

Syphilis of the stomach, a disease often suspected in the earlier years of the Society but rarely proved, has been placed upon a respectable nosologic basis by Eusterman.

The bacteriology of the intestinal tract is still largely terra incognita. Since Herter's monumental work on Bacterial Infections of the Digestive Tract, the additions have not been many. The work on dysentery by Flexner and Shiga, and the study of fecal bacteria by Torrey and others, the recent work on the acidophilus bacteria and the vaccine treatment of dysentery are perhaps the most important contributions.

It is rather interesting that Herter in 1907 made the following statement: "The onset of senility may be distinctly accelerated through the development of intestinal infections in which the putrefactive anaerobes are represented."

Chace has carefully reviewed the subject of the bacteriology of the duodenum.

The diseases of the colon up until the present session have not received adequate attention, yet from the point of view of daily practice they are decidedly important. An early paper by Stockton and DeWitz should not be forgotten.

Among the interesting anatomic anomalies of which I have already mentioned diverticula, reference should also be made to malformation of the stomach described by Bettman, and to the redundant colon and movable cecum to which Sailer, White and others have called attention, and to epigastric hernia, the significance of which has been pointed out by McGlannan.

Visceroptosis, enteroptosis, Glénard's disease, is of interest through the fact that Aaron has pointed out a diagnostic sign; while the late Henry D. Beyea had devised the no longer fashionable operation of gastropexia.

Bastedo and Famulener's and Thomas Brown's work on sprue is still vivid in the memory of those who heard the papers read. The same thing is true of the articles on Lamblia infections, by Kantor and by Hemmeter.

The work of Bastedo on the digestive ferments is a therapeutic contribution of value.

It is always interesting when diseases of the gastrointestinal tract are referred to systemic affections and are not looked upon as purely local conditions. They are indeed few diseases of the alimentary canal that are purely local. The occurrence of gastric hemorrhage in hypertension, pointed out by Simon, and the gastric disturbances in connection with exophthalmic goiter, referred to by McGlannan, likewise the gastric disturbances accompanying

renal diseases, to which Allen Jones has called attention, illustrate the conditions I have in mind.

Intestinal autointoxication is a phrase that the physiological chemist has always rebelled against, but one the clinician needs and feels justified in using. Thomas R. Brown's work in 1917 gave a scientific aspect to the subject.

The relation of indican and its relation to the gastrointestinal tract has had its ups and downs in medical history. We owe one important paper on the subject to our former president, William Gerry Morgan.

The cause of death in intestinal obstruction is another subject that the third decade of the thirty-year period has brought to the forefront. The work of Sweet, Peet and Hendricks, Whipple, Mayo, Haden and Orr is representative of the important researches made in this field.

In this connection attention should be called to the pioneer work of Robinson, Finney and Bloodgood on chronic obstruction in the third part of the duodenum through the crossing of the superior mesenteric artery and the mesenteric edge.

Kast's work on the pituitary origin of migraine will ever rank as an example of clinical investigation of high type.

I should like to speak at length of the work of that dynamic young Turck—Fenton B.—a mechanical genius, a physician, a biologist with unusual vision. I wanted to analyze the numerous articles, written in more than one modern language, that he was good enough to send to me a few days ago, but I could not in the short time find the necessary leisure. The future will deal justly with him, even if the present does not.

One word more. Gastro-enterology is a branch of internal medicine—that fact we must never forget. The human gastro-intestinal tract is not merely an alimentary canal, a hollow, winding tube, with a few necessary appendages. It is an inseparable part of the whole body. As a medical discipline, which as Chace had said in his presidential address, has made greater advances than any other specialty, gastro-enterology should have the same pedagogic privileges as neurology and that growing youth cardiology and it should be taught, as Lucas, our president of last year, so eloquently stated, as a regular part of the medical curriculum.

When the Association celebrates its semi-centennial and the younger men whose hair time has not yet touched with gray are sitting in our places as the elder statesmen, may they say of those who are then no more: "The pioneers have builded well."

WHAT YOU SHOULD KNOW ABOUT CANCER[1]

The sole hope for a cancer patient is that the disease shall be recognized at the earliest possible moment. Only the complete removal of the cancer either with the knife or by some other powerful means, such as radium, the X-rays or the electric cautery, can bring about a cure. There is no known remedy to be taken internally that cures cancer. No medicine can either remove or check the growth of a cancer, nor will any medicine applied to an external cancerous growth stop its spread. Stories concerning this or that remedy that has cured a cancer patient are not to be believed. Such cases have not been authenticated. In trying useless remedies precious time is lost.

The cancer or other malignant tumor does harm in at least two ways: 1. By steadily growing bigger locally it interferes with the function of the organ in which it grows. For example, if it grows in the gullet it may narrow the channel so that the patient cannot swallow, and he may starve to death; or it may close up the outlet of the stomach into the intestines with practically the same result. 2. As the dandelion scatters its seeds to distant places, so the cancer may scatter its seeds along the blood stream or the lymph stream to distant organs where these seeds set up equally destructive daughter cancers. Thus a small cancer of the breast may send its cells to the liver, to the brain or to the bones with indescribable suffering and early death. Fortunately cancers in their early stages do not send out such cells or seeds. Consequently if the growth is removed in its youth, there may be no daughter growths; and if the removal has been complete at the original site, the patient is forever cured.

No one knows how many lives are annually sacrificed through delay, but the number must run into the tens of thousands. Delay arises from several causes. One is bashfulness which leads a woman to shun a physical examination. If the woman notices a lump in the breast or an abnormal vaginal discharge she should throw modesty to the winds and have herself examined by a competent

[1] Reprinted from Hygeia, December, 1935, Vol. XIII, No. 12, pp. 1091-1092.

physician without a day's delay. If she is innately so shy that she cannot bring herself to go to a male physician she should go to a woman doctor with the requisite experience.

In a few instances that have come under my observation the patient was quite sure she had a cancer but would not go to a doctor because she did not want anyone to know. She looked on the disease as something loathsome, perhaps as contagious, as something of which to be ashamed. But cancer is not contagious. It is a disease like any other, and in no sense need the patient be ashamed of it. Perhaps she should be ashamed of having been ashamed and having thereby lost the ideal moment for hopeful treatment.

Sometimes delay arises from failure of recognition of the true state of affairs by the doctor. Often the symptoms are misleading and the doctor may be in doubt, but this happens less and less often with improvement in methods of diagnosis.

Another cause of delay is ignorance. It is the purpose of the propaganda organized by the medical profession to banish this ignorance.

The following facts should be borne in mind:

1. A lump in the breast, whether it follows a blow or bruise or has arisen without any apparent cause, may be perfectly harmless; usually it is, but it may be an incipient cancer.

2. A vaginal discharge, especially if bloody and occurring between mentrual periods, may be due to inflammation of no great moment; but it may also signify the presence of a cancerous growth.

3. An adult who has always enjoyed good health and who finds rather suddenly that his appetite is failing or that he cannot digest his food well may have only a simple dyspepsia from simple removable causes; but he may have somewhere in his stomach a small cancerous growth which, if discovered, may be removed.

4. Many persons who bleed from the rectum attribute this to bleeding hemorrhoids or piles, and in nineteen out of twenty cases that is the correct interpretation; but it may be the sign of an early growth in the rectum.

5. If a man past 50 years finds he has difficulty in urinating or that there are traces of blood in the urine he should see his doctor without delay. In all probability it is only the natural enlargement of the prostate gland at the neck of the bladder that comes to many men as they grow older; but it may be the symptom of an early and still curable cancerous growth in the prostate of the bladder.

6. Cuts on the lower lip and ulcers on the tongue that do not heal readily are to be looked on with suspicion, as cancer of those parts usually begins as an apparently harmless cut or fissure.

7. A sudden loss in weight in a middle-aged person may be due to any one of many possible causes. Most of them are important, and a malignant growth is the most important of all. A growing pallor which attracts the attention of friends may likewise be a sign of the presence of a malignant tumor.

8. There are certain moles and excrescences on the skin that may be cancerous or may undergo change into cancerous growths.

The discovery of any one of the foregoing conditions justifies a man or a woman in going at once to a doctor for examination. There is, however, no need of becoming panicky, for after all it is only rarely that the particular condition is found to be cancerous. What a comfort it is, however, to be told you have nothing to fear, you have no cancer. On the other hand, to the few in whom that terrible disease is discovered the discovery may bring the one and only chance of cure.

THE DOCTOR OF THE NEW SCHOOL[1]

Gentlemen:

That I value the honor you are bestowing upon me today needs scarcely a formal statement, yet I cannot refrain from telling you how greatly I appreciate this unexpected distinction.

Once upon a time I had a little to do with the formation of the Ohio Society of Philadelphia. I am happy to see that it continues to exist and to flourish, and that it holds a distinguished position in the life of our city by the side of other societies of a similar character.

Perhaps you will permit me to digress a moment from my set theme to say a few words about Ohio, where most of us spent the years of our light-hearted youth. Dr. S. Weir Mitchell once said that Benjamin Franklin was born in Philadelphia at the age of 18; if you will allow the juxtaposition I may say that I was born here in my early twenties, and have, therefore, lived the greater part of my life in Pennsylvania; yet so strong is the impress of my briefer sojourn in Ohio, that while I am a Pennsylvanian, I have never ceased entirely to be an Ohioan. When Ohio is attacked or disparaged I am ready to fight for her. In the domestic circle when some great man, a non-Pennsylvanian, is mentioned, the first question usually addressed to me is, "Is he perhaps from Ohio?" and with rare exceptions I can answer, "Yes, he is."

What is Ohio? What is an Ohioan? In many respects Ohio is like the other states of the Union. In certain ones it is different, and the differences are not always to her credit.

Perhaps more than any other state, Ohio represents the most complete amalgamation yet attained of the many human elements making up our national life. Into its old stocks—the Puritan from New England, the cavalier from Virginia, the pioneer from Pennsylvania—it has absorbed the immigrants of other lands. Physicists distinguish between adsorption, when a substance adheres to another without losing its identity, and absorption, when two or more substances in solution mingle completely to form one homogeneous body. In Ohio the process is one of absorption, in many of the other states adsorption.

There are some things about the Ohioan that are admirable—his

[1] Address to the Ohio Society of Philadelphia, May 4, 1923.

good nature, his energy, his persistence. I wish his voice were a little more musical, his culture a little more cosmopolitan, his love of beauty a little more persuasive. One phase of his energy, as Sherwood Anderson cleverly points out in the composite book, "These United States," is shown in the resistless and systematic manner in which he has gone about transforming the natural beauties of his streams and hills by means of cinder piles and factory buildings.

In medicine and in the abstract sciences Ohio lags a little behind some of her sister states; nor is she a particularly good soil for poets. Perhaps Anderson is right—the dreamer and the lover of green hills and picturesque river banks do not find a congenial atmosphere in the State. A country doctor in Illinois once wrote a thoughtful, beautiful poem on the line of Horace—"They had no poet and they died." The old Buckeye State needs a few poets and a painter or two and a Pleiad of dreamers who are successful failures in business.

But despite these limitations the Ohioan is of fine material—he is open minded, not a standpatter or a traditionalist. That quality makes Ohio politically a pivotal state, makes the Ohioan strikingly responsive to the demands of the new day—not only in his Buckeye home but also in the state of his adoption.

You are familiar no doubt with Balzac's fine characterization of the Country Doctor. It is a strong rugged portrait, which pleases me rather more than the sentimental one of Ian McLaren in the Doctor of the Old School. There is a prevalent belief that the world no longer needs that type of medical man. And it is true that except for primitive and pioneer communities in which the doctor must do everything, be surgeon, physician, accoucheur and specialist, the doctor of the old type is no longer indispensable. A man of the older type was Dr. Philip Jones in his prim Ohio village—bachelor, father confessor, doctor for all eventualities, adequate in all phases of his calling but one—he was a poor collector. His office was on the second floor above a country store. His sign read, "Dr. Philip Jones, Office Upstairs." In due time, or rather before his due time, worn out with work, he fell ill and died. The villagers had to bury him, for he had left no money. But there was no one of his loud spoken friends who was willing to capitalize his affections to the extent of buying a tombstone. So one day a thoughtful man of the village took the sign from the door, nailed it to a post, and planted it on the grave, and there it read, "Dr. Philip Jones, Office Upstairs."

The doctor of the new school, of whom I now want to speak, looks upon his professional problem more as a community than as an individual problem. He is primarily imbued with a desire to prevent disease and secondarily with the wish to cure it. He lets

his mind roam into the future, and sees the time when tuberculosis will be merely a memory like yellow fever in Philadelphia; when cancer will be as amenable to treatment as diphtheria; when death is what Metchnikoff hoped it might be, a happy consummation of old age. But to have that dream come true, the doctor of the new school needs help. He needs the help of an enlightened, an educated, a responsive public. You must understand the doctor's great purpose. You must share his enthusiasm. You must support him liberally in his great work.

The heroic enterprise upon which the doctor of the new school is engaged is merely in its first beginnings. Vaccination against smallpox marks the origin of the new era. It was followed by a long sterile interval, and then came a tanner's son, trained as a chemist, who made a great discovery. Pasteur had been working with the germs of anthrax, a disease of animals communicable to man, and had left some of them in their tubes when he went on a summer vacation. When he came back he found that the previously deadly germs no longer killed animals. His prepared mind at once grasped the significance of this phenomenon. He realized that something had taken place through which the virulence of the germs had become attenuated. This observation, which would have made no impression upon a less responsive mind, forms the basis of most of our preventive medicine today.

The discovery that malaria was conveyed by a mosquito forms another outstanding chapter in the fascinating history of the prevention of disease, for it is now in our power to eradicate malaria, so dreaded in the tropics, and to make many countries habitable for the white race. The story of yellow fever is known to you, I am sure; for the discovery that this disease is carried by a mosquito was an American discovery, and illustrates the wonderful methods of science as few discoveries do.

It may not be generally known—many physicians indeed are unaware of the fact—that it was an American discovery that paved the way for the epoch-making researches in malaria and yellow fever. A word about it before I pass to another subject will not be out of place. You may have heard of a disease of cattle known as Texas fever. In 1893 Theobald Smith, now the head of the Animal Division of the Rockefeller Institute for Medical Research, discovered that this disease was due to a small parasite conveyed to cattle through the bite of a tick.[2] This discovery was the first scientific demonstration, previously guessed at but not proved,

[2] A few years earlier, in 1879, Patrick Manson had demonstrated that the mosquito served as a host for the parasite of elephantiasis.

that infectious diseases could be transmitted by insect bites. Not only malaria and yellow fever, but the sleeping sickness of Africa, trench fever, Rocky Mountain fever and various other diseases of the tropics and temperate zones are carried from individual to individual by biting and stinging insects.

It needs but little imagination even for a layman to see the possibilities for prevention and eventual complete eradication of these diseases as soon as the conveying agent is known.

Typhoid fever was the next rampart to be stormed. Many of us recall the unenviable reputation of our city as a breeding place for typhoid fever. Many of you also remember that during the Spanish-American war more men died of typhoid fever than of Spanish bullets. Today as a teacher of medicine I find it almost impossible to show my students a typhoid fever case. Is not that a wonderful achievement of the new school? During the recent great World War, in the armies in which typhoid vaccination was compulsory, the cases of this disease were practically negligible.

In March of this year Philadelphia had a Diphtheria Week, the object being to bring home to the people the fact that diphtheria is both preventable and curable. Although these are established facts, there is still a great deal of diphtheria every year in our city. Experiments have proved that inoculation against diphtheria during the earlier years of life is an almost certain preventive of the disease; moreover, it is a safe procedure. Under the leadership of Dr. C. Lincoln Furbush, whose work as Director of Health I cannot praise too highly, provision has been made to inoculate children against diphtheria at the request of parents. The inoculation can also be done by private physicians who have taken the trouble to study the simple technic.

For the cure of the disease when it has arisen, antitoxin is a certain remedy if used early. By a combination of inoculation and the timely use of antitoxin the new physician, with his eye fixed on community health, is able to stamp out the disease. There need be no more membranous croup, no more diphtheria, and "the death a day," which is Philadelphia's present toll, need no longer occur.

In another subject is the doctor of the new school deeply interested, because it has a mankind-wide application, namely: the question of the relation of food to health. It has long been known that man needs five substances to maintain life: fat, starch, protein or albumin, mineral salts and water, and physicians in ordering diets have always borne these five in mind. Thanks to the work of many observers and experimenters, we have learned the important fact that for the continuance of health our food must contain certain

as yet undiscovered substances called vitamins. The quantities of these elusive substances needed are exceedingly small; they are present in adequate amounts in most of the foods the race has instinctively learned to eat. They may be destroyed by boiling or other methods of preparation, and are not present in all foods, so that a one-sided or unbalanced diet, even though the five fundamental articles are present, soon leads to illness. But long before we knew anything about vitamins, in 1780, the British navy had discovered the fact that scurvy could be prevented by lime juice. It is the presence in lime juice of a vitamin, the nature of which we do not know, that makes it a preventive of scurvy.

It may interest you to know of another serious disease comparable to scurvy, which we know can be controlled by diet. There is a disease called beriberi which prevails in the Far East where rice is the staple of food. Causing terrible ravages in the Japanese navy, in India, in Java, it had long been suspected that the rice diet had something to do with it. A Dutch prison physician, Eijkman, on the island of Java, discovered that fowls fed on the same rice as that given to the prisoners developed a paralytic condition of the legs similar to that found in the sick human beings. With keen perception he set to work and finally proved that polished rice was the cause of beriberi. When the prisoners and the fowls received unpolished rice, both remained well. Furthermore, when to the polished rice diet rice polishings, looked upon as milling waste, were added, the disease, if present, was cured.

It does not detract from Eijkman's merit that he did not perceive the true nature, at least the accepted nature, of the agent in the polishings that prevented beriberi, the so-called vitamin B, and it was a deserved tribute when the City of Philadelphia recently made him the recipient of the highly valued John Scott medal.

The public must not be misled by the claims of manufacturers of so-called vitamins—if the preparations do contain a vitamin, it may not be the particular one that the patient needs. On the other hand, fresh green vegetables, butter, eggs and milk, and for a certain disease cod liver oil, contain all the vitamins necessary and in more efficient form.

Quite recently the men who have concerned themselves not merely with a given case of disease, but with disease in general, have made valuable discoveries with regard to the influence of sunlight upon health. That sunlight is more wholesome than darkness is part of man's primordial experience. The worship of the sun was one of his early abstractions. Even in countries where winter and snow and ice were scarcely known did primitive people

place the deity in the sun. As man progresses in knowledge and experience he rids himself of symbolism and subjects the data of nature to experimental investigation. And so in recent times the light of the sun has been investigated, not only by astronomers and physicists, Einsteinians and anti-Einsteinians, but also by medical men who belong to the new school, by those who look for means of preventing as well as of curing disease. What has been the result? It has been shown that light, whether from the sun, from the arc light or from a mercury vapor lamp, contains invisible rays—at one end of the spectrum they are called infrared, at the other end ultraviolet. The former, so far as we know, have but little influence on the body; the latter are of tremendous importance. Let me give you an illustration. Rickets is a disease of children that has been known for many centuries; its cause is probably some food deficiency. It has been possible by certain food mixtures to produce the disease in rats. Now, if rats that are fed on a diet that invariably produces rickets are exposed to direct sunlight, rickets is prevented. If, however, the sunlight comes in through glass, rickets develops. Why is this? It is because glass does not allow the ultraviolet rays to penetrate. It holds them back, and it is the ultraviolet rays in the sunlight that prevent rickets. This is a discovery of great value, and will no doubt be made use of in the treatment of tuberculosis, anemias and other diseases in which we have hitherto thought it was adequate to put the patients on glass-surrounded porches. The sunlight streams in but the beneficial rays are kept out.

It is not my purpose to speak to you only of the great achievements of medicine. Frankness and scientific truth demand that I tell you of some of our shortcomings. One of them is the control of childbirth mortality. Recent statistics have shown that the death rate from puerperal fever has changed but little in the last decade, a fact of which—the work being out of my line—I was not aware until Dr. W. W. Keen called my attention to it recently. Committees are at work on a campaign to cut down this price paid for motherhood.

And now I come to the last phase of the work and aim of the doctor of the new school. From time immemorial it has been the custom to call the doctor in case of illness. Only in supposedly benighted China has the practice existed of paying the doctor to keep the family well. While that may seem to testify to the good sense of the Chinese, any one familiar with medicine in the Celestial Kingdom knows that it may be safer to pay the doctor to stay away than to come.

What I have in mind is the so-called health examination. By that I mean an examination during apparent health for the discov-

ery of latent disease, or disease in its incipiency. You have your automobile looked over after it has run a certain number of miles in the expectation that if a trifling flaw is present, the skilled mechanic will discover it and remedy it before it becomes a big defect, which may imperil the efficiency if not the life of the car.

The modern physician is trying to educate his patients to do the same thing with their corporeal engine, to have a periodic overhauling to discover a possible slight maladjustment, which if neglected may eventuate in some grave malady. The difference between the motor engine and the human engine, as Mr. Richard Spillane once pointed out, is that for the latter there are no spare parts.

I should be misunderstood if I gave the impression that these health examinations are for adults only. They are just as necessary, if not more so, for young, growing children.

The plan is feasible, but for its popularization education is necessary, education not only of the laity but also of the physician.

The state has undertaken something of the sort for the children of school age. But at present the service rendered is not as good as it should be. Under prevailing economic conditions school physicians are entitled to more pay than they receive, if their highly responsible duties are to be performed in the proper way.

I said a moment ago the physician and the laity will have to be educated if health examinations shall become universally adopted. At present many a doctor would like to make periodic examinations of his patients, but is deterred by a natural delicacy from offering his services for a pay job. He might find John, Dick and Sally perfectly healthy, and then the economical father might be reluctant to pay for a service which seems to him, on the event, to spring from impertinent distrust of nature. If, however, the laity takes the initiative and if the father comes to the doctor to have the children examined, then a negative result will tinge with joy any slight lurking regret he may have in paying his doctor's bill.

The system I am advocating must not be confounded with the plan in vogue in some places and recently praised as an ideal arrangement for all classes, namely, hiring the doctor by the year. What I suggest, and I trust I have made it clear, is not that sort of contract practice which soon degenerates into a perfunctory service on the part of the doctor or into unreasonable and excessive demands on the part of the family. I propose the extension to all persons in the community, rich as well as poor, of the opportunity for a systematic, thorough examination comparable to that a man receives when taking out a large life insurance policy, or like that the poor are now able to get in a few of our most modern clinics for health service.

The laity has ever been ready, when some loud-voiced apostle appears from abroad and proclaims his creed in the market place, to follow him, and to believe that the medical profession has neglected a method of treatment of assumed enormous value. When the primitive cave child pricked its finger on a thorn, its mother kissed it, and said, in a forgotten language, "It doesn't hurt"; that was the beginning of Couéism and of all so-called psychotherapy or mental healings of which every capable physician has made use since time immemorial.

The doctor of the new school is characterized by tolerance. He has no objection to any method of treatment that may relieve suffering and cure disease, whether it be the knife, medicine, manipulation of the spine, or ought else. He only asks that all men who set out to practice the healing art in any of its various forms, shall have the same fundamental training in anatomy, physiology, pathology and chemistry. Such insistence is altogether to the advantage of the laity, and has no selfish ends.

Much of the progress which gives the doctor of the new school that thrill of hope in the future of medicine, is based upon the patient work of the men in the laboratory. There is scarcely a single advance in the treatment of disease or in disease prevention that is not founded upon animal experimentation—from the demonstration that germs cause certain diseases to the recent discoveries in the treatment of diabetes. I am quite sure that if the true scientist were compelled to choose between animals for research and beef for his table, he would forego the latter for the sake of the former. Let me assure any one who from lack of knowledge of animal experimentation may sympathize with those who would suppress it by law, that the true investigator is gentle and humane.

The doctor of the old school came into close contact with suffering and disease; he spent his life in noble self sacrifice, a preacher, a teacher, a comforter to the body wracked and the mind diseased. The doctor of the new school has within him the same urge to help. He sees before him, however, the suffering race, not only the suffering man, and realizes the enormous possibilities of attaining human happiness through the abolition of human suffering. He clearly evaluates the task before him. What is his reaction? Is it, "Some one ought to do it, but why should I?" No. "Some one ought to do it, so why not I?" That, gentlemen, is the answer of the Doctor of the New School.

MAN BEFORE THE DAWN OF HISTORY [1]

A number of years ago I saw in the British Museum a vase from Mesopotamia with an accompanying card giving its age as 4500 B. C. It was the oldest dated object I saw in the museum on that visit. I gazed at it long in contemplation—6,500 years old—it was difficult to believe, but that was before I became interested in prehistory. Since then I have held in my hand a crude stone object known as a hand-axe or coup-de-poing that was found in England and that by the accepted criteria of prehistoric science is from 200,000 to 500,000 years old.

What evidence have we that man's antiquity goes back to a time of such inconceivable remoteness? The evidence is in the main of four kinds. First, the discovery of man-made objects or artifacts in ancient strata that are geologically datable with reasonable accuracy. Thus J. Reid Moir has found flint tools imbedded in the Red Crag of East Anglia, a geologic stratum which, overlaid by a number of later deposits, may well be between half a million and a million years old. Secondly, parts of human skeletons have been found in layers belonging to the so-called Pleistocene epoch. The most recent of these finds and perhaps the most important of all is the completely petrified Chinese skull imbedded in a solid layer of travertine. From its depth below the surface and from other dependable criteria the age of this layer is estimated at a million years. Then, human remains, human tools and human works of art—sculptures and paintings—have been found in Europe in association with the saber-toothed tiger, the woolly mammoth, the rhinoceros, the lion, the reindeer and the cave bear—animals belonging to an era long, long past in central Europe.[2] Finally, apart from any geologic or stratigraphic evidence one can not contemplate the artistry of the cave-dwellers without feeling that an immensity of time must have elapsed from the first appearance of man on the earth until such astounding skill was attained. No longer can we consider the Babylonians or the Cretans as very ancient peoples. The first dynasty of Egypt, that

[1] Reprinted from The Scientific Monthly, December, 1933, Vol. XXXVII, pages 553-562.

[2] Individual mammals of extinct species may have survived long beyond the time of the main stem of that species so that the finding of fossil mammoth or tiger bones, for example, does not warrant the conclusion that the contemporary humans go back to the time when these animals flourished in greatest number.

of Menes, 4700 B. C., Tutankhamen, Solomon, Assurnasirpal are of yesterday, and patient Bishop Ussher was quite mistaken when after a laborious calculation he decided that the world had been created on October 9, 4004 B. C.

I shall not go into the details of the geologic time-table accepted by scientists but will merely point out that primitive man, speaking chronologically, lived in the epoch called Pleistocene or Quaternary, which is the age that directly precedes the present called the Psychozoic or Age of Man. The beginning of the Pleistocene goes back from 200,000 to 500,000 years. Preceding it is the so-called Tertiary, a geologic period of vast length during which the large land animals appeared.

We are greatly helped in differentiating successive "cultures" or eras of prehistoric man by a study of his tools. It would be extremely interesting to know how early in mundane time man began to make tools and other implements. The first tools were probably made of wood, but they have not been preserved. Very early, however, man learned to use flint and other hard stone and to fashion them to his hand in a crude way by chipping. The resulting implements are relatively abundant and can be gathered in many places in Europe by a little digging beneath the surface and in caves and cliff hollows. In the oldest layers they are crudely chipped, but as we proceed to younger strata we find better and better workmanship. The French, who have so far done the most extensive work in prehistory, have used the stone implements as a basis for a systematic classification that is now generally adopted throughout the world. The names given are chiefly those of French towns or places where the particular type of stone culture or industry finds its best illustration. These are from above downward, that is, from the most recent to the oldest prehistoric age—Magdalenian, Solutrean, Aurignacian, Mousterian, Acheulian, Chellean, Prechellean. The series as a whole is known as the Old Stone Age or Paleozoic. The stone implements were made by chipping, hence they are rough. In the succeeding New Stone Age or Neolithic, they are smooth and polished.

Geologically, the Old Stone Age coincides largely with the Pleistocene epoch, a period during which occurred those tremendous glaciations or Ice Ages that swept down from the Arctic regions and covered vast areas of North America and Europe. Through Charpentier and Agassiz and their successors we know how profoundly the Ice Age has affected the present-day landscape as well as the fauna and flora of the temperate zone. The individual ice ages were separated by warm interglacial periods, during which the land was habitable. Evidence is accumulating that man was unques-

tionably living on the earth in the first interglacial period; and there is good reason for believing that he existed long before—in the Pliocene, the last epoch of the Tertiary.

Before I speak in detail of the Men of the Old Stone Age and their handiwork as it can be seen in the South of France, I want to discuss briefly the short annals of the science of prehistory. Fossils had been known since the time of Herodotus, but their meaning was not guessed until Leonardo da Vinci, the omniscient, recognized in them the petrified remains of once living organisms. But, like much else the fertile Leonardian brain suggested, the matter of fossils was forgotten. Johann Berringer, the Würzburg professor in the eighteenth century, looked upon them as objects placed in the ground by God himself to test the faith of man. When John Frere, in 1797, found in an ancient brick field in Suffolk, England, some hand-shaped flints and recognized them as human products, no one paid any attention to him. Dean Buckland, reader in geology at Oxford, in 1822 found in a cave at Paviland in Wales the remains of the rhinoceros, the cave bear and other extinct animals side by side with human bones. He attributed their joint presence to the Deluge. This reminds one of Asa Gray's explanation for the extinction of the mastodon—it was too big to go into the Ark.

In 1826 the Reverend Dr. T. MacEnery, a Catholic priest, found similar fossil remains in Torquay, in association with stone implements. He drew the correct conclusion that man must have lived in England contemporaneously with the mammoth and the rhinoceros, but he did not dare to publish these conclusions during his life, and they did not appear until sometime after his death.

In 1823 Boué sent to the celebrated Cuvier a human skeleton exhumed near the banks of the Rhine. Associated with it in the loess strata were remains of a number of extinct animals. Cuvier utterly failed to appreciate the significance of this discovery and rejected it as being of no importance. Several other isolated finds of similar nature were made but challenged no one's interest. Then came a man who may well be called the father of prehistoric anthropology—Boucher de Perthes (1788-1868), director of customs at Abbeville. He found a number of what he called antediluvian axes and identified them as the work of an extinct race of man. Like Pasteur a generation later, he was ridiculed by the academicians. But those who derided him as a dreamer and ignoramus are forgotten while Boucher de Perthes is enthroned among the immortals.

Probably the most important date in prehistory is 1856, the year in which a modest German professor, Dr. C. Fuhlrott, found a skull cap and other human bones in a cave in the Neanderthal, near

Düsseldorf on the Rhine. These bones, found as they were in association with those of animals of extinct species, created a sensation. Fuhlrott, Huxley, Lyell, King and Broca saw in them the remains of a primitive human type, but Virchow considered the peculiar appearances as due to disease, and by his great authority silenced his opponents. But as time passed similar finds were made elsewhere, particularly in Southwestern France, and we now know that they as well as the original Fuhlrott bones represented a widely disseminated race called after the place where the original skeleton was found, the race of the Neanderthals—*Homo Neanderthalensis.*

About 1894 Eugene Dubois, a Dutch army surgeon, discovered at Trinil, on the island of Java, the top of a skull, some teeth and a thigh bone which he believed were the remains of a sort of missing link and which he designated by the now famous name *Pithecanthropus erectus.* In close proximity he found parts of more than twenty-four species of mammals totally extinct. Although his discovery attracted world-wide attention, Dubois for many years absolutely refused to have any one see the originals, but recently he has become more complacent and has exhibited them to a number of scientific men, including Professor MacCurdy, of Yale.

The Java or Trinil man, as Pithecanthropus is also called, has evoked a great deal of discussion. The skull, as reconstructed by MacGregor, has a capacity of about 900 cc.; that of modern man 1,500; that of the Indian Veddhas and of the Papuans of New Guinea 1,230 to 1,250 cc., while that of the highest ape has a content of only 600 cc. Thus the Pithecanthropus is about midway between the highest anthropoid and the lowest human. There is much discussion as to the geologic age to which Pithecanthropus should be assigned. Dietrich, Osborn, Elliot Smith and MacCurdy place the Trinil man in the Pleistocene period, but others, who find the associated animals to be of an earlier age, put Pithecanthropus in the Pliocene. A lower jaw fragment has recently been found some twenty-four miles distant from the spot where Pithecanthropus was discovered. If it belongs to a second individual of the same genus, it suggests that the Java man had a lower jaw of slight build and an almost vertical chin. The skull cap is marked by expansive, heavy brow ridges.

One of the most revered of prehistoric relics is the famous Heidelberg jaw found in 1909 by Professor Schoetensack in the Maurer sandpit near Heidelberg at a depth of 82 feet below the surface. It is not strictly a human jaw, for it is too large and possesses, besides other minor anthropoid characters, a strikingly receding chin. Its age is estimated at between five hundred thousand and a million and a quarter years.

In 1911-1912 Charles Dawson discovered near Piltdown, Sussex, an incomplete skull and lower jaw, which from many points of view constituted, until 1929 at least, one of the most important of all prehistoric discoveries. The skull is unquestionably human, with a brain capacity of 1,240 cc. The lower jaw, however, as one writer puts it, has been a bone of contention since its discovery. Some think it is too simian to belong to the Piltdown skull. Recent finds, however, in the same region make it highly probable that the jaw belongs to the skull and not to an anthropoid. Piltdown man, whom Woodward has designated *Eoanthropus dawsoni* (Dawnman), had a receding chin, prominent canine teeth and low brow ridges—he differed thus considerably from the Java man. In close association with the Piltdown skull Dawson found a quantity of flints, crudely chipped, which he called Eoliths, believing them to be the handiwork of the Piltdown race. Many have disagreed with him, attributing the chipping to natural breakage, but belief is growing, largely through the investigations of J. Reid Moir of Ipswich, that they are true artifacts. Although placed at first in the Pleistocene, Sir Arthur Keith, Newton, Dawson and others are convinced that Piltdown man is of Pliocene age, a conclusion that places early man in England at a time of enormous remoteness. And if we accept the mute testimony of the Eoliths taken from exceedingly deep geologic strata in England, then the recently announced estimate of Professor Hooton that man goes back to the second half of the Pliocene, or about four million years, does not seem altogether out of reason.

In 1921, a skeleton of Neanderthal type was found in the Broken Hill mine in Rhodesia. More recently Professor Dart found at Taungs, northwest of Johannesburg, in a limestone cliff at a depth of 50 feet, the skull of a boy that possesses both human and simian characteristics. The name of *Australopithecanthropus africanus* has been given to this species. Since then other interesting finds have been made in Africa recalling the prediction of Darwin that Africa might be found to be the cradle of mankind.

Perhaps the most important recent African discoveries are those of Professor Reck and Mr. Leakey at Oldoway in Kenya Colony. Professor Reck had unearthed a skeleton of an apparently modern type man in 1913. If contemporary with the animals with whose petrified remains it was found, it indicates a very great age for *Homo sapiens*, at least in Africa. The matter is still in dispute, but the recent explorations of Mr. Leakey in Oldoway seem to bear out his contention that Professor Reck's skeleton is of lower Pleistocene age.

While an African origin for man is in the realm of the possible, the majority of scientific men lean to an Asiatic ancestry. Osborne

and his associates in the American Museum have been consistent advocates of this view and have had its confirmation as one of the main objectives of their several expeditions into the Gobi Desert. Fortune was not with them, however, but instead smiled upon a young Chinese geologist named W. C. Pei, who on the last day of a season's excavations, on December 2, 1929, made the most famous of all prehistoric discoveries. Imbedded in travertine and completely petrified, he found an uncrushed skull of a woman. After careful study—it took months to remove the stony encasement—Professor Davidson Black, of the Peking Medical School, and Professor G. Elliot Smith came to the conclusion that the skull represents an early type somewhere between Trinil man and Piltdown man or even an earlier species. The thick skull has more massive brow ridges and a greater skull capacity than Pithecanthropus. Geologically, *Sinanthropus pekinensis* belongs, according to Father Teilhard de Chardin and Dr. C. C. Young, to the lower Pleistocene or Polycene and may easily have an antiquity of a million years. In a personal communication just received from Professor Elliot Smith he calls attention to the evidence discovered by Mr. Pei that Sinanthropus knew fire. Charred objects were found in deep travertine deposits. These startling discoveries of Mr. Pei have been confirmed by Abbé Breuil, who last October made the arduous journey to Peking for the purpose of studying the evidence accumulated with respect to Sinanthropus.

Abbé Breuil holds that *Sinanthropus pekinensis* is not the being devoid of human faculties he was at first supposed to be in view of the approach of his skull to that of the Anthropoids, but despite his animal characters he is already "man," with a progressive intelligence and the beginning of supremacy over other animals by virtue of his knowledge of fire and of working in stone. He is not the last step toward humanity nor is he the first—the point of departure is much farther back. This man with his technique and practical science had numerous human ancestors, of whom we know absolutely nothing.

By the end of 1930 the finds in China had reached five jaw fragments and the same number of skull fragments, a large series of teeth, but curiously no human limb bones have so far been discovered. Large quantities of fossiliferous material, implements of bone, quartz and quartzite have also been found. We have no knowledge of the place where Pithecanthropus and Eoanthropus lived, the few broken fragments of their skeletons that have been found having been deposited either by running water in the gravel of a river-bed, as at Piltdown, or in the tufaceous bank of a stream, as in Java, but

in the case of the Peking man, he must actually have lived in the cave where his petrified remains were found.

Within recent years many important discoveries in prehistory have been made in Czecho-Slovakia. In the summer of 1930, at the suggestion of Professor and Mrs. Absolon, the well-known prehistorians, I paid a visit to Brno (Brünn), the capital of Moravia. Here under the inspiration of Professor Absolon a splendid prehistoric exhibition called "Anthropos" was in progress. I had known something of the activity of the Czechs in prehistory, but I was in no way prepared for the wealth of recovered material I saw in Brno. There were enormous quantities of fossil remains of the mammoth, the tiger, the lion, the rhinoceros and also human skeletons, as well as flints and other stone artifacts of every conceivable kind.

While there has been some dispute as to the proper assignment of the Moravian culture, the majority of scientific men agree with Professor Absolon that it is Aurignacian. Unfortunately, the national pride of the Czechs, in a measure justified by the signal progress of their newly established republic, impels them to publish everything in their native language, which by its very looks frightens off those not born with a Slavic tongue.

While at Brno I decided to pay a visit to the Augustinian cloister of Gregor Mendel. As my guide in the "Anthropos" exposition, Mr. Skutilh, had himself never been there, he gladly volunteered to accompany me. Unhappily we arrived after twelve o'clock and were informed by the affable monk who received us that the Mendel apartments were closed at noon. However, he would see the abbot. This worthy successor of Mendel gave permission to open the hallowed rooms, enabling us to inspect Mendel's library, his microscope and many other relics. I then asked to see the garden, in the hope of finding living descendants of Mendel's famous peas. Not a single one remained, only a tall tree that he had planted. I got the impression that the cloister was not greatly interested in Mendel's scientific work. On parting I casually inquired of our kind host whether they had many visitors. "Not many," he said. "Whence do most of them come?" His answer amazed me. "The majority," he said, "are Japanese."

Interesting finds have within recent years been made in Palestine. Miss Dorothy Garrod has found in the cave of Shukba a vast quantity of Neanderthal remains, among them a number of skulls from which pieces had been cut out, similar to the mutilated brain cases recovered from a quarry at Ehringsdorf near Weimar. The inference has been drawn, not unreasonably, that the holes were made by our cannibalistic ancestors for the purpose of extracting the brain. In

the Shukba cave and in many other places long bones have been found that were evidently broken by a sharp instrument while in a fresh condition, apparently for the purpose of obtaining the marrow.

A number of other startling discoveries have been made in Palestine since the beginning of this year. Professor MacCurdy informs me that nine skeletons of Neanderthal men have so far been found by Theodore D. McCown, of the British School of Archeology. Miss Dorothy Garrod believes that the skeletons are of Neanderthal type, although differing somewhat from the Neanderthal man of Western Europe. The hands have the characteristics of modern man, but the feet and thigh bones have not.

It is rather interesting that despite an almost feverish activity on the part of digging scholars the actual quantity of prehistoric human remains so far unearthed is comparatively small. The question naturally arises, "Why are the remains of early man and his precursors so rare?" Chiefly because primitive humans did not embalm or bury their dead. Consequently, the cadavers were devoured by wild beasts or rotted on the ground. You remember the grave-digger's answer when Hamlet asked him, "How long will a man lie in the earth ere he rot?" "In faith if he be not rotten before he die—as we have many pocky corses nowadays, that will scarce hold the laying in—he will last you some eight or nine years; a tanner will last you nine years." Shakespeare might be surprised to know that some bones interred accidentally or on purpose more than twenty thousand years ago have lasted until now. Survival, if one may use that word in connection with dead bones, probably depends upon the nature of the soil. The accidental fall into a river bed or in soft mud could easily bring about the preservation and fossilization of isolated skeletons or skeletal parts. Man, however, seems to have begun quite early to bury his dead, certainly in the latter part of the Old Stone Age, thus helping to preserve for us a number of skeletons of inestimable value to the science of prehistory.

I ought not to pass over in a historic retrospect the year 1859, which witnessed the appearance of Darwin's "Origin of Species." Sir Arthur Keith, in his presidential address at last year's meeting of the British Association, re-emphasized in strong anti-Daytonian phrases the important bearing of Darwin's work upon the study and comprehension of the descent of man.

I now want to take the reader to France, for it is there that the prehistorian finds more to interest him than anywhere else in the world. While a large part of France is rich in prehistoric sites or stations, as they are called, the real capital of the prehistoric world is the pleasant little town of Les Eyzies in the Dordogne. Through

the courtesy of Professor George Grant MacCurdy, director of the American School for Prehistoric Studies, I was enabled while in Europe to join the school for a brief stay in the romantic village of Saint Léon-sur-Vézère. The Vézère, a tributary of the Dordogne, is a silent dreamy river. Standing on its banks I had an overpowering sense of mystery—I was conscious of an antiquity with which that of the Roman Forum and the Egyptian Pyramids can not be compared. There is a fine little museum in Les Eyzies, containing quantities of artifacts and human fossils found in the region. The town is also noteworthy for its war monument, which is one of the best I have seen. The artist with an understanding of the genius loci has carved upon the granite boulder a youth who with one hand crushes a prehistoric bison and with the other strangles a German eagle.

In the vicinity of Les Eyzies are a number of world-renowned prehistoric caves which penetrate deeply into the hillsides and must have afforded a wonderful shelter for the cave man. I can not in words describe the impression made upon me by the pictures painted and graven on the walls in those caves. Only once before in my life did I have a similar experience—at my first sight of Saturn through a telescope.

In the "Prometheus Bound" of Aeschylus I discovered an interesting passage that shows how profound and true a conception the poet had of the primeval life of man, a conception that did not again rise into man's consciousness until 2,400 years later. He says, "Knowledge had they neither of houses built of bricks and turned to face the sun, nor yet of work in wood; but dwelt beneath the ground like swarming ants, in sunless caves, ἐν μυχοῖς ἀνηλίοις."

All the caves are interesting, and each has a character of its own. Among the most thrilling is the one called Grotte des Combarelles. There is a small fee for admission. Three of us entered, guided by a peasant woman, who knew her story and rattled it off remarkably well. We carried flat sticks with a tallow candle at the end. The floor of the cave is muddy and slippery, the walls come close, the ceiling is so low in places that we had to crouch for long stretches. From the entrance until we stopped to turn back was about one thousand feet. Through that whole length both walls are covered with drawings in black and white of animals—the reindeer, the mammoth, the cave bear, a species of horse, the bison, all done with an overwhelming realism. A few strokes indicate that the mammoth was woolly. From the Grotte de Combarelles we went to the equally interesting Font de Gaume. This particular cave belongs to the local laird, who has had it electrically wired. It too contains many vividly artistic drawings, some in colors. Many of the pic-

tures in Combarelles and in Font de Gaume have become well-known through reproductions. Although fewer are in polychrome than in the famous caves of Altamira in Spain, in artistic finish and realistic expression they are no less striking.

Who were the men who made those wonderful life-like drawings, unrivaled in their fidelity to nature? How were they able to draw and to carve so skilfully in the depths of a damp and sunless cave? What motives prompted them to what must have been slow and gruelling labor? These and other questions passed through my mind as I gazed upon the pictures. The first question may be answered by saying that the cave painting race belonged to the later Paleolithic epoch, to the Aurignacian and Magdalenian, also called the Age of the Reindeer, of which the Cromagnon is the most imposing representative. He was of good stature, had a fine head, and in practically every physical respect, and we must presume in mentality, the first to deserve Linné's designation of *Homo sapiens*. On the other hand, Mousterian man, his predecessor—how far removed in time we do not know precisely—was an inferior being, prehuman in the anatomic and cultural sense.

Prehistorians were for a long time puzzled as to what sort of light the Aurignacian artist employed during his work. There is nowhere any evidence of soot. It is conjectured that he used an animal oil, either on a torch or in a shallow dish like that used by the Eskimos, as pointed out by Sollas and by Hauser. Much has been written as to the possible motives of the painters and sculptors. Was it art for art's sake? The majority of writers do not think so. They look upon the painting and sculpture as motivated by magic or sorcery. One of the pictures of a man disguised as a beast is strongly suggestive of this. Moved by theurgic beliefs that graphic representation of an object could give control over it through magic, they may have drawn images of the beasts that served them as food so as to promote fecundity. This idea is brought out in the novel called "Bison of Clay," by the son of a well-known prehistorian, Count Beguën. It may account for the fact that by far the greatest number of animals pictured are food animals. On the other hand, the same magical control might be secured over dreaded beasts of prey by similar means, that is, by visible representation. Such beliefs prevail among primitive peoples today and even among some that are looked upon as civilized.

If pictorial representation was used to promote fertility, the rarity of the human figure on the cave walls might perhaps be explained as a sort of Paleolithic birth control. Under the conditions of life in the cave—not unlike those prevailing in this era of

grace—every additional mouth to feed was an unwelcome burden. The few human figures that have been found are chiefly those of the female, and are far less artistic than the animal pictures. They have small heads, large, pendulous breasts and huge buttocks, like the Hottentots. Is this figure a mythical or symbolic expression of fecundity or is it a realistic representation of the Aurignacian Venus?

As an amateur I ought perhaps not to express an opinion, but I could not escape the feeling that the cave art as well as the engraved bone and stone implements and ornaments represent a real urge for artistic expression, an hypothesis that does not contravene or exclude other motives.

Primitive man made use also of another kind of protected home, the so-called rock shelters, deep natural excavations in the sides of cliffs. A typical rock shelter is that of Laugerie-Basse, which is quite extraordinary in that it is possible to identify in its superimposed layers nearly all the old stone epochs. The thin compressed strata remind one of a layer cake, with layers rich in relics separated by sterile ones. In Laugerie-Basse, as almost nowhere else, one can trace without interruption all the ages of man in France—the Paleolithic, the Neolithic, the Gallo-Roman, the Middle Ages, and the present. Few places in the world have been inhabited by man for so many thousands of years without interruption.

Before leaving the Les Eyzies region we paid a brief visit to the village of Cromagnon, one of the holy places of anthropology, for it was here the famous Cromagnon man was discovered in 1868, during the construction of a railroad. There is, however, little of interest left in the sparsely settled village. Recently a statue has been erected at Les Eyzies to represent the Old Man of Cromagnon. It does not picture him as an Adonis; the long-armed slouching gorilla-like figure hardly suggests the talented painter of Font de Gaume or Combarelles. But after all the artist's fancy has nothing to do with unrecoverable reality.

Buried skeletons of a race similar to the men of Cromagnon but shorter in stature have been found in considerable number at Grimaldi near Mentone. The physical characters of the Grimaldi race are suggestive of a negroid admixture—this is also true of the taller race—which is not surprising in view of the probability of the existence of a land bridge to Africa in prehistoric times. Sir Arthur Keith, I may add, does not believe that Cromagnons had negroid characters because they were hybrids. As a "Unitarian" he would explain the evolution of the human race on the basis of a common ancestor, and that it was only after dispersion that the differentiation occurred into the black, yellow and white races of mankind.

The Cromagnons or Aurignacians lived in Europe not later than 20,000 years ago. They seem to have migrated into Europe, for until the end of Mousterian time Europe was inhabited by the Neanderthals. The Aurignacian tools and implements are of far higher order than those of the preceding Mousterian. Cromagnon man, according to MacCurdy, was the first to reach the stage of making tertiary tools, that is, tools requiring the use of primary—found ready to hand—and secondary tools for their manufacture. They were used for an ultimate purpose other than tool making. The Solutrean industry, although later in time, is marked by a perceptible decline in art, except in one respect—the spear points and harpoons show a workmanship that for sheer beauty and symmetry can not be matched by the most skilful artisan of today. The laurel leaf and willow leaf flints of Solutré are a joy to behold. Recently a number of implements made of rock crystal have also been found.

The Aurignacian and Magdalenian man had also begun to make ornaments—pendants and beautifully carved commander sticks (*baton de commandement*). No doubt he made use of wood in many ways, but those utensils naturally have not been preserved. Old Stone man apparently had no writing; a few linear strokes upon tools and weapons may indicate an idea of number. The inscribed tablets of Glozel,[3] which some refer to the Magdalenian period, are of questionable authenticity.

What about our own continent? Ancient human remains have been found in America, but whenever it was possible to determine their ethnographic position, they turned out to be Indian of the same type as that now living. No doubt man has been on this continent for many ages, but the human remains are not like those of primitive man in Europe. Quite recently Cook and Hay have found in Folsom, Arizona, and in Colorado, in strata that they identify as Pleistocene, flint artifacts in association with the bones of extinct mammals—bison, lion, elephant, etc. Whether the conclusion is warranted that the makers of these artifacts and the now extinct mammals were contemporary can not be definitely stated at this time, but a number of paleontologists do not agree with Cook's ideas as to the age of Folsom culture and agree with Hrdlicka that no evidence of prehistoric man in the European sense has ever been found in this country. The famous tooth, which was first considered to be the relic of Osborne's *Hesperopithecus haroldcookii*, later was admitted by Osborne and by Gregory to be the tooth of a peccary, an extinct species of pig. Edgar B. Howard, of the University of Pennsylvania Museum, has made some interesting finds bearing on

[3] Riesman, "The Story of Glozel," *Science*, LXXII, 1858, pp. 127-131, August 8, 1930.

the question of American prehistory in the Guadalupe Mountains, and only a few days ago the statement was telegraphed from Florida that an arrow head had been found in a mammoth skull. The implications of these things are so far-reaching that we must know more about them before drawing any conclusions.

After a lapse of time similar to that which separates us from the cave man of Europe, what will *Homo sapientior* think of us of the twentieth century, of our wars and hatreds, our economic and political ineptitude, our want and suffering in the midst of plenty? Will he place us in culture nearer to the Cromagnon than to himself? Who can guess? But no matter how dark the immediate future may appear, man's past achievements are colossal and an earnest of an infinitely greater civilization, the full possibilities of which are beyond our present imagination.

GLOZEL: A MYSTERY [1]

Those who have read something about Glozel may wonder why I speak of it here. Is it not a dead issue? No, for as a study of human credulity and as a commentary on the hot-headedness or should I say pig-headedness of many men of science, it will always occupy a prominent place in the history of civilization.

Although many of the audience are probably familiar with the main facts, I want to give a brief synopsis of the involved story. I say "story" advisedly for from the very outset the mystery of Glozel has formed a fascinating tale; very much in the genre of our best thrillers, with plot and counter-plot, gum shoe detectives and all the pertinent paraphernalia.

Glozel is a small hamlet of four farmhouses, about fifteen miles from the famous spa of Vichy. Emile Fradin, then a youth of eighteen and belonging to an old local family, was one day working in his grandfather's field when a cow suddenly slipped into an unsuspected hole. Fradin went to investigate and found that the hole led into an oval pit containing a variety of remarkable objects —bricks, tablets, vases, which he gathered and as soon as possible showed to the village school mistress, Mlle. Picandet. The latter in turn showed some of the tablets to M. Clément, a school teacher in la Guillermie. Eventually the news of the discoveries came to the ears of Dr. Albert Morlet, a surgeon of Vichy and an amateur archeologist. Thereafter Dr. Morlet and Emile Fradin together began to excavate at Glozel and brought to light more and more buried objects which they collected in grandfather Fradin's house and which Dr. Morlet described in detail in an endless series of articles in a literary journal, the *Mercure de France*. It was through this magazine—the Atlantic Monthly of France in more senses than one—that I became interested in the Glozelian discoveries. My interest was especially aroused by the claim of Morlet and others that an alphabet had been discovered at Glozel which antedated every other alphabet then known. I therefore decided while spending a vacation in the Auvergne to see Glozel for myself, but before doing so I determined to interview Dr. Morlet in Vichy. At first

[1] Read April 24, 1930. With lantern slide demonstration.

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he suspected me of being an archeologist, but when in answer to a direct question I denied the soft impeachment and proclaimed myself merely a doctor, he became cordiality itself and showed me his collection of Gallo-Roman and Glozel antiquities. He told me that he as well as others had been inclined to consider Glozel as belonging to the Magdalenian age because of the presence of harpoons and of stones engraved with reindeer and other animals long extinct in France but further studies had led to the conclusion that Glozel was Neolithic. Dr. Morlet kindly asked me to stay over until the following day and dig with him and Professor Björn of Sweden but I was unable to do so.

After leaving Morlet I motored, together with two American friends, to Glozel. Emile Fradin received us and at once offered to take us to the field of excavation. It was at the bottom of a deep ravine and was surrounded by a barbed wire fence. He showed us the original oval pit and the two tombs subsequently discovered. As it was raining hard and as the clayey ground was slippery, I declined his invitation to crawl into one of the tombs but asked instead to see the Museum. After paying two francs each we entered through a low door above which was a crude sign with the pretentious words, Musée de Glozel, and found ourselves in a square low-ceilinged room with shelves on the walls and very primitive glass cases standing on the floor. The objects exhibited on shelves and in cases were astounding in number and variety—vases, tablets, engraved stones, ornaments, especially pendants, some pieces of glass, and harpoons, the last not nearly as artistic as those of Magdalenian age I had seen at Les Eyzies and at Laugerie-Basse. Three articles attracted my special attention—vases or vase-like pottery-ware having eyes, nose and ears but no mouth which Morlet has called death masks, explaining the absence of the mouth by assuming that the primitive makers wanted to express the silence of the grave. Secondly, a squarish object suggesting the female figure with a cylindrical projection from the forehead interpreted as the phallus—this Fradin told me was a bisexual idol; and most striking of all clay tablets with graven signs looking in every way like alphabetical characters. I was struck by the clean red color of these tablets. When I spoke of this to Fradin, he explained it by saying that the soil in which the tablets had been found was such that it did not readily fuse with the clay and hence was easily brushed off. There were also some large casts of the human hand which differed from the imprints of the hands in the Spanish and French caves in having all the fingers present.

I offered to buy some of the articles, especially a tablet, but

Fradin resolutely refused to sell. During the whole of our stay in the Museum, the grandfather stood silent and motionless in a doorway leading to an inner room.

The reputed discoveries of an alphabet dating back to Neolithic times of which I had now seen the alleged evidence in abundance created a tremendous sensation in informed circles. Altogether about 136 characters have been distinguished, representing every letter of the alphabet except the letter B.

Hitherto the credit for creating an alphabet had been given to the Phoenicians but the oldest known Phoenician record found at Byblos a few years previously dated back only to about 1300 B.C.; Sir Arthur Evans' baffling Cretan inscriptions to ca. 3000 B.C. If Morlet and those who agreed with him were right, then Glozel was truly what M. Reinach called it—one of the greatest archeological discoveries of all time.[2]

Almost immediately after the first appearance of Morlet's reports, doubts began to be voiced about the authenticity of Glozel, although in the early period of the controversy there were perhaps as many scientists who accepted the discoveries in good faith as there were doubters. Soon the pro- and anti-Glozelians became personal and attacked each other with a vituperative vehemence and a destructive sarcasm for which the French language appears to be the ideal medium. Reputations were shattered, old friendships broken, and as one of the French dailies remarked—even butcher boys came to blows on the streets of Paris. In fact Mrs. O'Leary's cow did no greater damage to Chicago than Fradin's to the reputation of many French savants.

Before long the leading French prehistorians with only an occasional exception began to deny the authenticity of Glozel and to declare the excavated articles to be forgeries. A number of Englishmen were likewise unconvinced. However, Dr. Foat, a London scientist, makes the categorical statement that "if the finds of Glozel are not authentic, it is equally necessary to consider as false all that I have seen in museums between London and Constantinople." Several Scandinavian, Belgian and Portuguese scientists also supported Dr. Morlet and a German, Dr. Wilke, in a recent article enthusiastically upholds the standard of Glozel.

Are Dr. Morlet's supporters right or is Glozel but one more of the long series of frauds that history recounts since Jacob imposed upon his father Isaac? Many will come to your minds—Thomas Chatterton, our own Dr. Cook, Constantine Simonides, the pre-

[2] Dr. Hackh in an exhaustive essay on the History of the Alphabet makes no reference to Glozel—if true, Glozel belongs at the very bottom of the linguistic tree.

tended author of the Codex Sinaiticus, the forger of the Mecklenburg Declaration, the Lincoln love letters in the *Atlantic Monthly*, the Tiara of Saïtapharnes, and countless others. Two perhaps are germane and worth recounting. In the early eighteenth century George Psalmanazar, born in the south of France, came to England and with the connivance of a rascally clergyman, Alexander Innes, proclaimed himself a native of the Island of Formosa. He was lionized in London, wrote a description of the Island which he had never seen and included in the book an alphabet and grammar of the Formosan language. Though many doubted his veracity, the book passed through two editions and was translated into French. Toward the end of his life he revealed himself in his own memoirs as a colossal faker and declared that all he had published including the language and the grammar was a hoax.

One of the most interesting cases and the one having the greatest analogy to Glozel, if Glozel be a fake, is that of the so-called "Figured Stones of Würzburg."

In the first half of the eighteenth century there lived in Würzburg, in Bavaria, an ultra-pious physician named Johann Bartholomaeus Adam Beringer. He is not remembered for any great discovery or contribution to science, only for his share in a remarkable scientific hoax. At the time in which Beringer flourished an active discussion was going on as to the source and meaning of fossils. Although Leonardo da Vinci had understood their true nature—even Herodotus, 400 B. C., had a correct idea—the scientists of two hundred years ago accounted for them as the result of "stone-making forces" of "formative qualities" or as growths from seeds. We may be inclined to smile, but with Dayton in Tennessee to chasten us, we cannot throw stones at the Würzburg of two centuries ago nor at the Sorbonne which a hundred years later deprived the great Buffon of his chair because of his heterodox theories.

Beringer had committed himself publicly to the belief that fossils were the capricious fabrication of God, hidden by Him in the earth for some inscrutable purpose. His zealous maintenance of this fundamentalist position led some of the students together with members of the faculty and wags of the town to make numerous fossils of clay which they buried in the side of a hill where they knew the Professor was wont to search for specimens. Beringer chancing upon these objects was completely deceived. The jokers became bolder and buried the most extraordinary and extravagant figures their whimsical imagination could suggest. They fashioned tablets bearing inscriptions in Hebrew, Babylonian, Syriac and Arabic and buried them not far from the original spot. Beringer

was overjoyed to find such abundant confirmation of his doctrines and forthwith in true German fashion proceeded to write an exhaustive treatise. The wags now began to realize that they had gone too far. They expostulated with him and even told him the whole truth. Instead of believing them Beringer became more than ever convinced that the story his frightened colleagues told him was a ruse to rob him of the honor of his discoveries. No one could stop him. At great expense he published in 1728 the "Lithographiæ Wirceburgenses."

Only too soon the shout of laughter with which the book was greeted brought the truth home to him. In chagrin and despair he exhausted nearly his entire fortune in a fruitless endeavor to suppress the edition and to buy up the copies already issued. He died soon afterwards, it is said, of a broken heart.

Is Dr. Morlet like Johann Beringer the victim of deception? Upon me personally he made the impression of an honest man. In certain quarters he was accused of fraud, for example, by the *Journal des Debats* and by the French Society of Prehistory. He promptly brought suit against them and won a verdict of 1000 francs damages. The defendants carried the case to the Court of Appeals at Riom, the native town of Willa Cather's lovable archbishop. In confirming the verdict, the Court gave expression to an amusing quibble. It held that Morlet being a surgeon by profession and only by avocation a prehistorian, was not injured in the eyes of his real colleagues but only as an amateur archeologist. However, as the defendants had not actually proved fraud, they were declared guilty, but the fine was reduced to one franc and costs.

Another humorous episode might be mentioned. Regnault, President of the French Society of Prehistory, sued a M. X. because he, Regnault, had been compelled to pay the sum of 14 francs to see a collection of fake objects. As part of this legal action, the police of Moulins broke into Fradin's premises and took away a number of objects which were afterwards submitted to the public expert, M. Bayle. The latter reported that the tablets were of recent manufacture. Pieces of clay from a tablet crumbled readily in water; hence it was not conceivable that the tablets could have resisted the moisture in the ground had they been there for many years. Furthermore, a bit of grass picked out of a piece of earthenware showed under the microscope the vegetable cells, and some of the bone instruments still contained marrow. Bayle was soon afterward shot to death by one Philopponet against whom he had testified in court.

The Fradins themselves brought suit against M. Dussaud, member of the Institut, who in a trenchant brochure had called them fakers.

Let us now delve a little more deeply into this mystery so that

we may understand better the basis of the controversy. The first serious doubt as to the authenticity of Glozel was based on the heterogeneity of the articles in Fradin's museum. How could one explain the presence of so many dissimilar and unrelated objects—the two or three thousand at the time of my visit have now grown to five thousand—in one small field of excavation. No other archeologic site offers a parallel. Morlet answered this by saying that Glozel was a Champ des Morts, a cemetery, and that as among many primitive peoples of later times, everything belonging to the dead had been buried with him. C. Julian who considers Glozel a Gallo-Roman station accounts for the multiplicity of objects on the assumption that Glozel was a sorcerer's sanctuary. He has added greatly to the gaiety of nations by attempting a full translation of the inscribed tablets from the published illustrations. Dr. Morlet showed me with much amusement a crack in one of the tablets which Julian had translated as a character.

Aside from the puzzling complexity of the collection, it has been pointed out that the tablets first exhumed bore fewer and less perfect characters than the later ones. Further, as soon as some one had made a criticism, the objects next exhumed were free from the criticized defect. Quite often certain features appeared that could be traced directly to scientific articles published shortly before. These facts seem of course very significant. Moreover, the scratches on stones whether representing animal figures or alphabetic characters were without the patina covering other parts of the stones; this would suggest recent production. Much was made of the penetration of roots into vases or tablets; but upon examination these roots were not found to be properly fossilized, which would have to be the case had the objects been in the ground for long ages. The utensils—harpoons, handaxes, scrapers—are far less artistic than those in other Neolithic stations. Vayson de Pradenne and Abbé Breuil indeed contend that none of them could ever have been used.

Dr. Morlet and his chief supporter Van Gennep did their best to answer all these objections. The former at the height of the verbal battle-royal made a request for a governmental commission which was speedily granted, but when he found that a bitter anti-Glozelian, the well-known archeologist Capitan, was a member, he objected and the Commission was never sent. Eventually, at the International Anthropological Congress at Amsterdam, an International Commission was formally appointed to investigate Glozel. The Commission consisted of Absolon, Director of the Archeological Museum of the State of Moravia, Bosch-Gimpera, Professor in the University and Director of the archeological work of Barcelona, the

Abbé Favret, Forrer, Director of the Prehistoric and the Gallo-Roman Museum at Strasbourg, Miss Dorothy Garrod, member of the Royal Anthropological Institute and of the French Prehistoric Society, Hamal-Nandrin, Lecturer on Prehistory in the Museum of Liège, Peyrony, Director of the Museum of Les Eyzies, and Pittard, Professor of Anthropology in the University of Geneva. Absolon was prevented from taking part in the work of the Commission.

After spending three days at the site the Commission issued a unanimous report which was kindly sent to me by Miss Dorothy Garrod. This report states unequivocally that the articles are for the most part of recent manufacture and have undoubtedly been planted in the ground by some one whom the Commission does not name; and that Glozel is neither prehistoric nor authentic. Vayson de Pradenne in a devastating brochure in which he declared the Glozel finds fakes, also accused no one by name but put the blame upon the Esprit de Glozel; in other words upon a fairy.

One might think that with the leading French, English and American scientists—Peyrony, Pradenne, Abbé Breuil, Sir Arthur Evans, Dussaud and, I believe, Professor MacCurdy, arrayed against Glozel, and with the destructive judgment of the International Commission, Glozel would cease from troubling the scientific and the lay mind. Though all due obsequies have been performed, Glozel refuses to remain in its sepulchre, and the literary battle continues. Dr. Morlet kindly sends me newspapers and pamphlets and a distinguished pro-Glozelian of Belgium, Professor Tricot-Royer, has just supplied me with his defense of Glozel which is particularly interesting because Professor Tricot-Royer was present during the visit of the International Commission.

What keeps Glozel alive? First we have the fact that when men take sides in print they are loath to recant, fearing ridicule—the more untenable their position, the more stubborn their resistance.

Secondly, six months after the International Commission's visit Dr. Morlet called together a Comité d'Études consisting of Drs. Foat, Bayet and Tricot-Royer of Belgium, Reinach, J. Loth, W. Loth, Van Gennep, Dépéret, Ajcelin, Roman, and Audollent of France, and Soderman of Sweden, all sympathetic to Glozel. At their meeting they pronounced unanimously in favor of its genuineness.

Another reason is found in the attitude of a group of French and German scientists who are opposed to the traditional belief that "ex oriente lux"—that civilization is of oriental origin. The alleged Neolithic alphabet of Glozel and similar finds at Alvao in Portugal are grist to their mill.

In addition quasi-political factors have entered into the con-

troversy—Fradin an obscure peasant, Morlet a provincial doctor without much influence, have a definite appeal for the proletariat and for a large section of the press.

And finally, it must be remembered that the Academicians are not always right—they ridiculed Pasteur and Boucher des Perthes; even Koch and Lister met a similar fate in the beginning.

All these elements co-operate to keep the spark of life in Glozel. Within the past few weeks the publication of an exhaustive treatise by Dr. Morlet has been announced. This, however, I fear, can throw no new light upon the subject.

As a detective tale the story of Glozel remains unfinished and will remain so until a Sherlock Holmes discover the person or persons who manufactured the articles and put them in the ground. What was his motive? How are we to explain the extraordinary industry that has fashioned five thousand or more articles, and how is it that he, the Esprit de Glozel, has escaped detection in a community of twenty-nine souls where everyone knows everyone else's business? Or how, if there are witnesses to the dark deed, can we explain an unbroken neighborly silence extending over a period of six exciting years?

THE ZEISS PLANETARIUM *

About the middle of August, 1927, I spent two days in Vienna. On my trips to the Allgemeine Krankenhaus I passed a large sign bearing the word Planetarium. I had read something of an instrument of that name but had no clear idea of its nature or its potentialities. Being, however, deeply interested, purely as an amateur, in astronomy I determined to postpone my departure until midnight of the second day so that I might avail myself of the opportunity of seeing the Planetarium in action.

The building in which the instrument was housed was a curious wooden structure, squarish in form and with a pyramidal dome at the top. The doors were thrown open at 7.30 P. M., and after buying a ticket, I entered into a large room the level floor of which was covered with arm chairs. Overhead was a hemispherical dome unsupported by girders and uniformly illuminated from an invisible source of light. In the center of the room stood a very grotesque instrument looking like a huge dumb-bell or a caterpillar with sprawling arms, resting upon a base which in its turn rested upon wheels. The audience which filled every chair consisted of men, women, and children who were all exceedingly quiet, whether in anticipation of something remarkable or whether because Viennese audiences are by nature quiet, I do not know. All eyes were directed toward the dome which showed nothing but the diffuse light of which I have spoken. Gradually the light began to fade and one's eyes became accustomed to the increasing darkness. Suddenly the prevailing silence was broken by a deep gasp from the whole audience. The dome it appeared had opened noiselessly to reveal the starry firmament overhead. All the stars and familiar constellations of the season were visible. Upon close inspection, however, it became evident that the constellations were somewhat contracted, that is to say, while the stars maintained their relative positions all of them were a little more crowded than is actually the case in the heavens. Not only their relative position but even the relative brightness of the fixed stars was strikingly preserved. Then unex-

* Address delivered by invitation before the Rittenhouse Astronomical Society at Houston Hall.

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pectedly a voice was heard asking the question—"Ladies and Gentlemen, which is the brightest star that you can see?" One said this, one said that, pointing to the particular star, but of course in the dark room this pointing had little meaning. Then the speaker said, "Is it not that one?" and behold a flaming arrow had appeared in the firmament at the star Sirius and the audience agreed it was the brightest star. The speaker now began his discourse with the legend of the Pleiades. Then he entered upon an explanation of the seasons and showed how they came about; he illustrated the rising and the setting of the sun, the phases of the moon, and the position of the planets in August. The audience sat spellbound for one hour, seeing the stars rise in the East and sink slowly in the West and as they set Dawn appeared in the East, gradually the sun arose and daylight diffused itself over the sky as the stars faded out. The whole thing was overwhelming in its majesty. The year was contracted into a few minutes, the stars in their annual revolution were shown in the briefest space of time. I am sure that I was not the only one who was sorry when the speaker finished and the audience was dismissed.

I stopped to say a few words of appreciation to the lecturer whose address in melodious High German had been so delightful. His answer to my remarks came like a blow between the eyes, for instead of his diction being in the same genre, he replied in a very unmelodious Viennese dialect, expressing his pleasure that I was pleased.

After that memorable evening I dreamt of nothing but Planetariums. If only Philadelphia could have an instrument of such transcendent beauty, of such incomparable utility in the education of the people!

On entering into correspondence with the makers, the Zeiss Company, the Director of the Astronomical Division, Dr. W. Villiger, kindly sent me an abundance of literature from which and from considerable later material I learned the history of the instruments and the principal features of its construction.

The Planetarium owes its creation to Dr. von Miller, Director of the famous German Museum in Munich. In developing the astronomical section, Dr. von Miller wanted to find a means that would permit a considerable number of people to view astronomical phenomena in the most impressive manner possible. Upon his request the firm of Carl Zeiss, Jena, constructed a Copernican Planetarium, a model of the solar system on a large scale, with nine meters as the diameter of the orbit of Saturn. While this model has many advantages, it gives the observer an erroneous notion of the alignment and distances of the planets, and creates a

false conception of the really extraordinarily small amount of luminous material in space.

Appreciating the deficiencies of the Copernican model, Dr. von Miller proposed to the Zeiss Company as a second problem the construction of a celestial model that would show the heavens as we see them from the Earth when out of doors. He intended to place the observer upon a platform—on the Earth regarded as motionless according to the ideas of the ancient astronomers—this platform to be built up within a great rotary metal dome, the celestial sphere. The planets attached to different mechanisms, were to be moved upon the inside surface of the sphere in accordance with their actual apparent motions.

Much experimental construction work was carried out in Jena on this problem but no satisfactory solution was found. That is quite understandable, for to secure a correct representation of Nature seems out of the question as long as one clings to the idea of reaching the goal through cumbersome mechanisms, that is, through constructions that can never be in a position to create the illusion of the mysterious, silent march of the worlds of Nature. It was, therefore, a happy thought, when Dr. Bauersfeld of the Zeiss Company evolved the following proposition: "The great sphere shall be fixed; its inner white surface shall serve as the projection surface of a multiplicity of small projectors which will be placed in the center of the sphere. The reciprocal positions and motions of the little projectors shall be interconnected by suitable driving gears in such a manner that the little images of the heavenly bodies thrown upon the fixed hemisphere, shall represent the stars visible to the naked eye, in position and in motion just as we are accustomed to see them in the natural clear sky."

Five years of hard work were required to carry out Dr. Bauersfeld's ideas and to create an artificial sky which has exceeded all expectations.

In simplest terms the Planetarium consists of a series of integrated projection lanterns by means of which the stars, sun and planets are thrown upon the vaulted dome acting as a screen. The bulbous ends of the instrument carry the slides for the fixed stars of the northern and southern firmaments respectively, while in the shank, if I may call it so, the orbits of the sun, moon, and planets are arranged in tiers. Separate projectors are provided for the Milky Way, for Sirius, and for the brighter nebulae. In addition there are slides for the Great Circles, for the names of the Constellations, for the movements of nutation of the moon and for the reading of the years. A seemingly complicated but in reality simple

system of gears and motors controls the entire mechanism, the control being located in a switchboard under the speaker's desk. In the earlier instruments fixed stars down to magnitude 6, 4500 were shown, but in the later ones 5200, to magnitude 6.2 are projected.

By means of a luminous pointer, the speaker can throw an arrow to any part of the sky—this proved exceedingly helpful to the audience during my visit to the Vienna Planetarium.

One of the most interesting developments of the Planetarium is the dome. The limit of diameter of the dome is set at about 25 meters. The construction of so large a dome is a problem in itself. Dr. Bauersfeld attacked this problem with the same success as he attacked that of the Planetarium. By means of a new kind of network construction he has been able to build a dome at a minimum cost. The rib network consists of thin iron rods 22x8 millimeters in cross section and about 60 cm. long. Fifty-three different lengths were found necessary in building the Jena dome.

The inner surface of the dome is covered with a temporary wood sheathing against which a concrete sheet is spread with compressed air by the Torkret system. For insulation "Expansit" cork sheets cover the dome and over these is an outer cover, two layers of "Ruberoid" roof. It is noticeable that the entire thickness of the dome covering including the outer insulating layer is only about 1-250th part of the dome's diameter. The ratio of the thickness of the shell of the dome to its diameter is therefore less than that of the egg shell to the diameter of a hen's egg.

The first dome in Jena had very poor acoustics. An echo developed in the hemispherical dome that made it difficult to understand the speaker. It was necessary either to change the shape of the dome which was impossible in the nature of things or to substitute some other material. After careful study by highly trained technical men including physicists, it was found that of all substances thin stretched linen reflected the smallest percentage of the incident sound waves—only about 10 per cent. As a result this plan was then carried out: Inside the concrete dome and concentric with it a second hemispherical dome of a slightly lesser diameter is constructed consisting simply of rib iron, similar to the rib iron dome which forms the core of the concrete dome. Light-weight white linen which serves as the projection surface is stretched on the inner surface of this iron-rib dome. In the space between the rib iron dome and the concrete dome there are sheet iron plates about ¾ inches thick and two square meters area, so arranged that they reflect the sound waves which penetrate the thin cloth with

little loss of intensity in random directions so that no sound-focus can be formed.

The cloth-lined dome has the additional advantage that it can be built inside any type of structure—thus the outer dome or covering may be developed as a tower or other form of construction.

What are the advantages of a Planetarium?

There is, I believe, a wide-spread interest in astronomy, the oldest and greatest of the sciences. Perhaps there are not as many amateur astronomers as there are golfers—but without doubt more persons are interested today in astronomy than in any other science.

Unfortunately, the majority of the inhabitants of our towns and cities seldom have an opportunity on account of the disturbing lights and the haze on the horizon of getting a good view of the heavens; the presence of the sun during the day naturally interferes with star gazing. Finally great patience is required to follow the slow movements of a planet or a star.

But by contracting the 1440 minutes of the day or the 525,600 minutes of the year into a brief space of time makes it possible to follow these movements with ease.

What the Planetarium can show:

1. The Planetarium shows, as I have indicated, the fixed stars visible to the naked eye in their proper luminous and spacial relations—this affords a means of becoming acquainted with the constellations, a knowledge readily transferred to the actual heavens. It shows the nebulae and the milky way. The larger the dome, the closer the resemblance to nature.

2. It shows the planets and their movements—inclusive of Saturn —even the complicated retrograde movements of the outer planets.

3. It portrays the origin of the Moon's phases and shows clearly the movements of the Moon's nodes due to the slight inclination, 5°, of its orbit to that of the Earth. Even the nutation or wobbling produced by the attraction of the Sun upon the Moon is provided for in the Moon-Earth mechanism. The gear connection for all of these movements is such that at whatever speed the year is run off the speed of the planetary and lunar movements is always in proper proportion. For example, if the year is made four minutes long, one revolution of Mercury requires 58 seconds, one of Venus 148 seconds, one of Mars 7.2 minutes, one of Jupiter 47.2 minutes, one of Saturn 2 hours, 56 minutes.

4. The precession of the equinoxes, caused by the gyroscopic motion of the earth, is readily showable. This curious wobbling of our supposedly steady earth brings about a change in the direction of the earth's axis; hence, a change in the position of the Pole Star.

Although one revolution requires 26,000 years, the Planetarium is so geared as to show this in the course of a few minutes.

5. Several other things can be shown: the meridian circles, the method of locating heavenly bodies by Right Ascension and by Declination from the celestial equator.

6. The Planetarium shows the difference between the sidereal and the solar day—demonstrating why the former always has the same length, while the other is variable.

In all the places where Planetariums have been erected the popular and educational value has been amply demonstrated. In most cases they are operated by the cities themselves through the school boards and a small admission is charged. Although not intended as a money-making scheme the receipts even in the relatively short time of operation have gone toward paying both cost and upkeep. There is every prospect that in a few years most of them will have fully paid for themselves. A total of more than a million paid admissions has already been recorded in the Planetariums of Germany alone.

Everywhere care is taken that the demonstrations do not degenerate into sensational exhibitions but that they remain a means of giving the spectators an insight into cosmic occurrences. The material which the Planetarium is able to present is divided into a large series of different program numbers. In the little town of Jena the first program was presented for eight months without change; 500 performances took place within that period and were witnessed by 78,000 people. The program permits of so many variations that there is no danger of exhausting the popular interest.

I may have made you feel that I was overenthusiastic, but let me read to you what Clyde Fisher of the American Museum of Natural History has to say. He says he was overwhelmed. The illusion of the immensity of space is perfect. One feels that he is in the great outdoors under a clear night sky. Due to subconscious imagination perhaps traceable to some psychologic or physiologic reason the artificial sky seems to possess the deep night blue of the real sky and yet there is no blue on the inside of the dome and none in the projection apparatus.

Mr. James Stokley (Publications of the Astronomical Society of the Pacific) felt that he was actually out of doors under the sky depicted. He said he had never been in any country other than the United States but felt that he had seen the Southern Cross, so realistic was it on the Planetarium dome.

Professor Max Wolf says that the Zeiss Planetarium has grown to be a popular means of education, almost without parallel in any branch of learning in the history of man.

Professor Dr. Stromgren of Copenhagen says that never has means of entertainment been provided which is so instructive as this, never one which is so fascinating, never one which has such a general appeal. It is a school, theater and cinema in one, a school room under the vault of the heavens, a drama with the celestial bodies as actors.

I trust that I have conveyed to you some of the enthusiasm that I feel for the Planetarium and that you have an equally strong desire to see this incomparable instrument in Philadelphia so that young and old may take pleasure and profit from it. You probably know that a generous merchant has offered one to the city of Chicago; the American Museum of Natural History in New York in connection with its Astronomical Hall also contemplates the installation of a Planetarium—Mr. Clyde Fisher of the Museum Staff purposely visited Jena and other German cities to investigate the instrument. What about Philadelphia—the home of the first American astronomer after whom this Society is so justly named? I am happy to be permitted to say to you tonight that Philadelphia will soon have a Planetarium. A generous, high-minded, modest citizen who of late years has become deeply interested in astronomy and has erected a small telescope in his summer home, has agreed not only to give the costly instrument but also to erect a noble building in which to house it. To secure the best possible structure he has commissioned Mr. Paul Cret, an architect renowned for the perfection of his art, to draw the plans. I hope before a year passes we may be joined together in celebrating the inauguration of the Philadelphia Planetarium.*

* Mr. Samuel S. Fels was the donor of the Planetarium. He gave it, together with a large sum of money, to the Franklin Institute. It was shown publicly for the first time on November 6, 1933.

OSTEOPATHY [1]

To the Editor of THE LANCET [2]

Sir,—Osteopathy of today has travelled a long distance from the principles taught by the founder. Since its beginning in the little frontier town of Kirksville, in the State of Missouri, it has had a remarkable growth, and is now recognised as a method of practice by a number of States of the Union. This result is only in part due to osteopathy as originally conceived—namely, that disease is caused by misplacement of bones and joints and can be cured by readjustment. To a great extent the spread of osteopathy was due to the belief of credulous people in the mysterious power of cults. Its spread was also furthered by the activity of osteopaths and their political adherents who influenced State legislators to give osteopaths the privilege of practise. More recently they have acquired even further legal rights by adopting many therapeutic methods of regular medicine. The medical profession of this country has always been dignified in its opposition to the granting of undeserved privileges to the osteopaths. It seemed unfair for the State to demand of regular physicians a long and arduous course of training and then allow osteopaths to come in through the back door and to have nearly all the rights that the regular profession enjoys. Quite recently the governor of the State of New York vetoed a Bill authorising osteopaths to engage in any form of medical practice except the giving of drugs by mouth to cure disease and the performance of certain specified operations.

In discussing osteopathy we have to differentiate between the original cult and that of today. Originally osteopaths ascribed all diseases to displacement of bones, a conception that must appear preposterous to anyone who knows something of pathology and bacteriology. Equally absurd is the claim made by the early osteopaths that all drugs are poisonous. Such a statement can impress only those who do not know the value of quinine, mercury, digitalis, laxatives, not to speak of morphine, the greatest boon to sufferers from hopeless, painful disease. That osteopaths treat

[1] Reprinted from The Lancet, London, March 2, 1935.
[2] The Editor of The Lancet had requested Dr. Riesman for an opinion which could be presented to the House of Lords while an act to license osteopaths was pending.

whooping-cough, scarlet fever, pneumonia, and diphtheria by manipulation only, must seem to anyone acquainted with the origin and nature of these diseases the height of irrationality. No doubt a goodly number of children get well, not because of osteopathic treatment but in spite of it. The honest physician under whose ministrations, perhaps with few or no drugs, the patient recovers from an acute infectious disease, would not claim too much credit for himself but would ascribe the recovery largely to the powers of nature. The vis medicatrix naturæ was known to Hippocrates, yet osteopaths claim the discovery of this 2000-year-old fact for A. T. Still, their founder and patron saint. It is also claimed for him that he was the first to recognise that the body has an immunity toward certain diseases, something that is as old as the hills and is well known to the laity.

Of late years the osteopath, finding that osteopathy would not cure everything, has found it necessary to use surgical measures, and this has led him to the study of surgery. He also discovered that his aversion to drugs was not altogether rational, and he began to use them. This is unlawful in some States but is permitted in others. It indicates a radical departure from the original cult. The osteopaths have also become aware of the fact that focal infections may play a part in disease in addition to mechanical displacements. Thus a pamphlet issued by the American Osteopathic Association of Chicago advises that peptic ulcer be treated as a preliminary to osteopathic manipulation of the spine by the removal of diseased tonsils, bad teeth, &c. Thus osteopathy, like homeopathy before it, has gradually discarded its original principles and approaches more and more the practice of medicine. If that is the trend, why should the osteopath not be required to have the same preparation as any other practitioner of the healing art. To-day the homeopath in my country has to have the same preliminary education, the same premedical training, and the same medical course as any other doctor of medicine. His preparation is differentiated only in that it contains some teaching of homeopathy, which however few really follow in after life. The homeopaths are now highly respected members of the medical profession and regular physicians consult freely with them. I see no reason why anyone who chooses to select osteopathy as a specialty as another man might select roentgenology or laryngology, should not go through the same regular preparation in anatomy, physiology, pathology, bacteriology, biochemistry, hygiene, diagnosis, obstetrics, and surgery as any other specialist. If the osteopath does not have such training, then he has no right to practise medicine under any name whatsoever. His position

before the law should be that of the chiropractor, the electrotherapeutist, or any other who makes use, or ostensibly makes use, of only one therapeutic method. His main function would then really be to assist the physician in the treatment of such diseases in which manipulation may be useful, and that osteopathic manipulation sometimes helps is proved abundantly. But it is not a universal panacea and does not constitute the practice of medicine as a whole.

It is interesting that the Philadelphia College of Osteopathy, one of the best in the country, whose catalogue has not a word to say about the founder Still or about the original principles of osteopathy, gives a four years' course and requires for admission a four years' high school course and one year of college. This is about what the best medical schools used to require up to a few years ago. It is an interesting commentary on the state of osteopathic practice that in the Philadelphia College therapeutics and—shades of A. T. Still—prescription writing are taught. Little wonder that nothing is said in the catalogue about the original principles of osteopathy.

If osteopaths are practising the osteopathy of A. T. Still, then they are not entitled to be recognised as medical practitioners but only as representatives of a special type of mechanotherapy. If they are practising osteopathy, so-called, as it is now taught in their best schools, then they are entitled to larger rights but only on condition that they submit to the same fundamental training required of all persons who appear as doctors or physicians before the public.

I am, Sir, yours faithfully,

DAVID RIESMAN.

Philadelphia, Feb. 7th.

We commend[1] to close attention the letter from Prof. DAVID RIESMAN. Prof. RIESMAN, one of the best known clinical physicians and teachers in the States, and professor of clinical medicine at the University of Pennsylvania, in a lucid description of the evolution of osteopathy shows that the medical profession in his country has always been opposed to the granting of privileges to osteopaths, holding it unfair to demand from the regular profession a long and arduous course of training while allowing the osteopath to come in through a back door to enjoy the rights of the regular profession. It is significant that he should write from Philadelphia, which is a prominent center of osteopathy and the seat of one of

[1] Editorial in Lancet, London, March 2, 1935.

the best educational institutions which osteopathy possesses. He is sympathetic to all progress, while critical of that assumption of learning which imposes on those who are willing to believe in the mysterious power of cults. And by as much he shows that the osteopathy of to-day has progressed towards the scientific medicine, by so much does he whittle away its claim to be regarded as a new system of medicine such as it was suggested to be by Lord ELIBANK.

RELATIONS AND FUNCTIONS OF THE CLINICAL PATHOLOGIST IN THE HOSPITAL STAFF *

The honor you have done me in asking me to speak to you tonight on the occasion of your Annual Banquet I should like to requite in a becoming manner. I might perhaps do so by glorifying the clinical pathologist as he is but that would hardly be worthy of your intelligence even if it were in keeping with my own sense of scientific honesty. For the clinical pathologist has not yet attained that rank, that degree of perfection of which he is capable; therefore I shall try to portray him as of the future, to picture him as some day he will be. That method will inferentially bring out his present shortcomings.

The clinical pathologist is a product of specialization in medicine. Most of us are of two minds regarding specialization—we see advantages and we see disadvantages in its development. That it is a phase of the evolutionary process in medicine cannot be doubted and as such is as inescapable and as inevitable as the machine in industry. Its drawbacks to medicine are that it separates the profession into an ever increasing number of water-tight compartments. The day of the universal scholar in medicine—of the Charcots, the Strümpells, the Jonathan Hutchinsons, is past and as unlikely to come back as that of the universal geniuses, the Michelangelos, the Da Vincis, the Goethes. Prophecy, however, is always dangerous and perhaps I should not go so far as to say that such repetition of history is impossible, but scanning the world's horizon today fails to reveal the universal man either in the humanities or in the sciences, or for that matter, in statesmanship.

We must therefore content ourselves with specialism and take advantage of its virtues, which are many. The greatest is that it provides the world with men of superior knowledge in a limited field. Such specialization has been of enormous value in medicine—witness the high development of neurosurgery, urology, bronchoscopy, ophthalmology, roentgenology. What a comfort and satis-

* Read at the Annual Banquet of the Tenth Annual Convention of the American Society of Clinical Pathologists, Philadelphia, Pennsylvania, June 7-9, 1931.
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faction it is to be able to appeal to men highly trained in these special branches for help and advice.

In a hospital with its complexity of cases any one of these and other specialties may on occasion be needed but there is one which is always needed by all departments, and that is the one which you gentlemen represent—that of the clinical pathologist, and by that token your dignity rises and your responsibilities increase.

Perhaps, however, Dr. Lynch is right in thinking that we may be asking too much of the clinical pathologist who has to be anatomist, histologist, immunologist, chemist and bacteriologist, but the very fact that so much is asked of him is in itself a compliment.

So much depends today upon the laboratory—Dr. Fishbein has said that a + or a — may determine life or death—that the position of the clinical pathologist in the hospital is well-nigh supreme. He is called upon to aid in the interpretation of symptoms, in the diagnosis of obscure cases and in the treatment of many diseases.

In order to discharge his multitudinous responsibilities and to make use of his new-born opportunities it is of the greatest importance for him to keep in touch with clinical medicine. The test-tube pathologist cannot fulfill the function that pertains to your position.

There are a number of ways in which contact with clinical medicine may be maintained:

1. By occasional visits to the wards to see interesting cases. The clinical pathologist should of his own initiative make such visits; at the same time the members of the staff should encourage him and welcome him on the wards.

2. By a discussion of the clinical aspects of cases coming to autopsy.

3. By conducting jointly with the other members of the staff clinical and clinicopathological conferences. By the former I mean conferences on living patients either in the wards or in small side rooms, conferences attended by interns, staff and students. Not only are such exercises of enormous pedagogic value for those who attend them but they bring the clinic and the laboratory together in an ideally helpful way.

4. By active participation in the work of an intramural medical society.

All these measures help to promote contact and coöperation between the clinic and the laboratory which it will be agreed is one of the greatest desiderata in medicine. It will be easier in the future when clinicians have a sounder and broader training in the fundamental branches.

On his recent visit to Philadelphia Prof. v. Gröer of the University of Lemberg told me that before engaging in pediatrics as a specialty, he spent five years in the fundamental branches of biochemistry, physics, physiology and immunology.

Under an ideal arrangement the clinical pathologist is a full-time attaché of the hospital. That status need not prevent his answering an occasional outside call in consultation or doing a limited amount of laboratory work for the medical profession. Such activities, however, ought not to interfere with his primary duties to the hospital and to the staff.

These duties I should now like to elaborate a little more fully.

First of all it is, I think, important that the clinical pathologist create enthusiasm among the medical personnel of the hospital for autopsies. Although the chiefs in the wards have a similar duty, the pathologist can do a great deal in this direction by making autopsies interesting. In my days as resident physician and afterwards as pathologist the autopsy room was always filled with interns who wanted to learn. I realize that morbid anatomy is no longer the drawing card it was a generation ago. For this waning interest, which I consider most regrettable, the pathologist is largely to blame.

I do not believe that the clinical pathologist can ever achieve a really high position unless in addition to being a chemist and immunologist, he is a good morbid anatomist.

It should be remembered that for nearly a hundred years the actual leaders in medicine have nearly always been pathologists in the anatomic sense—Virchow, Rokitansky, Orth, Prudden, Welch, Councilman, Aschoff, Hektoen, Flexner, Warthin. Such men are the court of last appeal in the diagnosis of tissue changes. No matter how far chemistry and immunology may go, a profound knowledge of morbid anatomy and histology will command the highest respect and will single out the man who possesses it.

Another duty of the clinical pathologist is to teach the interns the principal tests and laboratory procedures needed in the clinic. In order that this be done properly the pathologist must be interested in teaching. He must be able to select the essentials and must have the interns for an adequate length of time. Four months is, I take it, the minimum.

He should, however, not limit his teaching to the interns. The senior staff in most hospitals stands also in need of instruction. In every institution there are men who deride the laboratory, although they are usually the ones who make the most indiscriminate use of it. Such men must be tactfully educated to a knowledge of what the laboratory can do and what it cannot do, and that it

is economically wasteful and scientifically irrational to have all manner of tests done routinely.

On the other hand the clinical pathologist must guard against overemphasizing the importance of the laboratory, else the interns will go out with such blind faith in laboratory methods that their confidence in the time-honored, never antiquated procedures of history taking and physical diagnosis is undermined. Only the man who knows something of clinical medicine can steer safely between Scylla and Charybdis.

The pathologist should stimulate the research spirit among the interns and should have no end of problems for assignment. If these problems can be different phases of the same major research, so much the better.

I was once in the laboratory of Professor Emil Fischer in Berlin. If I remember correctly there were 167 places in one enormous room, all occupied by men working on different problems in biochemistry under the unifying influence of the great master. I shall never forget my attendance at a so-called colloquium at which various men presented the results of their work.

That the report from the clinical laboratory should be reliable and prompt is a sine qua non although not yet attained in all hospitals. But no matter how reliable the reports may be the clinical pathologist must not be offended if the clinician does not accept them in blind faith. Laboratory reports must be judged in connection with the clinical findings.

Only recently I had a case in point. We had obtained some fluid from the chest of a patient and had sent it to the laboratory. A dogmatic report came back "endothelioma of the pleura." The physical examination and clinical history pointed to long standing cardiac disease and not to tumor of the pleura. The autopsy confirmed the clinical diagnosis and revealed no pleural tumor.

If there are enough interns to organize an intramural medical society, the clinical pathologist should be a leader in the organization and should give to the meetings a scientific tone.

He is in the best position to create a true esprit de corps, not only among the interns but among the staff as a whole. Such a spirit soon makes itself felt beyond the walls of the hospital and becomes one of the chief determinants for medical students in choosing that hospital for their internship.

A pendant to the medical society of the hospital is the library. As his department will undoubtedly make the most use of it, the clinical pathologist has the deepest interest in its maintenance and expansion.

The clinical pathologist in a small hospital in a town or city not

having a medical school and far away from a medical center has a splendid opportunity of making his hospital a school of post-graduate study for interns and staff.

Under his inspiration such a hospital may become a nucleus from which a scientific spirit irradiates the entire medical profession of the community. This has been well pointed out by Funk.

The growing employment of technicians in hospitals and by physicians in private practice makes it desirable that there should be schools for this modern female species. I see no objection to such a school being attached to the Department of Clinical Pathology in a large hospital, provided that it is conducted properly and with due regard to the primary needs of the hospital itself.

And now I come to a matter that is not strictly scientific and yet I dare not neglect to speak of it, and that is emolument. The laborer is worthy of his hire. The clinical pathologist considering his responsibilities, his devotion to an intramural job that takes him out of the current of life, ought to be well compensated, although not too well. I say not too well for the same reason that makes me differ from President Hutchins of the University of Chicago, who not so long ago stated that a professor should receive at least $50,000 a year salary. A clinical pathologist or a professor receiving such a magnificent wage would soon be bothered by his investments and in a few years might be so rich that his wife would insist on his retirement from active duty.

There is one danger connected with the clinical pathologist's compensation, that is the danger of commercialism which the whole profession faces in this era of economic upheaval. The danger must be combated on the basis of the high ethical ideals that are the tradition and the pride of medicine.

I have sketched the ideal clinical pathologist as I conceive him. To achieve the state of distinction I have in mind he must overcome any inferiority complex; he must feel himself the equal of his colleagues on the clinical side and not merely a super-technician. Then he will have that flattering and responsible position for which the time seems to be ripe—namely the position of consultant-general.

SCHOOL AND THE LONG VACATION[1]

There is a widespread belief shared by those working in the pedagogic field and those on the outside that something is radically wrong with our educational methods. The results achieved in schools and colleges are in no way proportionate to the native intelligence, the expenditure of effort in teaching, and the stupendous outlay of money represented by material equipment and cost of maintenance. Employers of labor in stores, shops and factories complain of the lack of training and efficiency in the young men and women available for hire, and college teachers of sound judgment seem quite generally convinced that the average student at the end of his four-years' course has not enough to show in cultural attainments and useful knowledge. As I have intimated, this disappointing result is not due to lack of ability on the part of the American youth, who for quickness of perception and capacity of learning are not outclassed by the youth of any nation. The fault lies elsewhere. It would carry me too far from my present purpose were I to enter upon a discussion of all the defects of our system. I intend dealing with one only, a definite concrete condition easily comprehended and fully remediable if once educators are impressed with its significance.

The fault I have in mind has to do with the long summer vacation. In my opinion this is placed in an entirely false relation to the school year. Long-established custom has fixed it in elementary and secondary schools, in colleges and universities between two separate and independent school years. The student finishes a course and drops books and habits of study for a period varying from two to nearly four months. At the end of the vacation he returns to a new class, to new teachers, to new studies. It takes him a considerable time—in the professional schools of a university, as I know from my own classes, from a week to ten days—until he gets properly oriented, which still further increases the unused hiatus.

I am not criticizing the length of the vacation. In our climate it is almost a necessity for teacher and student to have surcease from school work during the long heated term; but I believe the vacation is wrongly placed. It ought to come within the school year, not at

[1] Reprinted from Science, N. S., Vol. XLIII, No. 1104, February 25, 1916.

its close. In its present position there can be no work assigned, for, speaking generally, the teachers of the completed year have no control over the student in the year he will begin in the autumn. If a student is industrious he may carry on work in the continued branches, but will do and can do little or nothing as regards new studies—Greek, higher mathematics, physiology or what not—in the mysteries of which he has not yet been inducted. The loss in momentum and direction is tremendous, and if we add it up for all the vacations during school life from the first year to graduation from the university, this potential loss becomes vast and staggering.

What is the remedy? There are two; one is the all-year-round school such as is in vogue in the University of Chicago, with its four trimesters. In the South and the mid-Atlantic region, a summer trimester is almost out of question. It would, for example, be well-nigh impossible to keep all the departments of a university in full swing during July, August and September. There is another remedy, and that I want now to propose. I would not do away with the long vacation, but I would place it in the mid-period of the school term, by making the scholastic year begin in February or March instead of in September. The school year would end in February with promotions and graduations and a new year would begin after a brief recess of not more than ten days or a fortnight. The student would remain in the new class for at least three months before the summer holiday, more than enough for a good start. The long vacation might then be utilized for valuable and purposive study, partly assigned, partly optional.

I am aware of the existence of a certain pedagogic prejudice against burdening children with school work during the long vacation. What I am advocating is not the projection of the school year with its tasks and mental circumscription into the vacation, for I myself believe that one of the advantages of our long recess is that it gives the child's individuality a chance to develop. I maintain, however, that the assigning of a small amount of work does not interfere with the child's freedom. In the lower grades a very small amount suffices to keep up an interest and to preserve a continuity of thought, which is all that we need strive for. In the case of older pupils and certainly of college students we could well ask not merely the preservation of the mental *status quo* but enough work, proportionate to the length of the vacation, to carry the student a little beyond where he left off—and this again without materially infringing on our youth's traditional claim to a carefree holiday. When student and teacher meet in the fall, work could commence at once with the accumulated energy resulting from a sane com-

bination of work and play during the summer. There would be no loss, but instead a great gain in momentum. Consider the totality of gain in the period from the first grade until the close of the four years' college course, a matter of fourteen or sixteen years.

The change I have suggested is applicable to all schools, elementary, high school, college and university, and can be brought about without doing any violence to the fundamental principles of our educational system. I know of no other reform comparable to this in practical feasibility that promises such great results.

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DR. DAVID RIESMAN

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10. Hysteric Clonic Spasm of the Wrist.
11. Rheumatoid Arthritis, with Report of Two Cases.
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194. How the New Blockley Came Into Being.
195. Hydrophobia, Report of Two Fatal Cases, with Pathologic Studies in One.
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207. Medical Progress in One Generation.
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209. Encephalitis Lethargica.
210. Introductory Remarks at the Dedication of Wards and of the William Osler Memorial Building at the Philadelphia General Hospital, December 4, 1934.
211. The Future of Blockley.
212. Vascular Crises.
213. Osteopathy.
214. Thomas Sydenham (Paul B. Hoeber, Inc., New York).
215. Dr. Richard Mead and the Motto of the College of Physicians of Philadelphia.
216. Max J. Stern—In Memoriam.
217. The Story of Medicine in the Middle Ages. Paul B. Hoeber, Inc., 1935.
218. Albert Bernheim—In Memoriam.
219. William Henry Welch, Scientist and Humanist.
220. What You Should Know About Cancer.
221. How Librarians May Contribute to the Fostering of an Interest in Medical History.
222. Diseases of the Gall-Bladder.
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224. The Clinical Approach.

225. Address Delivered at the 90th Annual Banquet of the Northern Medical Association, March 16, 1936.
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227. Emphysema.
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231. Splenectomy in the Treatment of Subacute Bacterial Endocarditis.
232. Memorial of Dr. John B. Deaver.
233. Treatment and Guidance of Patients with Damaged Hearts.
234. Assembly Dinner Program, Wednesday Evening, October 14, 1936, St. Paul Hotel.
235. The Early History of Urology. Professor Max Neuburger, Dr. Med. et Phil., Vienna. Translated by Dr. David Riesman.
236. Bourdelot, a Physician of Queen Christina of Sweden.
237. Dr. James M. Anders as Practitioner and Consultant.
238. Memorial of Dr. Jay F. Schamberg.
239. Glossopharyngeal Neuralgia Due to an Impacted Wisdom Tooth.
240. Thoughts on Hypertension.
241. The College of Physicians: Its Library and Other Treasures.
242. The Thymus and Status Lymphaticus. Oxford Medicine.
243. History of the Interurban Clinical Club. (Editor.) The John C. Winston Company, Philadelphia, 1937.
244. A large number of book reviews in medical and other journals.

Articles Published in the Transactions of the Pathological Society of Philadelphia and Not Published Elsewhere

245. A Case of Primary Sarcoma of the Spleen with Extensive Metastasis.
246. Calcareous Concretion from the Tonsil.
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261. Address of the President of the Philadelphia Pathological Society.

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Dr. George S. Zugsmith
Dr. Edwin Zugsmith
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