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LECTURES

ON

INFLAMMATION,

EXHIBITING

A VIEW OF THE GENERAL DOCTRINES,

Pathological and Practical,

OF

MEDICAL SURGERY.

BY JOHN THOMSON, M.D. F.R.S.E.

PROFESSOR OF SURGERY TO THE ROYAL COLLEGE OF SURGEONS, AND REGIUS PROFESSOR OF MILITARY SURGERY IN THE UNIVERSITY OF EDINBURGH.

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TO

ANDREW WOOD, ESQUIRE,

SENIOR MEMBER OF THE ROYAL COLLEGE OF SURGEONS OF EDINBURGH,

ONE OF THE MANAGERS OF THE ROYAL INFIRMARY, &c. &c. &c.

DEAR SIR,

THE following publication contains the introductory part of a course of Lectures on the Principles and Practice of Surgery, which by your advice I was encouraged to undertake, and to which the Royal College of Surgeons have since been pleased to grant their patronage, by an appointment which has laid me under the deepest obligations of duty and gratitude.

By printing this part of my Lectures, I wish to leave myself time in future for the discussion of various important practical points in surgery, which the limited term of our academical session has obliged me hitherto either to omit altogether, or to consider only in a very brief and superficial way. I have published these Lectures also with the hope that they may be useful to those students, who, in entering upon the study of the medical profession, are desirous of obtaining more exten-

sive views of the general doctrines of Surgery than are to be met with in the common elementary books of instruction.

But whether the purposes which I intend by the publication of these Lectures shall be fulfilled or not, you may be assured that no other circumstance connected with them can ever afford me a satisfaction at all equal to that which I feel in the remembrance of the kind attentions, counsel, and support, for which, on various occasions, I have been indebted to your friendship, and without which this work had probably never been composed, nor my attention directed, in a particular manner, to the study of Surgery.

I remain, with every sentiment of regard and esteem,

Dear Sir,

Your obliged and faithful Servant,

JOHN THOMSON.

JAMES' SQUARE,
1*st October*, 1813.

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INTRODUCTION.

THE practice of Medicine has long been divided into two departments, Physic and Surgery. Physic is said to have for its object the treatment of internal, surgery that of external diseases; and each of these departments of the healing art has been supposed to be the peculiar province of a distinct and differently educated practitioner. But though this is a distinction which has been often recognized in the practice of the medical profession, it must be confessed that the limits between physic and surgery are not very precisely marked, and that the respective functions of the Physician and Surgeon, long as those names have existed, are still but very inaccurately defined. The most superficial acquaintance with the symptoms, progress, and termination of the various morbid affections to which the human body is liable, must be sufficient to convince every unprejudiced inquirer, that there is but a slight foundation, if indeed there be any, for this distinction, in the nature of the diseases which these practitioners are required to treat, or in the modes of treatment by which the diseases themselves may be cured or relieved. Experience has long shown, that the use of internal remedies is not only required in a large proportion of the diseases which are regarded as strictly chirurgical, but also that there are few diseases which come under the care of the physician, in which morbid affections, requiring the manual aid or practical skill of the surgeon, do not frequently occur. A very few examples will serve, I hope, to illustrate the truth of these remarks, and to place this subject in a proper light.

The treatment of febrile and internal inflammatory diseases, it will be allowed, belongs exclusively to the province of the physician, wherever the distinction between physician and surgeon has been introduced, and is rigidly observed; yet in some species of fevers, and in all internal inflammatory diseases, blood-letting is often the principal, if not the

only remedy that is required. But this is an operation, however urgent the necessity for it be, which from engagement the physician cannot, aud from the fear of degrading his province of the profession, will not perform. Retention of urine not unfrequently takes place in symptomatic febrile diseases, and this is an affection which does not always yield to the use of internal remedies: but it is an affection also, from the painful uneasiness which it immediately excites, as well as from the danger which it threatens, that will not admit of delay. When internal remedies, therefore, fail in relieving the patient, the urine must be speedily drawn off by means of a chirurgical operation, otherwise inflammation, mortification, and rupture of the bladder, must necessarily ensue. Febrile and internal inflammatory affections terminate not unfrequently in the formation of fluids, which it is necessary to let out by a chirurgical operation; and abscesses, fistulous openings, and ulcers, are formed, which require the aid of the surgeon. In patients, also, affected with severe febrile diseases, from being long fixed down to their beds in one position, some of the parts of the body upon which they rest occasionally acquire a disposition to mortify, larger or smaller portions of the skin and subjacent cellular membrane becoming dead, separate from the living parts, and sores are formed which are but too often the subject of unavailing chirurgical practice. To employ, in the different stages of this species of mortification, from its first commencement to the complete separation of the dead parts, and the formation of a new skin, the appropriate external and internal remedies, requires a greater share of chirurgical skill, and a more extensive and accurate knowledge of chirurgical remedies, than can reasonably be expected in those who make a profession solely of physic. Unhappy, therefore, must be the lot of that patient, who, in circumstances similar to those which I have described, has the misfortune to have for his sole medical attendant, a physician ignorant of surgery.

But, if a knowledge of surgery be necessary to the student who intends to practise physic, the knowledge of physic, on the other hand, is no less necessary to him who intends to devote his attention exclusively to the profession of surgery; for indeed there are few chirurgical diseases which are not, in some period or other of their existence, accompanied by morbid affections of the same nature with those which fall

properly and most frequently under the care of the physician. To such of you as have any acquaintance with practical medicine, it will only be necessary to mention, as examples of these affections, the symptomatic fever which attends inflammation, whether this affection has been induced by external injury, or has occurred spontaneously in the body from internal disease; the hectic fever supervening to long continued process of suppuration; the febrile state, and other morbid affections which are sometimes brought on by the too sudden and injudicious use of mercury; bilious fever, and the various derangements of the digestive organs, which are sometimes the cause, and at other times the consequence, of local diseases; the nervous affections, such as apoplexy, convulsions, paralysis, and mania, which arise not unfrequently from injuries of the head; and locked jaw, or tetanus, which, in warm climates particularly, is so very liable to be induced by punctured wounds. These are morbid affections, the proper study and treatment of which, when they occur without local injury, are supposed to belong to the physician rather than to the surgeon; but occurring, as they do very frequently in chirurgical diseases, and always modifying or aggravating the effects of these diseases, ignorance of their nature, relations, and modes of cure, is not only inexcusable, but highly criminal in the practitioner who ventures to undertake their treatment.

To these remarks it seems scarcely necessary to add, that an accurate knowledge of external and internal diseases, and of their proper modes of treatment, implies a knowledge not only of the structure of the human body, and its functions in the state of health, but also of its deviations from this state during diseases, as well as of the various causes by which diseases may be induced, and of the means remedial and dietetic, by which they may be cured or relieved. Whatever branches, therefore, of elementary education, and whatever kinds of medical knowledge are requisite to the physician, the same must of necessity be equally so to the surgeon.

I am happy to be able to quote to you, upon this subject, the sentiments of the celebrated M. Quesnai, author of the Œconomical System in Political Œconomy. The sentiments of this author are the more deserving of your attention, that M. Quesnai had practised with great reputation both branches of the healing art, having been in early life a

professor of surgery, and afterwards physician to the court of Louis XV. of France.

"A very slight attention," says this intelligent author, "to the objects of physic and surgery, must be sufficient to show that these two arts can have but one common theory; for the external diseases which form the object of surgery are essentially the same with the internal diseases which form the object of physic. They differ only in position, they have the same importance, they exhibit the same indications, and require the same means of cure.

"But though the theory of physic and surgery be the same, it does not follow that the physician and surgeon are characters whom we can, or whom we ought, to confound. A person who is in possession of general theoretical knowledge, and nothing more, is neither a physician nor a surgeon. To form a physician requires, besides a scientific knowledge of the different branches of the healing art, practical skill in applying the rules of that art to internal diseases; and in the same manner, to form a surgeon, the habit, facility, and skill of applying those rules to external diseases, are no less necessary.

"Scientific or elementary knowledge does not give this skill in the application of the rules of the healing art. It simply dictates these rules, and nothing more. It is by practice alone that we learn to apply them properly, and by practice under masters learned and skilful in the respective arts which they profess. By study we acquire knowledge, but we can acquire the art or the habit of applying the practical rules of physic and surgery only by seeing and comparing together, again and again, all manner of external and internal diseases. This is a habit that must be acquired, but it is one which can be acquired only by practice."

The importance to society of every student of medicine being obliged to obtain, not only a general but a minute knowledge of physic and surgery, must appear obvious also when we reflect how very small a proportion of those who are educated for the medical profession find it possible, in after life, to devote their attention exclusively to one of these branches, and to forego the advantages which they reap from the practice of the other. It is in great cities, and in great cities only, that the distinction in the exercise

of the medical profession, between physician and surgeon, either has been, or ever can be, observed : and even in those cities where this dictinction has prevailed in the highest degree, how small a portion of the community, it may be asked, have enjoyed the advantages supposed to be derived from this division of the healing art? The rich, it is true, may, in all cases of danger, whether real or imaginary, add the attendance of the physician or surgeon to that of their ordinary medical guide, the apothecary : but the poor, who form the greatest body in every community, must either be contented to live and to die without the advice or assistance of those who practise physic and surgery as distinct professions, or betake themselves to some of the asylums or hospitals that are maintained at the public expense. A physician in a large city ought to be regarded as a practitioner to whom recourse is to be had in cases of difficulty and danger : but the proper education of this class of practitioners, and the necessity which exists for their having enjoyed opportunities of extensive practice, as well as having gone through a course of academical study in order to qualify them properly for the duties of consultation, are points which do not seem to have been hitherto fully investigated by the medical profession, nor rightly understood by the public. A consulting practitioner without experience is certainly an incongruous, and may become a dangerous character in society.

In small towns, on the contrary, and particularly in country villages, subdivision of labour in the medical profession is totally inadmissible. In these situations, the customs, convenience, and necessities of their patients do not admit of any distinctions among medical practitioners, which are not immediately derived from a real or fancied superiority of professional skill. But how extensive the practical information required to qualify the village or country practitioner for the duties which he has to perform, will be obvious, when we reflect that he must undertake the cure of all the accidents and diseases to which men, women, and children are liable, in the district in which he is to practise. It is this circumstance which renders it so desirable for the public that every young medical practitioner, in the commencement of his practice, were placed for a time under the superintendence and direction of men older and more experienced than himself. Without the advantages to be derived from this mode of

medical instruction, the young practitioner, when he first enters upon the practice of his profession, can supply the want of personal experience, only by the lessons which he obtains from the errors and mistakes he commits, at the hazard or even to the detriment of his patients.

An arrangement of medical practitioners according to seniority, or implied experience, has long been advantageously followed in the practice of the army and navy, and accordingly a general acquaintance with all the branches of practical medicine is very properly required of those who are educated for these two departments of the public service. Without this general knowledge, they would be totally unfit for the ordinary medical practice of the army and navy. In these departments the distinction between physician and surgeon, though occasionally recognized in name and in particular duty, has never been rigidly carried into effect; for in the army and navy, of this as well as of every other country with which I am acquainted, the surgeons, together with their assistants or mates, have been the physicians in ordinary, as well as the apothecaries also, of the men whose health and lives are intrusted to their care.

Since, therefore, in the ordinary and general practice of medicine, physic never has been nor ever can be separated from surgery, it seems but reasonable that those who, from the nature of their profession, and from the circumstances of the situations in which they may be placed, must practise physic and surgery together, should learn equally the rudiments of both arts. These arts have had the same origin, and they have the same end. The human body is the sphere of their exertions, and whatever can effect it, in matter, vitality, or mind, is the object of their researches.

It will not, I hope, be conceived, from the earnestness with which I have recommended the study of physic and surgery in common, that I am disposed to deny the great and peculiar advantages which society derives from the subdivision of labour in the medical profession. The effects of this subdivision in improving individual skill in the medical as well as other professions, wherever the state of society is such as to admit of it, is too obvious to be made the subject of any dispute. But the sum of what I wish to contend for is, that those who are destined for the exercise of the medical profession, by whatever name denominated, whether physician, surgeon, or apothecary, should all receive the

same elementary education; for it is this only that can ensure their mutual co-operation, and enable them to discharge, with full utility to the public, the duties of any particular branch of medical practice to which they may afterwards be induced to devote their exclusive attention. This, it appears to me, is the only rational reform that the present state of medical education admits of, the only proper barrier that can ever be raised between the medical profession and the practice of dangerous quacks and ignorant pretenders. It is with the view to promote such improvement in the education of medical men, that the honorary degrees and certificates of qualification conferred by universities or colleges of physic and surgery should have their origin, and not in that exclusive and illiberal spirit, which, by enjoining a distinct course of elementary instruction, vainly endeavours to separate, in the general practice of the medical profession, branches which ever have been, and ever must be united. Instead, therefore, of attempting to widen, as has been but too often done, the breach between the different branches of the medical profession, by a distinct education and by exclusive privileges to colleges of physicians and surgeons, it must be an object infinitely more desirable to every liberal mind, to see reunited, under one roof and in the same school, all the children of a family too long separated from one another. "*Illud ante omnia scire convenit,*" says Celsus, "*quod omnes medicinæ partes ita innexæ sunt, ut ex toto separari non possint, sed ab eo nomen trahunt, a quo plurimum petunt.*"

After having endeavoured, in this very summary manner, to show the intimate and in some degree inseparable connexion existing between physic and surgery, it would form a curious and perhaps not unedifying subject of inquiry, to trace the origin of the distinction between physician and surgeon, such as it has existed in modern Europe, and to ascertain, as far as can be done by historical documents, the circumstances which gave rise to the institution of two distinct colleges or communities of physic and surgery, each of them invested with separate, exclusive, and often contradictory rights and privileges. But it is the bare outline only of this subject which I can at present attempt to delineate.

In the history of ancient times we find nothing which bears any resemblance to that division of the medical pro-

fession, which has prevailed in modern Europe. Dietetics, pharmacy, and surgery, appear indeed to have been distinguished from each other at a very early period; but this distinction extended merely to the classification of the objects of study and of the means of cure in diseases, not to the persons who were to employ these means in the practice of medicine. In the times to which we refer, medical practitioners seem either to have practised indiscriminately all the branches of the healing art, or to have undertaken only the cure of particular diseases.

In Egypt, each individual disease appears to have had its appropriate practitioner, who was regulated in his practice, not by his own knowledge, experience, or views, but by the medical precepts contained in the sacred books of that country. In deviating from these precepts, his life became the forfeit of unsuccessful practice.

In Greece, so far as we can trust to her traditional or written history, all the branches of the healing art appear to have been exercised indiscriminately by those who were bred to the study and profession of medicine. The writings of Hippocrates, Galen, Ætius, and Paulus, contain many incontrovertible proofs of the very great proficiency which these authors had made in the knowledge of surgery; a knowledge in many respects so accurate and particular as could have been attained only by practice.

Medicine does not appear ever to have been much cultivated, or to have risen into any sort of reputation, at Rome. Before the time of the Cæsars, it most commonly was regarded as an ignoble profession, and practised only by slaves, freed-men, and foreigners. Celsus, whether a practitioner or not, seems to have studied carefully, surgery as well as physic, and accordingly his descriptions of chirurgical diseases and chirurgical modes of practice, like those of the Greek practitioners, from whom he has professedly borrowed so much, constitute not the least accurate and valuable part of his writings.

From the overthrow of the Roman empire till the revival of literature and the arts in Europe, medicine, like many of the other arts and sciences, took refuge with the Arabians. Though prohibited by their religion from dissecting dead bodies, the Arabian physicians appear to have practised surgery in common with physic. In proof of this we need only appeal to their writings, in which we find several diseases and

chirurgical operations described, that were unknown to Greek and Roman practitioners.

But though the cultivation of medicine as a science might be said to be wholly in the possession of the Arabians, from the time of the overthrow of the Roman empire till the revival of literature in the twelfth and thirteenth centuries, this was by no means the case with regard to the practice of the art. For, during the whole of that long and dark period, as has been remarked by an acute and intelligent surgeon,* the practice of medicine was, in the greater part of Europe, almost entirely in the hands of the clergy, who, by involving it in superstition, found it a profitable employment, and in many instances an introduction to ecclesiastical preferment. Surgery during this period was in a very low and degraded condition; even anatomy, the only true foundation of this as of all other medical science, was no where taught, and the knowledge of operations, imperfect even as it had been among the Greeks and Romans, was no longer to be found in papal Europe. So degraded indeed was the practice of surgery, that a principal part of it, the care of the wounded and lame, was commonly entrusted to women and ignorant pretenders. Such at least was the state of medical science and of medical practice in the greater part of Europe, when the university of Paris began to assume a regular form under the reign of Louis the Seventh.

The establishment of literary and scientific colleges or universities forms a remarkable æra in the history of human instruction. These institutions seem to have had their origin in the East, and to have borrowed some of their usages, as well as their form, from the sacred colleges of the priests. In these seminaries, as the classical historian of Charles the Fifth remarks, the course of education in modern times has been fixed; professors have been appointed to teach different parts of science, a regular form of trying the proficiency of students has been prescribed, and academical titles and honours are conferred on such as acquit themselves with approbation.

Of the universities first established in Europe, a few in Italy excepted, the greater part were originally ecclesiastical

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* See Observations in Defence of a Bill, &c. by Mr. Chevalier. London, 1797.

tion of churchmen. They were founded by the pope, and were so entirely under his immediate protection, that their members, whether masters or students, were exempted from the civil jurisdiction of the countries in which they were situated, and were amenable only to the ecclesiastical tribunals.

But as the improvement of medicine was not the principal object of these institutions, so it was sometime before in papal Europe this science was permitted to be taught in them. It was not till about the end of the twelfth century, that a faculty of medicine was added to those of divinity, arts, and decrees, in the university of Paris, the source, it may be remarked, from which the other universities of Europe, have since borrowed most of their regulations, usages, and ceremonies. In consequence of this improvement in academical education, the established teachers began to study and to explain, in their public lectures, the writings of Hippocrates and Galen.

But the novelty of these studies leading many of the clergy to neglect their religious duties, the church found it necessary to interfere, and to emit various edicts, which seem to have been but very imperfectly observed by those for whom they were intended. In one of these edicts, emitted in a council held at Tours, by Pope Alexander the Third, in 1163, it is very openly insinuated, that the devil, according to his usual custom, transforming himself into an angel of light, had, under the pretext of giving assistance to their brethren languishing under disease, seduced many of the regular clergy out of their cloisters to the study and practice of medicine; and that, as this practice was calculated to involve spiritual men in the affairs of this world, the church found it necessary to ordain, that no one, after he had taken the vows, and made a profession of religion, should apply himself to the study of medicine or civil law, and that if any person did so, and did not return to his cloister within two months after the publication of this edict, he should be shunned by all as one who had been excommunicated. This edict having been sadly neglected, was afterwards repeated by Pope Honorius the Third, about the year 1215, with an additional canon, which ordained that no ecclesiastic should prescribe blood-letting, practise that operation, or be present corporations, instituted chiefly, if not solely, for the educa-

where it was performed ; and that no sub-deacon, deacon, or priest, should exercise any branch of surgery, or give the rite of benediction to any who practised the same.

"In consequence of these restrictions, a few laymen were encouraged to apply to the study of physic. But, as the university of Paris would not receive them without a vow of celibacy, most of them became priests when they had finished their studies. The priests being now forbidden to leave their cloisters, were, for the most part, consulted at home. The servants or friends of the sick used to carry their urine, and other excrements to them, with as good an account as they could give of the indisposition."* Nothing, says the author of L'Histoire de L'Origine et de Progres de la Chirurgie en France, a work which has usually been attributed to M. Quesnai, nothing could be wanting to complete the ridicule of physic practised after this fashion, but the act supposed to have been made by Henry II. of France, which ordains, That, upon the complaint of the heirs of persons who die through the fault of their physicians, justice shall be administered as in other cases of homicide, and that the physicians who receive fees shall be bound to taste the excrements of their patients, and to perform to them all manner of kind offices; otherwise they shall be adjudged to have been the cause of their death. After examining with all due care the natural discharges of their patients, regarded even at that time as excellent sources of information, the clerical physicians directed what medicines were to be taken, and, in cases of external disease, what applications were to be employed. In cases of external disease, it was most usual for the priests to send their own servants, who acted as their barbers, to perform what was necessary of manual operation, and hence the first origin of that class of practitioners, so well known since in Europe by the name of the Barber Craft or Barber Surgeons. It deserves to be remarked, that about this time Pope Alexander the Third had revived the canon first issued by the synod of Carthage, respecting clerical tonsure, or shaving of the head ; and that cold applications to the head, previously shaved, formed a very principal remedy in many diseases. From these two circumstances the number of barbers was of course greatly augmented.

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* Observations, &c. by Mr. Chevalier.

Many of them became wholly employed in visiting the sick for the clerical physicians, in performing the inferior operations of surgery, and in examining into, and prescribing for the diseases of the urinary and genital organs, particularly of the female sex; all of which employments were considered as too indelicate and degrading for the sacred function of the priesthood. The barbers employed in these offices acquired, as may be readily conceived, some slight knowledge both of physic and surgery, and in time also obtained a considerable degree of the confidence of the public. The more important chirurgical "operations, of which very few indeed were then performed, were commonly entrusted to the lay scholars of the universities who had studied physic, but had not been permitted to become members of the medical faculty, not having taken the vow of celibacy. These scholars, however, were very few in number, so that the clergy occasionally intermeddled with this branch of practice, till at length by two decrees, the first issued by Pope Boniface the Sixth, at the close of the thirteenth century, and the second by Pope Clement the fifth, at Avignon, soon after the beginning of the fourteenth century, surgery was formally separated from physic. The priests were absolutely forbidden to practise it under pain of excommunication; and the university of Paris, in consequence of these decrees, refused to admit any student into the faculty of medicine who did not abjure surgery."* It is from the separation produced by these two decrees, that we ought, I conceive, to date the true origin of the distinction between physician and surgeon, such as it has existed in modern times; a distinction unknown in the practice of the ancients, and for which, after some research, I have not been able to find any better reasons than those which have been assigned, unless perhaps we were to except that maxim, *Ecclesia abhorret a sanguine*, often expressed in its decrees it is true, but never, I believe, acted upon, but in this instance, by the church of Rome. This is a distinction also, it deserves to be noticed, for which we are indebted to men who, though they made little scruple of murdering obnoxious rivals, or of burning reputed heretics alive, regarded anatomy, or the dissection of dead bodies, as barbarous and profane, ignominious to the persons who performed it, and injurious to the character of the deceased.

* Observations, &c. by Mr. Chevalier.

Some time before this separation had been produced between physic and surgery, medicine was begun to be cultivated with some degree of attention at the famous school of Salernum, in Italy; and the study of this science appears also to have been not a little promoted by several of the Italian universities admitting lay students to equal privileges with the clerical. Some of these lay students became physicians of celebrity; and the clergy, partly from choice and partly from necessity, left the performance of chirurgical operations entirely to them. "Several of these lay physicians passed over into France at different periods, where they practised surgery with considerable success and reputation; but that they did not confine themselves entirely to surgery is very evident from their writings."*

It deserves to be remarked, that the French, however unwilling their historians may be to allow it, seem first to have obtained a scientific knowledge of surgery from the lessons and example of these Italian physicians, who ought to be regarded as the restorers of surgery in modern Europe. They had probably in their turn received a great part of the knowledge which they possessed from the Arabians, who had for some centuries over-run many parts of the south of Europe. Francis the Second of Naples, the most enlightened monarch of his age, and who, during a long reign, had resisted the tyranny of the pope, always maintained a strict friendship with that laborious people, and carried on with them, even after he had expelled them from his dominions, an extensive intercourse in literature and the arts. This monarch regulated by an edict in 1233, the period of attendance, and the forms of examination, necessary to qualify the student for a medical diploma in the school of Salernum, and in several other universities of Italy; and by these regulations ordained that no one should be admitted a master, or doctor in physic or surgery, till he had studied carefully the rudiments of both arts. It was this edict which seems to have given rise to the titles *Chirurgo-Medici*, or *Doctores Utriusque Medicinæ;* titles which are still preserved in some parts of the continent, but which have never been united in the medical degrees conferred by the universities of this country. Soon after this period also, Louis the Ninth of France, commonly called St. Louis, who had accustomed

* Observations, &c. by Mr. Chevalier.

himself to assist in dressing the wounds of his soldiers, first incorporated into one public body, the surgeons of Paris. "After the mandate," which I have already mentioned, "of Pope Alexander, had been repeated by Honorius the Third, the clerical physicians more frequently gave advice in the churches, especially in the church of Notre Dame, where the surgeons attended to receive their directions about some of their patients, and to dress the sores of such as resorted to that asylum. At length, St. Louis thinking the surgeons deserving of more respect than merely to be considered as the scholars and underlings of the physicians, formed them into a college, or confrerie, about the year 1268, in honour of St. Cosme and St. Damien, and in the church consecrated to these saints, the surgeons for several centuries after were obliged to attend the first Monday of every month, after divine service, to dress the wounded and lame poor gratis.

"In this manner arose the two classes of surgeons in Italy and France, which have in a greater or less degree existed ever since in most countries of Europe; those who had had a regular education in the schools of medicine, and occasionally practised as physicians, and those who, without any academical education, were originally employed as the servants of the priests, being in fact barbers."*

Some of these barbers, on leaving their employers, began to encroach on the regular practitioners of surgery. The number of surgeons who had obtained an academical education, had begun, it is true, to multiply; but, as it was still small in comparison with that of the barbers, these were of necessity tolerated as inferior practitioners. At length, "however, in the year 1301, the barbers were summoned before the Procureur de Roi, or king's attorney, and forbidden to practise till they had been examined by the regular bred surgeons; or, as they were then styled, *Les Maitres Chirurgiens.* The word *Maitre*, or Master, was equivalent with Doctor; and accordingly the physicians, in the writings of that period, are often styled *Maitres de Medicine*, or Doctors of Physic. The *Maitres Chirurgiens*, Doctors of Surgery, or Master Surgeons, had no specific authority, so that the number of ignorant pretenders daily increased; till at length, John Pitard, who had been surgeon successively to St. Louis, Philip the Brave, and Philip the Fair, obtained

* Observations, &c. by Mr. Chevalier.

an edict from the latter in the year 1311, by which he was empowered to assemble with the masters in surgery, to compel all the practitioners in that art to appear before him, in order to be examined respecting their qualifications, to grant licenses to such as were of competent abilities, and to take them before the Provost of Paris to be sworn. The provost was at the same time authorized to punish all who dared to practise within the city and liberties of Paris, without having first obtained this sanction from John Pitard, or his successors in office. This edict was repeated with some slight alterations by King John, in 1352, and again in 1355, and afterwards by Charles the Fifth, who, while he was regent, had enrolled his own name among the list of master surgeons, and who finally determined, in the year 1372, that the surgery of the barbers should be confined to dressing boils, bruises, and open wounds, which were not mortal, but which might become so without timely assistance."*

This community, or college of regularly bred, or master surgeons in Paris, is the first example, I believe, to be met with in history, of the institution of a medical college distinct from a university; and the great purpose of its erection, it deserves to be particularly observed, was to secure the public, as well as the medical profession, from the dangerous intrusions of rash quacks and ignorant pretenders.

Separate colleges of surgery and physic now began to be established in the different countries of Europe, and attempts were made to ascertain, and to establish by law, the particular limits of these two professions. A very slight examination, however, of the charters granted in different countries, or even in the same country at different periods, to the respective colleges of physicians and surgeons, will, to those who take an interest in inquiries of this nature, suffice to evince, that government, in attempting to fix these limits, had undertaken a task far above its reach; because a task contrary to the decrees and to the intentions of nature. Of course we find that the limits between these two parts of the medical art were perpetually varying, according to the prejudices of the legislators who vainly endeavoured to fix them; or, according to the temporary, and but too often selfish interest of those, by whom such charters were ob-

* Observations, &c. by Mr. Chevalier.

tained. Instead of regarding their charters as barriers wisely placed by the legislature between the public and those who pretended to practise physic and surgery, without having had the advantages of a liberal and professional education, these charters were converted by their possessors into instruments of mutual warfare, and made the subject of endless and most disgraceful disputes.

A slight enumeration of some of the rights and privileges which, at different times, were made the subject of contest by the respective practitioners of physic and surgery in the city of Paris, while it cannot fail to convince you of the folly of all such disputes, will also, at the same time, serve to explain the manner in which those two classes of men have in modern times been almost always the enemies and rivals of each other.

I have made choice of Paris in giving this account, because it was, as I have already said, the great theatre of these contests, and the source from which most other countries of Europe borrowed their customs and medical institutions. These contests, however, have not been confined to Paris alone, but have uniformly arisen in every country in which the distinction between physician and surgeon has been confirmed by law ; and there is but too much reason to believe, that they are contests which will continue, in a greater or less degree, so long as separate colleges, or communities, of physic and surgery exist.

The surgeons of Paris, I have stated, were formed by Louis the Ninth, into a confrerie, community, or college of surgery, about the year 1268, in honour of St. Cosme and St. Damien, and, to distinguish them from the barbers or servants of the priests, who at that time practised surgery, they were denominated *Les Maitres Chirurgiens*, or the Master or Doctor Surgeons, and afterwards surgeons of the Long Robe, or the surgeons of St. Cosme. At the time of their first erection into an incorporated body, these surgeons seem to have been possessed of no peculiar privileges or immunities, and their powers were limited to the examination of candidates, and the granting of licenses to practise surgery to those who were approved of by them. In an act of King John, of 1355, they are represented as forming a *Faculty*—a term by which the different literary bodies in the university of Paris were at that time distinguished. To quicken their vigilance in preventing ignorant or improper

persons from intermeddling with the practice of surgery, they were allowed, by an act of the same king, in 1360, one half of the fines imposed upon those who ventured to practise without having a license; and in 1370, King Charles the Fifth of France granted them the privilege of exemption from the keeping of guard and watch in the city of Paris. It is obvious, from the terms of this last grant, that the surgeons, in imitation of the different faculties existing in the university, had introduced honorary distinctions, or degrees, into their body; for we find them mentioned in this act as Bachelors, Licentiates, Masters, Graduates, and Non-graduates in Surgery. Narrow and circumscribed as the powers and privileges of this body were, they appear to have been viewed with a jealous eye by the clerical physicians, who, at that time, formed the medical faculty in the university of Paris, and were consequently more immediately under its protection. It is in this jealousy of privilege, and in the opposition of interest necessarily arising between the surgeons and the medical faculty, that we are to seek for the true origin of the disputes which lasted for several centuries between these two bodies. So early as the year 1390, we find the regularly bred, or master surgeons, complaining to the university of the encroachments of the barbers, and other ignorant practitioners, who were secretly patronised by the medical faculty; and at the same time petitioning the university to take them under its protection, and to assist them in the suppression of this irregular and empirical practice. After much deliberation among the different faculties in the university, the prayer of this petition was granted, but with this particular condition, "*quod domini supplicantes eisque adherentes tanquam veri scholares non alias essent juvandi.*" By this transaction the surgeons became the acknowledged scholars and pupils of the university—an appellation which certainly did not imply any inferiority on their part to the other scholars of that institution, nor derogate in any degree from the literary and scientific character, which it ever after was the pride and ambition of the surgeons of St. Cosme to maintain.

A request was made by the college of surgeons, about the year 1486, to be acknowledged as members of the university, with a view to obtain an exemption from the payment of certain heavy impositions or taxes, which were at that time laid upon the inhabitants of Paris. So favourable an

opportunity of obtaining some mark of respect from the surgeons, was not to be neglected by the medical faculty; and accordingly we find that the favour which the surgeons solicited, was granted on condition, that those who were to be bred to the profession of surgery, should attend the lectures given by the medical faculty in the university. In this condition also, there was surely nothing degrading to the surgeons. It provided for their better education, by obliging them to study, not only in their own schools, but also in those of the medical faculty. But, instead of being denominated the scholars of the university, the surgeons, in consequence of this transaction, became the scholars of the medical faculty. This distinction, though at first sight apparently trifling, led afterwards to very important consequences. For no sooner almost had the surgeons made this acknowledgment, than they were immediately accused of inattention, neglect, and want of due respect, towards their teachers, the clerical physicians.

About the year 1452, Cardinal Etouteville abolished the law which bound the physicians of the university to celibacy—a measure which had most important consequences to physic, and to those who professed it; for "many of the clerical physicians thinking there was more comfort to be found in a wife without a benefice, than could be expected in a benefice without a wife, abandoned the priesthood, and were then permitted of course to visit their patients at their own houses. They became very jealous of the influence of the surgeons, to whom before they were so much indebted, and tried all the arts and manœuvres that monkish craft could devise, to oppress and degrade them: violent disputes, therefore, frequently arose between these two bodies of men, in which the physicians, being members of the university, and more immediately under clerical protection, generally prevailed. The surgeons, very unwisely, made several attempts to push themselves, as a fifth faculty, into the university, and to make friends for this purpose of the very men who were despising and persecuting them. They appealed to their honour, their good sense, and so on, but as they could not appeal to their interest, the surgeons generally frustrated their own intentions, and only gained the honour of being acknowledged as the scholars and pupils of the medical faculty, and of being occasionally admitted to receive apostolical benediction in the university, from the

same lips as their rivals and oppressors, the clerical physicians."* But it was among the class of barbers that the physicians endeavoured to form a body of adversaries formidable to the surgeons. They encouraged these barbers in private; promised them their protection, and began by giving them secret lessons on an art which they themselves had been strictly forbid to learn or to practise.

The surgeons complained in a formal representation to the medical faculty, in 1491, of the protection that was given to the barbers, and of the lessons on anatomy and surgery, that were privately read to them by some of the members of the medical faculty. The medical faculty seem at first to have been ashamed of this protection, and of these lessons; for, in their reply to the complaints of the surgeons, they declared, that if any such lessons had been given to the barbers, they were given contrary to the laws and to the wishes of the faculty. Yet, notwithstanding this declaration, the medical faculty two years afterwards published a decree, by which they bind themselves to instruct the barbers in the lesser operations of surgery, and for that purpose agreed to give them one of their doctors, or, as he is denominated in the decree, one of the masters of the faculty, to read the chirurgical writings of Guy de Chauliac, and to explain these writings to them in their vernacular tongue, to instruct them also in anatomy, and to practise with them the treatment of boils, tumours, and some other external diseases. By this decree provision was made for the future education of an order of practitioners, who were to learn surgery in the schools of physic, and who afterwards became known by the name of Barber Surgeons, though that was an appellation which they were not permitted to assume for several years after they had become the professed scholars and dependants of the medical faculty.

In every dispute which arose after this time, we shall find each of these three different classes of practitioners, the physicians, surgeons, and surgeon barbers, constantly striving to advance its own individual interest, to the detriment of the other two branches of the profession; the physicians uniting sometimes with the surgeons, and sometimes with the barber surgeons, according to the vacillations of interest, or

* See Observations, &c. by Mr. Chevalier.

according to the real or supposed influence of either of these contending rivals.

It must not be forgotten, that it was among these three orders of men that the disputes about privilege and superiority of professional rank commenced, which have been perpetuated to our times; and that it is in the prejudices and absurd customs of these men that we are to seek for the maxims by which the opinions and conduct of those who still contend for separate and exclusive privileges in the practice of medicine, are in some measure regulated. The barbers of Paris, in their origin, were the servants of the priests, but in the progress of time they became, like the apothecaries of England, or the surgeon-apothecaries of this country, the medical guides of by far the greater part of the community. It was not, however, till about the year 1301 that the barbers were distinguished, in any public act, as a distinct body of medical practitioners. At that period they became licentiates of the College of Surgeons. They were to be examined by the surgeons, and to be by them declared qualified, before they were permitted to practise any of the lesser operations of surgery. This right of examining, and of licensing the barbers, appears to have continued unimpaired with the surgeons of St. Cosme till about the year 1577, when the physicians, after much intrigue, and many ineffectual struggles, at length obtained the privilege of being present at the examinations of their pupils the barbers; though it does not appear that they ever claimed any right to give an opinion on the qualifications of the candidates, but merely to collect the suffrages of the surgeons who were the examinators. But even with this license the barbers were not permitted to intermeddle with the management of any important case, unless in accidents threatening immediate danger from loss of blood; and the moment the bleeding was suppressed, they were obliged to give public intimation of what they had done, and to deliver over the patient to the surgeons. Their practice at first was strictly confined to blood-letting, opening small boils, dressing slight wounds, and to the administration of glysters.

It was not till about the beginning of the sixteenth century, that the disputes between the two faculties of physic and surgery in Paris began to assume a regular form, and

to be limited to distinct claims on the part of one of these faculties, which were always more or less strenuously opposed by the other. One of the privileges, as has been already mentioned, which the surgeons of St. Cosme had often solicited, and which they were most ambitious to obtain, was that of being acknowledged as members of the university. They had, indeed been repeatedly recognised as its scholars and pupils; but, in the year 1515, they were encouraged to petition for admission into the university as a fifth faculty. To this petition the university returned for answer, that the surgeons could not be admitted into the university as licentiates and doctors in surgery, forming a fifth faculty, but merely as the scholars of the medical faculty, and that also, only so long as they continued to attend the lectures and other public acts of the medical faculty.

The exclusion of the surgeons from the university became after this one of the rights claimed by the physicians, and of course one of the grievances complained of by the surgeons. Surgery was no where regarded as a liberal art, and accordingly from this time, for a period of nearly three hundred years, it has either been prohibited from being taught, or no provision has been made for that purpose in the erection of the greater number of the universities established in Europe. Exclusion from the university at that period, however, is not simply to be regarded as the deprivation of a literary honour, for it carried along with it the privation of other advantages of much more valuable consideration. To say nothing of the taxes and other burdens to which laymen in those times were liable, and from which the members of the university, as belonging to the clerical order, were exempted, it will be sufficient to mention the denial to the surgeons of the rite of apostolical benediction. When the principal, or chancellor, as he was then termed, of the university of Paris, at the request of Charles the Ninth, was about to confer this benediction on the surgeons of the long robe, the medical faculty interposed, and emitted the following declaration: "That this intention of the chancellor was most unjust, because the surgeons were not qualified to receive the apostolical benediction, having never been members of any of the four faculties in the university, nor ever having received certificates from the professors in these faculties; conditions which had usually been complied with by those who had sought to obtain apostolical benediction,

and the degree of a licentiate in any of the faculties; and that it did not belong to the chancellor, nor indeed to any man, without the express mandate of his holiness the Pope, by whom the university was founded, and upon whom it chiefly depended, to introduce any innovation into that ceremony." It is singular enough that the ceremony of conferring apostolical benediction continues to be, even at the present day, and in protestant countries, the very form by which candidates for medical degrees are constituted licentiates, graduates, and doctors in physic; though the reason, it is to be hoped, for the continuance of this ceremony, is not in our times so urgent as it appears to have been at the period of which we were speaking. The historian Riegel, from whom I have taken my account of this transaction, remarks, that the apostolical benediction in those days supplied in the candidates the want of a knowledge of anatomy, surgery, physic, and philosophy.

Another privilege which the surgeons of Paris claimed as a right inherent in their body, was that of conferring honorary degrees in surgery; and this privilege they continued to enjoy for a period of more than two hundred years. The precise period at which the different universities in Europe first began to confer honorary titles or degrees is not well ascertained; but it seems to have been a practice borrowed from the mechanical trades; "as to have worked," says Mr. Smith in his Wealth of Nations, "seven years under a master properly qualified, was necessary in order to entitle any person to become a master, and to have himself apprentices in a common trade, so to have studied seven years under a master properly qualified was necessary to entitle him to become a master, teacher, or doctor, words anciently synonymous in the liberal arts, and to have scholars or apprentices, words originally synonymous, to study under him." With what advantages to society this period of study has been abridged in the education of those who are intended for the profession of medicine, I shall not now stop to inquire. Degrees in surgery are first mentioned, so far as I can find, in a grant of Charles the Fifth of France, to which I have already referred; and many proofs of their having been publicly conferred, with all the ceremonies of the university, might be adduced, were it necessary, from the registers of St. Cosme. Besides the ceremonies which we have retained, it is recorded in the history of these

times, that the new graduates, upon receiving their medical degrees, made a present of red bonnets, *des bonnets rouges*, to their teachers, and of gloves to their fellow-students, a part of the ceremony of graduation for the omission of which I do not find that any satisfactory reasons have been assigned. After the union of the College of Surgeons with the Barber Surgeons, which took place in the year 1655, the Medical Faculty endeavoured to prevent, sometimes with greater, sometimes with less success, the surgeons from giving or assuming any honorary titles or degrees.

Among the various points which at different times were contested between the Medical Faculty in the university of Paris and the practitioners of Surgery, one would scarcely expect to find the right of publicly instructing their respective pupils; and yet while anatomy was almost exclusively taught by the surgeons, the physicians, in their turn, uniformly, and most strenuously maintained, that they were the only good, fit, and competent teachers of surgery.

"The absurdity of having surgery taught by one set of men, while it was wholly practised by another, seems almost too gross to need pointing out. Such a plan was probably never thought of in any other profession; and it is, at first view, rather surprising it should ever have been thought of in surgery."* But this practice, absurd as it appears to us, and pernicious as it has been wherever it has been adopted, to the progress of surgery, had its origin, like many other customs of modern Europe, in the prejudices and absurd opinions of the church of Rome, and in that spirit of domination, exclusion, and monopoly, by which most of her institutions at that period were actuated.

The dispute with regard to this point lasted for several centuries between the College of Surgeons and the Medical Faculty in the university of Paris. These bodies appointed their respective professors of surgery, and the College of Surgeons were repeatedly interdicted, both by the university and by its holy protector the pope, from teaching publicly the art which they professed.

I believe I cannot exhibit to you a juster view of the nature of this disputed point than is to be found in a few passages, which I shall take the liberty to quote, from a

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* See Observations, &c. by Mr. Chevalier.

speech of Rodolph the Brave, Deacon of the College of Surgeons in Paris, and delivered by him about the year 1567, during one of these disputes, in an assembly of his professional brethren. I quote these passages the more readily, that the sentiments which they express are not of a local or temporary nature, but the plain dictates of common sense, applicable to every age and country.

"So blinded are they," says Rodolph, speaking of the medical faculty in the university, "that every thing which seems to favour them bears in their eyes the impression of equity. The privileges of the College of Surgeons they regard as so many abuses and the work of injustice. Even that right, so ancient and so legitimate, the right of publicly instructing our disciples, appears to them to be a total overthrow of all established order. Yet, according to the primary and usual ideas of order, should not knowledge of every kind issue from those who possess it? Divines, are they not the interpreters of religion? Lawyers, are they not the best judges of the law? In all the arts, liberal or mechanical, is it not practical skill which confers the right to teach?—and is it not, let me ask, the practice alone of our art which can ever form the skilful surgeon? How can men who are unacquainted with the practice of surgery explain its principles? A merely speculative surgeon would indeed be a dangerous guide for students.

"How then shall physicians, who are in general only spectators of our operations, be able to point out or to obviate the difficulties which are daily to be met with in the practice of surgery? Can they instruct us in an art which they have never practised? Would it not, on the contrary," adds this sensible and eloquent surgeon, "be a perversion of good order, and a dereliction of our duty, to give up our public school to men who may write books, and read what they deem lectures on surgery, but who never performed on the living body a single chirurgical operation? Are these indeed the men to whom we ought to resign our professional chairs, where we have been placed by those very rights by which we have been constituted surgeons?"

As a very natural consequenee of the right of instructing the surgeons, the Medical Faculty strenuously maintained, that they had a right also to determine the cases in which chirurgical operations are necessary, to be present at these operations, and to direct in every particular the conduct of

the operator. In practising surgery after this fashion, it will not be very easy to point out the precise benefits which society might derive from this division of labour, unless it be, that, in saving the surgeon the trouble of thinking, the physician eases him also of that responsibility, which, but for this singular expedient, would necessarily attach itself to every step of his operations and to every exercise of his art. The very deplorable state of a patient, however, upon whom any operation of consequence is to be performed, in the circumstances which I have mentioned, is too obvious to require any commentary. Such a mode of conducting chirurgical practice cannot be any where long endured, unless in those countries in which the surgeons have not enjoyed the benefits of a liberal and professional education, or in which the physicians remain altogether ignorant of surgery. One of the last attempts on the part of the medical faculty in Paris, to determine for the profession, and for the public, the propriety of a chirurgical operation, was in a meeting of that faculty held on the 13th of March, 1726. This meeting was held for the express purpose of determining whether surgeons should be permitted to operate for the stone ; but though the errors and mistakes of the surgeons in that operation were fully discussed, the meeting seems to have broken up without coming to any specific resolutions. Such of you as have any inclination to see the grounds upon which the medical faculty contended for the right of being present at chirurgical operations, and of directing the operator, will find your curiosity amply gratified by perusing a small treatise in two volumes, " Concerning the Pre-eminence of Physic over Surgery," by the late M. Andry, Dean of the Faculty of Medicine in Paris. These claims also were often distinctly urged in a variety of memorials addressed sometimes to the king, and at other times to the parliament of Paris ; but it does not appear that they ever met with much attention either from the legislature or from the public ; for we find the medical faculty, sometimes as individuals, and at others as a public body, offering to attend the operations of the surgeons, without exacting for their advice or attendance any honorary fee. A proof, it may be presumed, that their attendance and advice in chirurgical operations were in no very high request.

Not only were the surgeons not to perform chirurgical operations except in the presence, and under the superintend-

ence of the physicians, but the medical faculty also contended that surgeons should not be permitted to publish any work, even on the subject of their profession, till it had been examined, and had received the approbation and license of that faculty. In urging this claim they seem to have been more successful, for they actually obtained a decree prohibiting, under severe penalties, the publication of any medical books which had not previously obtained their imprimature. How such a right was likely to be exercised by those who regarded it as a most presumptuous thing for a surgeon to write a book, may easily be conjectured. I shall give you only one example of the exercise of this right, in so far as it relates to the writings of the most distinguished surgeon France has ever produced. Ambrose Paré who has always been considered as the father of French surgery, had the merit of introducing into practice, an improvement, the most valuable that has ever been made in surgery, namely, that of tying the arteries in amputation. But this improvement gave great offence to the medical faculty in the university, and particularly to M. Gourmelin their Dean, who was himself an instructer of the barbers in surgery. The right of imprimature, accordingly, was denied by the faculty to a small work of Ambrose Paré's, which contained an account of this improvement. This work could not have been published, nor his improvement generally made known in France, but for a particular license, which, in consequence of his influence at court, Paré obtained directly from the king.

The medical faculty seem to have remained in the possession of this right till about the year 1725, when, in consequence of a great deal of disturbance, occasioned among them by an approbation which had been given by the celebrated Winslow, to a treatise on the Diseases of the Bones by M. Petit the surgeon, an attempt was made, on the part of the surgeons of St. Cosme, to be permitted to examine and to give to or withhold their imprimature from books written on the different subjects of surgery. This attempt excited great alarm among the physicians. Meetings were held and representations and remonstrances presented against the surgeons. But the surgeons at last prevailed, and the two faculties of physic and surgery now began a new kind of warfare, in the acts of approbation which they gave to the books they respectively examined.

Another point long keenly contested between the medical

faculty, and the college of surgeons, and one indeed that was not unfrequently made the subject of legal interference, was the right of preventing surgeons from using internal remedies even in chirurgical cases, and from undertaking the management of internal diseases. The Legislature of France made many vain attempts to fix the limits between the two professions of physic and surgery; and mutual concessions and grants made to each other by the contending parties, of particular diseases as a species of disposable property, were not productive of any better effects; for the public perversely persisted in employing those practitioners in whom they reposed the most confidence, without any regard to the faculty to which they belonged, and the practitioners themselves continued to follow that branch of the profession from which they found they could derive the largest emoluments. So strongly indeed did this disposition manifest itself, that the medical faculty was often reduced to the necessity of binding its members by an oath not to practise any of the branches of surgery.

This jealousy of the medical faculty, with regard to the encroachments of the surgeons upon the province of internal disease, showed itself often in very minute particulars. A prescription for some trifling complaint, or a certificate of bad health written by a surgeon, was often adduced in courts of law, as undeniable proofs of a violation of legal charters, and the offender was usually punished by being obliged to pay heavy fines, or to make most humiliating submissions. In the month of February, 1726, the medical faculty made a formal representation, on the subject of certificates for health, to Cardinal de Noailles and the curates of Paris; in which they take great pains to convince that pious and learned body, that the reason why Lent had for some years previous to this been so ill observed, and infidelity had made such an alarming progress, was the facility with which certificates of indisposition could be obtained from the surgeons of Paris, and the too easy exemption from the observance of that ceremony, which the curates had granted to those who produced these certificates. In this representation, the medical faculty state, that they were influenced in making it solely by a regard for religion, never having taken any thing for the certificates of health either from the rich or the poor; and request, that the curates would no longer grant a dispensation from the observance of Lent, on the certifi-

cate of a surgeon. An order to that effect was soon after emitted by the cardinal, and fixed up in a conspicuous place on the doors of all the churches in Paris. How long and to what extent this order was obeyed, it is of little consequence for us to inquire. It answered completely for the time, the purpose which the faculty of medicine intended by it, and procured for them from the cardinal and curates of Paris, as M. Andry, the historian of this transaction, informs us, much praise for their disinterested zeal for religion, their attachment to the laws of the church, and their pious concern for the spiritual welfare of their patients.

But one of the most singular of the many points long litigated between the medical faculty and the college of surgeons, was undoubtedly that which relates to the rightful possession of the services of the barbers. This third body of medical practitioners, in the progress of the disputes of which I am endeavouring to give you a slight account, became alternately the enemy or ally of each of the two more powerful contending parties. Their original alliance by contract was formed, as I have already mentioned, with the physicians, in 1493, and this alliance continued to exist, with some slight interruptions, till the union of the barbers with the surgeons in 1655, a period of more than 160 years. By this contract, you will remember, the medical faculty bound themselves to instruct the barbers in anatomy and surgery, and the barbers again on their part promised to receive the instructions and obey the directions of the medical faculty. They sometimes revolted, it is true, and endeavoured to throw off their allegiance to their masters the physicians. On one memorable occasion the medical faculty seem to have been obliged to take the bagnio keepers under their protection in place of the barbers, and to make over to them, in a formal manner, the right to let blood and to dress sores. The contract entered into in 1493, the medical faculty affirmed, was repeated in 1577, and in 1644, and was by them always regarded as the true foundation of the reciprocal obligations existing between them and the incorporation of barber surgeons.

It was not till the year 1505, that the barbers obtained the name of surgeons, or were permitted of themselves to practise surgery. For some time the lessons to the barbers were delivered in their vernacular tongue, though this was contrary to the statutes of the university, and in contradic-

tion to an express agreement with the college of surgeons. At length, however, it was resolved that the lessons should be delivered only in Latin ; and this resolution seems to have operated very powerfully in improving the education of succeeding barber surgeons. Though many of the barber surgeons were themselves too old to acquire a knowledge of Latin, this order of the medical faculty must have been a strong inducement to them to have their children instructed in that language ; a circumstance which must, in the course of a very few years, have changed considerably the condition of those who were to become the pupils of the physicians, have broken down in some measure the barriers which separated them from the surgeons, and have gradually paved the way for that union between the two communities of surgeons and barber surgeons into one incorporated body or college, which took place in the year 1655. This union displeased exceedingly the faculty of medicine in the university, who had been accustomed to consider the barbers as their servants. They accordingly presented a remonstrance against it to the king, and in this remonstrance they were supported by all the authority of the other faculties in the university. The case was pleaded with great solemnity before judges specially appointed to try it. In the course of these pleadings the faculty of medicine contended that the barber surgeons were inseparably connected by two solemn contracts with their faculty ; that they owed to it their establishment as an incorporated body, and could not without ingratitude forget the favours which they owed to its protection, nor refuse without injustice to yield the obedience which they had so solemnly promised.

This union, however, was confirmed by the king in 1660 ; but with the following limitations: that the barber surgeons should not assume the titles of licentiates, bachelors, doctors, or professors, and that in their anatomical and chirurgical demonstrations, which were to be given with open doors, they should not wear a gown or a bonnet, ornaments of literature to be reserved, after the publication of this edict, for the professors and scholars of the university. But the medical faculty did not content itself with these limitations. It demanded that all public lectures, theses, and disputations should be prohibited in the schools of surgery ; that the surgeons of St. Cosme, who had become associated with the barber surgeons, should be obliged to obey the conditions of

the contracts which had been entered into by the barbers with the medical faculty; that the surgeons should be obliged to learn their art in the schools of the physicians; that the physicians should preside in the meetings of the surgeons when members were to be examined or received; that the surgeons should not be permitted to instruct their pupils in the theory of surgery; and that the physicians should preside at the anatomical dissections made by the surgeons, so that while the surgeon performed the manual part of the dissection, the physician should prelect and explain. In addition to these demands, the medical faculty insisted, that the surgeons should be obliged to take an oath of fealty, and pay annually a small piece of money, as marks of their inferiority and of their dependance upon the faculty of medicine. The resistance of these claims occasioned long and violent disputes, and each party in these disputes, as its influence at court or genius for intrigue was superior, alternately prevailed; till at length, in 1671, Louis the Fourteenth, weary of these useless altercations, but anxious to promote both branches of the medical profession, determined that the lectures on surgery should in future be read at the Jardin Royal by a surgeon, and shortly after gave orders that bodies for dissection and the necessary demonstrations should be freely supplied. "The wars which deluged the continent with blood during the reign of that ambitious monarch, made surgery of greater importance to the public than ever. The increase of anatomical knowledge rendered its operations more sure, more exact, and more successful. It rose, as it deserved, in general esteem; and as Paris was considered as the principal source of these improvements in surgery, which were every where visible and every where beneficial, the demonstrations in the Jardin Royal were crowded with pupils from all parts of Europe, and in the year 1724, no fewer than five public professors of the theory and practice of surgery were appointed in that school."* The effects which this institution has had not only on the state of surgery in France, but in all the other countries of Europe are too well known to require any explanation.

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* See Chevalier's Observations, &c.

LECTURES

ON

INFLAMMATION, &c.

DEFINITION AND SYMPTOMS OF INFLAMMATION.

The term Inflammation has long been employed by medical men, to denote the existence of an unusual degree of redness, pain, heat, and swelling, in any of the textures or organs of which the human body is composed. The simultaneous occurrence of these four morbid phenomena is in general accompanied by an increased quickness of the pulse and warmth of the skin, together with more or fewer of the other signs of fever, and hence the distinction among the symptoms of inflammation and of inflammatory diseases, into those which are local, and those which are febrile or constitutional.

There is reason to believe, that the terms which, in different languages, are now used to denote the states of inflammation and fever, were originally employed to express particular forms only of inflammatory and febrile diseases; for, as climate is known to modify the form, and even, in some measure, to change the nature of diseases, so it seems probable that the words which in different countries have been adopted to express those combinations of symptoms, to which we give the names of inflammation and fever, may have been applied to distinct and different forms of inflammatory and febrile diseases.

The red colour of the skin in inflammation seems to have

suggested to the Greeks, to whom we owe so much of the nomenclature of science, the resemblance of this state to flame—and hence the terms Phlogosis and Phlegmon, in the same manner as the increased warmth of the skin in fever seems to have suggested the similarity of that state to fire—and hence, probably, the terms Pyretos of the ancients, and Pyrexia of the modern physicians. But inflammation and fever, words so nearly allied in their primitive and figurative significations, are now to be regarded as terms purely technical, neither intended nor fitted to express any thing relative to the nature, causes, particular combinations, or distinguishing characters of the two distinct and very dissimilar trains of morbid phenomena, the occurrence of which they are respectively employed to indicate.

It has long been acknowledged in the schools of medicine, that the foundation of a rational education in physic must be be laid in a minute and accurate acquaintance with the appearances and treatment of the different kinds of fever; but that the knowledge of the phenomena of inflammation is not less extensive in its applications to practice, nor less necessary to the acquirement of a proper education in the art or science of surgery, seems to be only beginning to be perceived by medical men. That this view, however, of the subject of inflammation is just, must appear obvious, when we reflect, that of all the morbid affections to which the human body is liable, inflammation is not only one of the most distinct in its forms, and important in its consequences, but it is also by far the most frequent in its occurrence. Indeed, there are no external injuries, of which inflammation is not almost the immediate effect; and but few, if any, local diseases of which it is not in some degree or other to be regarded as a concomitant, cause, symptom, or consequence.

It is but just to the late Mr. Hunter to remark, that he appears to have been among the first surgeons who became fully aware of the importance of a minute knowledge of those curious and singularly diversified appearances, which inflammation produces in the different textures and organs of the body. We learn from his writings, and by his invaluable collection and descriptions of diseased parts, that he spent upwards of thirty years in the investigation of this subject. The general results of his labours have been be-

queathed to posterity, in his Treatise on Inflammation, a work which, by establishing the pathology of surgery upon the solid basis of observation, experiment, and accurate analysis, forms a new era in the history of this art. In most points relative to inflammation I shall endeavour to follow that distinguished pathologist, as my best and most accurate guide.

In attending to the local and constitutional phenomena produced in the body by the state of inflammation, we are at first liable to be perplexed with the great and apparently endless variety which occurs in these phenomena. A closer attention, however, soon discovers that they are sufficiently uniform in the order of their occurrence, and in the particular combinations which they form, to enable us to distinguish them into several kinds of inflammation and of inflammatory diseases, each exhibiting appearances, and requiring a mode of treatment, in some respects peculiar to itself. In directing your attention at present, however, to the phenomena of inflammation, I wish to point out to you those circumstances chiefly, in its causes, progress, and treatment, which are common to all the forms in which that affection occurs.

The local symptoms, which seem essential to inflammation, are the four following—redness, pain, heat, and swelling. I have not included in this enumeration either the sensation of throbbing, or an increased action in the vessels of the part affected. The first is a symptom which does not occur in every species of inflammation; and increased action of the vessels is rather inferred from other phenomena than actually perceived.

The *redness* which accompanies inflammation varies in its degree and kind according to the violence of the affection and the nature of the part in which it occurs. In the incipient stages of inflammation, it obviously depends on the influx of an unusual quantity of blood into the vessels of the part becoming inflamed. The redness may be produced either by the distention of those minute vessels, which naturally convey a small quantity of red blood, or by the red particles entering into vessels, which in their healthy state admit only serum. At the commencement of an inflammation of the skin, the redness bears a very striking resemblance to the colour of the cheeks in the act of blushing, and may be almost as suddenly excited as that state, by the

application of various chemical and mechanical stimuli. When thus artificially induced, it uniformly extends to a greater or less distance from the point or surface to which the exciting cause has been more immediately applied. But its progress is best seen in parts naturally transparent; as in the tunica conjunctiva of the eye, or in the membranes which line the cavities of the chest and belly. In such parts it is distinctly seen to increase in brightness, and extend in proportion to the enlargement of the smaller vessels.

The whole of the serous, or invisible capillary vessels, which become red in an attack of inflammation, must have existed previous to the commencement of that state, for inflammation of the tunica conjunctiva of the eye, of the pleura and peritoneum can be produced in a few seconds, in all its degrees, from the slightest tinge of red to the deepest colour arising from the extravasation of blood. In inflamed surfaces we also observe, that the small but visible blood-vessels become obviously enlarged in their diameters, and that the new red vessels which appear suddenly, seem to be merely continuations of their trunks.

The enlargement in the capacity of the smaller blood-vessels during the state of inflammation, and the increase in the number of those which become capable of conveying red blood, are facts which have been long known to pathologists. They are appearances which are perceptible to the naked eye, and have often been rendered still more obvious by inspection with the microscope, and by the injections of parts that had been inflamed previous to death.

Of the various illustrations which Mr. Hunter has given of this point, it may be sufficient to select the following :— "I froze," says he, "the ear of a rabbit, and thawed it again ; this occasioned a considerable inflammation, an increased heat and thickening of the part. This rabbit was killed when the ear was in the height of inflammation, and the head being injected, the two ears were removed and dried. The uninflamed ear dried clear and transparent, the vessels were distinctly seen ramifying through its substance; but the inflamed ear dried thicker and more opake, and its arteries were considerably larger."

It is well know that a part may be made red by friction, by the application of the cupping-glass, by warm water, &c. but this redness, being only of short duration, does not alone constitute the state of inflammation. It may be considered,

however, even when thus excited, as the first step to the production of that state; for if any of the causes which excite redness be continued or increased, the redness becomes accompanied with pain, and passes more or less speedily into the state of inflammation. The redness in cutaneous inflammation appears to the naked eye as one undistinguishable efflorescence, such as is seen in the cheeks of young people in the act of blushing. In inflamed skin, however, as well as in blushing, blood-vessels may be seen with a lens, which are distinguishable from one another, like the blood-vessels in the cheeks of elderly people, who have clear skins and florid countenances.

The redness in inflammation is generally greatest towards one point of the part affected, and decreases gradually as it extends from this, until it becomes imperceptible. But in some inflammations its termination is abrupt and distinctly marked. During inflammation of the skin, it can generally be made to disappear for a moment, under the pressure of the finger, but it returns immediately after the pressure has been removed.

The kind of redness in some inflammations resembles that of arterial blood; in others it is dark; and in others again it is of a purplish or bluish hue, having more or less of the colour of venous blood. The utility of attending to these differences in the shades of colour in inflammation, will appear when we come to consider the marks by which the different species of inflammation are distinguished from one another.

The redness of parts which have been slightly inflamed not unfrequently disappears after death, so that it is sometimes difficult to discover the precise spot which, during life, had been the seat of inflammation.

The *pain* accompanying inflammation arises from some change induced in the state of the nerves, and varies from the slightest increase of sensibility to the most excruciating torment. It is not very well known, whether the increased sensibility or pain ever occurs before the increased influx of blood takes place into the vessels of the part becoming inflamed; but it is certain, that this influx greatly augments the sensibility.

The pain probably depends partly on the over-distention of the vessels and fibres, and partly on the pressure caused

by the swelling on the nerves of the inflamed part. It is often distinctly increased at each contraction of the heart, and corresponding distention of the arteries, constituting what is called pulsatile pain. Mr. Hunter supposed that the arteries, in a state of inflammation, do not contract by their muscular power, otherwise a considerable degree of pain would be experienced during the moment of contraction, as in inflamed muscular fibres during an attack of rheumatism.

Parts, which in the sound state have little or no sensibility, become exquisitely sensible in the inflamed. That this is the case with tendon, ligament, cartilage, bone, and membrane, seems to be fully established by Dr. Whytt, in the very instructive controversy carried on between him and Haller, respecting the sensibility and irritability of the different parts of man and other animals. It has been a question whether such parts become sensible from some change induced in the state of the nerves, accompanying the inflamed blood-vessels, or whether a new species of nerves are developed. But that the sensibility depends on a change in the nerves, occasioned by the state of inflammation, seems to be clearly shown by the suddenness with which it is acquired, as well as by its abating as the inflammation diminishes, and ceasing altogether when that state is removed.

The kind, as well as the degree of pain, varies much in different inflammatory affections. In some instances it is continued, in others periodic; sometimes it is acute, at other times dull; sometimes it is of a pricking kind, at others itchy, lancinating, or throbbing.

The sensibility of the nose and mouth, as organs of sense, is diminished during the state of inflammation. The reverse of this, however, is the case with the eye and ear, which in the inflamed state become exquisitely sensible.

Pain, when conjoined with other constitutional symptoms, is one of the surest marks which we possess of the existence of inflammation in the internal parts of the body.

The *heat*, or real increase of temperature in an inflamed part, is much less than, trusting to our feelings, and previously to experiment, we should be led to imagine. It never exceeds the heat of the blood at the heart. This, in health, is generally about 100° Fahrenheit's thermometer, but sometimes in disease it rises to 106°, or even 107°. Parts placed near the centre of the circulation, are naturally

warmer than such as are more distant ; in the latter, therefore, the increase of temperature accompanying inflammation will be proportionally greater than in the former.

If inflammation be excited on the surface of the chest by the application of a blister, the heat of the inflamed part will seldom exceed that of the surrounding parts more than one or two degrees. But if the blister be applied to any remote part of the upper or lower extremities, it may occasion an increase of temperature of five, six, or even more degrees. It is this great difference in the temperature of any portion of the extremities, when inflamed, from that of the parts immediately surrounding it, which has given rise to the idea that an excessive heat always accompanies the state of inflammation.

Mr. Hunter appears to have been the first who thought of ascertaining experimentally the extent of the change of temperature, produced in parts affected with inflammation. He excited artificially inflammation in the chest of a dog, and in the abdomen, rectum, and vagina of an ass, without being able to perceive any very distinct rise of temperature in these parts.

In a patient, however, on whom he operated for hydrocele, the rise was much more remarkable; for a thermometer introduced into the tunica vaginalis, and kept for some time close to the side of the testicle, indicated a temperature of only 92°, while, on its being introduced next day, after inflammation had come on, the temperature was found to have risen to 98¾°. " Here," says Mr. Hunter, " was an increase of heat of 6¾°; but even this was not equal, probably, to that of the blood at the source of the circulation in the same man. This experiment," he adds, " has been repeated more than once, and with nearly the same results."

The increase of temperature in inflammation is now generally regarded as being dependent on the increased influx of blood into the part inflamed. It has been suggested, that the increased heat may be ascribed to the intricate and inexplicable operation of the vital energy. But if it be the production either of such energy, or of any local secreting power, why does it never rise above the temperature of the blood, which is conveyed into the inflamed part by the arteries ?

Connected with increase of temperature in the inflamed part seems to be the state of dryness, or want of perspira-

tion, which often occurs in the skin. I have repeatedly had occasion to observe, in inflammations of the joints, whether rheumatic, venereal, scrofulous, or acute and arising from external injury, that the skin covering them remained hot and dry, while the rest of the body was covered with perspiration; and that as soon as the pain, heat, and swelling of the inflamed part abated, a moisture appeared on its surface. This local appearance resembles a general one that occurs in typhus and scarlatina. The skin in the commencement of these fevers is not only hot, but dry; a state in which we often succeed in bringing out perspiration, and in relieving the other symptoms, by diminishing the temperature of the surface of the body by means of the cold effusion.

The *swelling* in inflammation is accompanied with a greater or less degree of stretching or tension. In the earlier stages it seems to be produced solely by the unusual influx of blood; but no very great increase can be produced by this circumstance alone. As the inflammation, however, proceeds, a quantity of serous fluid is usually poured out into the interstices of the cellular membrane, in the parts contiguous to the seat of inflammation. This produces a kind of swelling, which pits under the pressure of the finger, and is distinguished by the term œdema. In some cases, where the inflammation runs high, the effused fluid is found tinged of a red colour. In other rare cases, instead of serum, coagulable lymph, or, as it is now termed, the fibrin of the blood, seems to be effused. When this happens, the swelling continues after every other mark of inflammation has disappeared, and remains often during the whole of after life. Swelling and tension, therefore, seem to depend partly on the inflamed vessels being unusually distended with blood, and partly, perhaps chiefly, on the effusion of serum and other fluids into the surrounding cellular membrane.

The degree of swelling, and the distance to which it extends in inflammation, depends partly on the violence of the attack, but chiefly, perhaps, on the structure of the parts in which it occurs.

Almost all parts of the body feel hard at the commencement of inflammation. This is remarkably the case in the swelling of the integuments, which is so very common an attendant on inflammation of the bones, or their mem-

branes. But there is a peculiar kind of swelling which sometimes accompanies inflammation of the skin and cellular membrane, in which these parts feel as hard as bone, and in which the hardness sometimes continues after the other symptoms have disappeared. In two instances, I have seen the integuments surrounding the knee-joint affected in this manner in consequence of externalin jury; and I have seen the same kind of hard swelling occur, without any obvious cause, in the skin covering the lateral and fore part of the chest. In all the cases of this affection, which I have had an opportunity of observing, it spontaneously disappeared in a few weeks. It probably depends on the exudation of coagulable lymph.

A very considerable degree of hardness also occurs in the disease, called phlegmasia dolens, occurring in the lower extremities of pregnant women; and in that peculiar enlargement of the legs and scrotum occurring frequently among the African negroes, and well known under the name of the Arabian elephantiasis. In elephantiasis, however, besides effusion of lymph, there is probably an alteration of structure in the integuments.

CAUSES OF INFLAMMATION.

The word *cause*, in a strict and logical sense, signifies the object or event which immediately precedes any change, and which is in similar circumstances always followed by a similar change; but in medical writings, and particularly as applied to the objects or events which produce inflammation, the term cause is used in a much more extensive and indefinite sense. Accordingly you will find that the causes of inflammation, as of all other diseases, have usually been divided into the remote and proximate: but this is a division which is inaccurate, and of no practical use. By the proximate cause of inflammation, pathologists in general wish to express that state of the body, or rather of the part affected with inflammation, upon which the phenomena peculiar to inflammation more immediately depend. In this sense the term proximate cause, it is obvious, is merely another name for the state of inflammation; and being in fact the disease itself, it neither requires nor admits of being distinguished from it.

Nor does the epithet remote, as applied to the causes of inflammation, appear to be more happily chosen; for under this term are comprehended all those agents, events, and states which contribute immediately, as well as remotely, directly, as well as indirectly, to the production of that state.

When inflammation occurs, as it not unfrequently does, without our being able to trace its production to the action of any obvious cause, it is termed spontaneous inflammation. But in most instances we are able to trace the origin of inflammation to causes which act either, directly on the part becoming inflamed, or indirectly, through the medium of

those sympathies which connect distant parts of the body with one another.

As exemplifying this last class, it is only necessary to remark, that particular kinds of food taken into the stomach, or mercury or arsenic given in small doses, often, without appearing to affect the organs with which they come into contact, produce each a distinct and specific inflammation of the cutaneous texture. The exposure of the feet to cold in one person occasions an inflammation of the throat, in another inflammation of the chest, and in a third, inflammation of the belly.

Very striking diversities are observed in the effects that result from the operation of the same causes, according to differences in the structure of the parts on which they act, or according to peculiarities of constitution. And experience has also taught us, that there are certain circumstances which render the body peculiarly liable to inflammation, and which therefore have been denominated predisposing causes of this state. Such, for example, are certain temperaments and periods of life, the influence of particular climates, and the use of particular kinds of food. In a systematic course of pathology, each of the predisposing causes I have enumerated, would require a separate and full consideration. The effect of climate in particular, in predisposing the body to different kinds of inflammation, and in modifying the appearances of that state, is a subject highly deserving of investigation ; but the various facts relating to this inquiry, that are to be found dispersed in the writings of those who have practised medicine in different regions of the globe, have not yet been collected into one view, nor compared with each other.

The varieties of constitution which modify the operation of the causes of inflammation, have been distinguished into two classes ; first, such as are peculiar to certain particular individuals ; and, secondly, such as are common to many. In other words, these varieties are either special or general. The former are denominated *idiosyncracies*, and the latter *temperaments*. To these two we might probably add a third class, namely, *diathesis*, or morbid dispositions.

Idiosyncracies are innumerable in their kinds, and they are in general discovered only by accident. Thus there are some persons in whom opium does not produce sleep ; others on whom milk seems to act as a poison ; some who are

purged by astringents; and others in whom purgatives appear to have produced an astringent effect.

The temperaments have long been reduced to four kinds; the sanguine, the bilious, the phlegmatic, and the melancholic. To these a fifth, the nervous, has been added in modern times. You will find the distinctive characters of each laid down in elementary books of physiology and pathology.

As examples of what is usually meant by diathesis, I may point out to your notice the rheumatic, the gouty, the scrofulous, and the scorbutic dispositions. Like the idiosyncracies and temperaments, most of these diatheses are hereditary; yet they may also be formed by a variety of circumstances connected with climate, food, and manner of life.

A predisposition to inflammation may either exist in the general system, or it may have its seat only in some particular part. A part which has been once inflamed is in general observed to be more liable to an attack of inflammation, than a similar and corresponding part which has never been in that state.

Another general circumstance deserving our attention, with regard to the causes of inflammation, is, that some of them produce their effects immediately, others only after a considerable interval of time, in many instances, not till after a period of several days.

Little advantage can, I conceive, be obtained from attempting to form a systematic arrangement of the causes of inflammation; for, indeed, what substance is there in nature which may not occasionally, from the manner in which it is applied to the body, prove, directly or indirectly, a cause of that state? But if we adopt a common division of the direct causes of inflammation into mechanical and chemical, the following will belong to the first class:

1st. *Pressure.*—This is very liable to excite inflammation in parts which are sound, or mortification in those already inflamed. The surgeon has frequently occasion to employ pressure in the practice of his art; and much of his success in the treatment of diseases, accidents, and operations, such as œdema, wounds, and fractures, will depend on the skill and judgment with which it is applied. Continued pressure upon any part of the skin occasions a redness to appear after the pressure has been removed. We see this effect produced upon the hands and cheeks of those who have

fallen asleep with those parts pressing on each other. We see it also in the parts of the body upon which we have lain during the night; and we often observe this redness pass into the state of inflammation in accidents or diseases, which fix down the body in one position, and oblige the patient to rest his weight for a considerable time upon particular parts.

2d. *Friction.*—A slight degree of friction upon the skin excites warmth; but if it be increased, or long persisted in, it will soon occasion inflammation. Drawing the nail firmly, for example, along the surface of the body, is followed in a few seconds by redness of the skin, which remains visible for some time. If the scratch is severe, inflammation may be immediately excited, but when slight, the redness which is excited soon disappears, leaving behind it neither subcutaneous effusion nor hardness. There are some parts of the body, as the eye, which are more liable to be inflamed from this cause than others; and there are persons in whom particular parts are inflamed by friction much more easily than in others.

3dly. *Bodies which bruise.*—We have daily examples of the effect of these in contusions of all kinds. When contusion is slight, inflammation is the consequence, but when severe, it is liable to produce the state of mortification.

4th. *Bodies whch cut or divide.*—The interval which elapses between the application of these bodies and the occurrence of inflammation in wounds, is very various in different individuals.

To the head of mechanical causes may also be referred the irritation occasioned by all solid bodies foreign to the system, whether introduced from without, or generated within the body itself. We have examples of the former in needles, pins, bits of glass, splinters of wood, and bullets, which sometimes occasion an immediate inflammation, and at other times remain in the body, or even move through considerable portions of it, without producing this effect; the latter are exemplified by the stones which sometimes form in the kidneys, and afterwards excite inflammation in passing through the ureters and bladder. Similar effects are produced by gouty, and sometimes, though rarely, by salivary concretions: and to this head also we may refer all tumours generated within the body, whether these tumours be of a solid or fluid consistence;

for tumours, however indolent they may be in their nature, are always liable, during their increase, to excite a certain degree of inflammation, by distending the parts which are naturally placed over them.

To the class of chemical causes will belong all substances capable of exciting inflammation in the parts to which they are immediately applied, without at the same time appearing to produce any visible mechanical effects. Such are high degrees of temperature, the action of concentrated acids or alkalies, metallic oxides and metallic salts, acrid vapours, such as ammoniacal gas, the nitrous, sulphureous, muriatic, and oxygenated muriatic gases, oxygen gas, and, in certain circumstances, also common atmospherical air; alcohol, æther, and all acrid vegetable essential oils, animal poisons, and the whole of that class of substances known by the name of rubefacients. The local inflammatory and subsequent constitutional effects resulting from the operation of these causes are exceedingly diversified, according to the degree in which they are applied, and according to the nature of the parts upon which they operate. If applied in a high degree of power, many of them destroy the vitality and structure of the parts on which they act. The parts killed by their action are surrounded by a circle of inflammation, the extent and severity of which is in every instance different, according to the peculiar action of the chemical power, the texture to which it is applied, or the particular constitution of the patient. Applied in a less degree of power, many of these chemical causes excite, almost instantaneously, a high degree of inflammation, such as is often followed by the death of the part, if not of the whole system. We have frequent examples of this in the effects produced by animal poisons. If, again, the chemical power be much weakened or diluted, it may, when applied to the different external or internal surfaces of the body, either produce no inflammation at all, or only a very inconsiderable degree of that state.

The cuticle seems to have a powerful influence in resisting the action of the greater number of the chemical causes exciting inflammation, and in protecting the body from their injurious effects; for these effects are often produced only where the cuticle has been removed or perforated, so as to allow the chemical agent to come into contact with the subjacent textures.

Almost every chemical cause of inflammation seems to have its own mode of action, and to produce in the different textures of the body peculiar and specific effects. Thus it is well known that the poison of the viper may be taken into the stomach without exciting inflammation in the surface over which it passes; though the smallest quantity of this substance, inserted under the cuticle, immediately produces pain and inflammation. The bile and urine excite no inflammation in the cavities in which they are naturally lodged, or in the canals through which they pass out of the body; but if either of these fluids escape into the cavity of the abdomen, or be extravasated into the cellular membrane, inflammation almost immediately ensues; followed in the first instance by local, and in the second by general death.

The effects of heat in exciting inflammation are too well known to require any illustration. Inflammation of the brain, and inflammatory affections of the face and neck, are often observed to arise, in almost every climate, from exposure to the influence of the solar rays; and the inflammatory affections, arising from the application of artificial heat, are objects of daily and familiar observation. Oxygen gas excites inflammation when it is injected into the cavities of the chest or abdomen; and atmospherical air produces pain and irritation the moment it is admitted to the surface of a fresh wound, or of a part that has been recently blistered.

No attempt, so as I know, has hitherto been made to arrange, or even to enumerate, the causes indirectly producing inflammation. These causes, however, are highly deserving of our attention; and on examination will be found to be more numerous, I believe, than has usually been imagined. Under this head I am inclined to comprehend the operation of all those powers, which, when applied to the body, either excite inflammation in parts at a distance from those to which they are more immediately applied, or, if they excite inflammation in these parts, produce that effect only after a certain interval of time, and in consequence of changes which they seem to produce in the general constitution.

The operation of cold upon the human body affords the best example which I can suggest to you, of the production of inflammation from the operation of a power acting upon

a part at a distance from that in which the inflammation takes place. The instances formerly mentioned of inflammation of the throat, chest, or belly, from the application of cold to the feet, are daily occurrences in these climates, of which it is impossible for us, in the present state of our knowledge of the animal œconomy, to give any thing like a satisfactory explanation.

In some instances cold, or a diminution of temperature, seems to act more directly upon the parts with which it comes into contact. We have examples of this in the inflammation of the mucous membranes of the nose, fauces, trachea, and bronchiæ, from the inhalation of cold air; and in the production of rheumatic inflammation from the accidental exposure of some part or other of the body to cold. The application of cold, in the instances I have mentioned, seems to have somewhat of a directly exciting effect; and perhaps the same remark is still more applicable to the local effects of cold in the production of the inflammation accompanying the state which is usually denominated frost bite. Touching a solid body, as a piece of metal, the temperature of which has been greatly reduced, produces a sensation like that of burning, and may be followed, like the application of fire, with a blister.

No subject is more deserving of your study than the effects which are produced in the human body by the operation of cold applied to its surface; but the subject is, at the same time, exceedingly extensive, complicated, and difficult. These effects differ according to the degree in which the cold is applied, the state of the system, the part of the body to which it is applied, and the mode of its application. So diversified, indeed, are these effects, that it requires no mean confidence in theoretical reasoning, to believe that the operation of cold in producing them is explicable upon any single general principle.

To the head of causes indirectly exciting inflammation, I am inclined to refer all those substances, which, when taken into the stomach, produce peculiar and specific cutaneous inflammations. The eating, for example, of the bitter almond, of various sorts of fruit, of shell-fish, &c. often produces, in particular individuals, an inflammatory eruption of the skin, resembling that which the sting of the nettle occasions. The use of mercury is now well known to produce in many individuals a still more severe inflammatory

affection of the skin, an affection which in most instances resembles the eruption arising from exposure to heat, or from the too free use of spirituous liquors; though it occasionally imitates also, in its appearance, various other forms of cutaneous inflammation. The internal use of arsenic, in doses so small as not to affect the stomach, produces in some patients an inflammatory affection of the skin. In the cases in which I have seen this effect produced, the inflammation was of the erythematous kind. In the instances which I have mentioned we see cutaneous inflammation excited, and can trace it to the use of certain substances which, when swallowed by the same individual, or by individuals having similar idiosyncracies, usually produce similar effects; but the series of changes which intervenes between the introduction of these substances into the stomach, and the appearance of inflammation in the skin, is, and most probably will ever remain, unknown to us.

To the head of causes indirectly exciting inflammation, we may refer also, I conceive, almost all the morbid animal poisons, which are generated in the human body, or propagated in it by succession from individual to individual. By the term, *morbid animal poison*, I understand every animal secretion or effluvium, capable of producing, by its action upon the system, a distinct specific disease, a disease not only distinguished from every other by trains or combinations of symptoms peculiar to itself, but capable also of being communicated from one individual to another by contact, inoculation, or contagion.

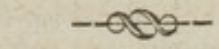
Some of these poisons produce inflammation, it is true, in the parts into which they are immediately introduced, as the poison of itch or of syphilis; but in most instances the poison, though locally introduced, produces its specific effects only through the medium of the general constitution. This is the case in small-pox and in cow-pox, where the local inflammation first excited by the wound made in the insertion of the poison, goes off before the constitutional change takes place upon which the subsequent local and specific inflammatory affection depends.

In the plague, in catarrh, in the mumps, in Egyptian ophthalmia, in hospital gangrene, in scarlet fever, in the measles, in small-pox, &c. we see inflammatory diseases produced by animal poisons in the state of effluvia, which cannot be supposed to produce their specific effects unless through the

medium of the unknown changes which they occasion in the general system. In all these instances, however, irregular distributions of the blood occur from increased actions of arteries in particular parts of the sanguiferous system, and give rise to all the phenomena and consequences of local inflammation.

One of the most singular effects in the inflammatory diseases, produced by the operation of these morbid poisons, is, that some of these diseases leave the body in a state incapable of being again affected by the application of the same specific poison. Great progress has been made in the knowledge of the means by which the symptoms of some of these diseases may be mitigated, and their propagation prevented. Experience had long shown that one of them, the small-pox, might be rendered milder by artificial inoculation ; and more lately we have been taught to render the body incapable of small-pox infection, by the substitution of an innocent and harmless disease. I need not tell you, that Dr. Jenner is the person to whom we are chiefly indebted for this discovery—a discovery which has given to him a distinguished pre-eminence among the benefactors of the human race.

STATE OF THE BLOOD-VESSELS IN INFLAMMATION.



The mechanical and chemical causes of inflammation seem all to concur in producing an increased flow of blood to the part to which they are more immediately applied. The causes, also, which indirectly excite inflammation, seem to produce that state by acting in a similar manner. This local increased flow of blood, produced by the exciting causes of inflammation was taken notice of by Hippocrates; and has served, if I am not mistaken, as the principal basis for the various, and, in some respects, contradictory hypotheses, which have at different times been employed to explain that state of the sanguiferous system in the inflamed parts, upon which the phenomena peculiar to inflammation immediately depend. This is the state which has been usually, though perhaps improperly, denominated the proximate cause of inflammation, and concerning which so many hypotheses have been invented, and so much useless controversy carried on among medical men. But when we consider with how much difficulty every thing that relates to the circulation of the blood, in the natural and healthy state, has been discovered, and how many points respecting this function still remain to be ascertained, we need not be surprised that differences of opinion should still subsist respecting its irregular distributions in disease. In many respects the sanguiferous system may be regarded as an hydraulic machine, consisting of a combination or series of elastic pipes or canals, in which the fluid to be moved is subjected to the common laws of hydraulics. But, besides this structure, the sanguiferous system possesses within itself an internal principle of motion by which it is distinguished from every other

hydraulic instrument; a principle which it derives from the contraction of the heart and arteries, and which seems to vary in degree and force, not only in different parts of the sanguiferous system, but even in the same parts in the ever-varying states of health and disease. It has been justly remarked by a celebrated philosopher, M. D'Alembert, that "we must not imagine that the theory of the motion of fluids in tubes, whether solid or flexible, can ever lead us to a knowledge of the mechanism of the human body, of the velocity of the blood, or of its action upon the vessels in which it circulates. To succeed in such an investigation, it would be necessary for us to know exactly to what degree the blood-vessels are capable of being dilated, in what manner, and according to what laws they are dilated; to know precisely their figure, the degrees of their elasticity, their different anastomoses; the number, force, and disposition of their valves; the heat and tenacity of the blood, and the moving forces which impel it, or by which it is circulated. Even if each of these circumstances were perfectly known, the great number of elements which enter into a similar theory would probably lead us to impracticable calculations. This is, indeed, one of the most complex cases of a problem, the simplest case of which is extremely difficult of solution. But since the operations of nature are too complicated, and too little known to be subjected to our calculation, experience is the only guide which remains; we can rest our opinions only upon inductions deduced from a great number of facts. Such is the plan that we ought to follow in the examination of an hydraulic machine so complicated as that of the human body. It may be left to idle physicians to indulge the hope, that they shall ever unveil the secret springs and hidden operations of the animal economy, by algebraical reasoning or hypothetical statements." If such be the difficulties which attend the investigation of the circulation of the blood in the state of health, it is easy to perceive how much these difficulties must be increased in ascertaining the precise amount of the irregularities in the distribution of this fluid, which take place in disease. Instead, therefore, of entering upon this investigation, or of attempting to add to the number of hypotheses that have been invented to explain the state of the sanguiferous system in an inflamed part, I shall content myself, at present, with enumerating some of the

principal facts relative to this state, of which we have acquired a knowledge by experience, and the truth of which seems to be universally acknowledged.

1st. Inflammation has its principal seat in the capillary vessels.—2dly. The diameters of the capillary vessels are enlarged in inflammation.—3dly. This state of dilatation can in some instances be suddenly, and in others slowly produced in various parts of the body, by the application of the exciting causes of inflammation.—4thly. The greater part of these exciting causes do not, when applied to the larger arterial trunks, occasion any evident increase of their diameters.—5thly. The pulsation of the arteries is not occasioned by any power or action which is inherent in themselves, but is derived entirely from the dilatation and elongation which they experience from the blood impelled into them by the systole of the heart. The pulsations in the artery going into an inflamed part, depending upon the action of the heart, it is obvious that they cannot occur oftener than the heart contracts, though it has often been maintained that the contractions in an inflamed part are not only stronger, but also more frequent, than in the other corresponding parts of the body.—6thly. The action of the muscular fibres, whether of large or small arterial canals, (supposing these fibres to exist,) must produce a diminution, not an increase, in their diameters.—7thly. Pulsations in an artery leading to an inflamed part, are stronger or more perceptible than those which are to be felt in the arteries leading to similar parts in the uninflamed state.—8thly. If the arteries thus pulsating be divided, the blood emitted from them will be in greater quantity, and projected to a greater distance, than from the division of similar corresponding arteries, leading to uninflamed parts, and this projection takes place during the diastole of the artery.—9thly. If an incision be made into an inflamed part, more blood will be effused from it than from the division of this or a similar part in the uninflamed state.—10thly. Local inflammation may, in particular individuals, exist for some time, and in a considerable degree, without any increase either in the frequency or strength of the contractions of the heart; but, in general, inflammation is soon followed by increased action of the heart, and pulsation of the larger arteries.—11thly. Certain degrees and kinds of inflammation admit of resolution, or a spontaneous cure.—12th and lastly. There

are various means, remedial and dietetic, which have a powerful influence in procuring or promoting the resolution of inflammation.

There are two hypotheses which at present divide the opinions of pathologists respecting the state of the capillary vessels affected with inflammation. According to the first of these hypotheses, the inflamed vessels are in a state of increased action; according to the second, they act with less force than the trunks from which they are derived.

The first of these opinions seems to have been suggested by the views which Stahl took of the animal œconomy, though I do not find it any where very fully or distinctly stated in his writings. He attributed a tonic, vital, or muscular action to the arteries, and in consequence of this opinion was led to give a fuller and better view than any of his predecessors had done, of those irregular distributions of the blood which so frequently take place in disease. His attention seems to have been chiefly turned to the irregular distribution which precedes hemorrhage, and which may be regarded as the predisposing state to that affection. Stahl's ideas respecting the tonic or vital action of the capillary vessels, and the share which they have in producing inflammation, have been more fully developed and insisted on by his disciples and followers; but by none have they been stated more distinctly and with greater precision, than by Dr. Gorter, both in his Compendium Medicinæ and Chirurgia Repurgata.

In one place this author states expressly, "that the proximate cause of inflammation consists in an increased vital action of some particular artery or arteries, by which the blood is propelled with greater force than usual into the communicating lymphatic and colourless vessels." "Stimuli," he remarks in another place, "may increase the action of a particular artery, without producing any change whatever in the action of the heart." "When the increased action," he remarks, "takes place in all the vessels of the body, fever is produced, but when the increased action is confined to one or to a few vessels only, inflammation is the consequence." "The heart," says Dr. Gorter, "cannot produce a greater velocity in one branch of an artery than in the other branches which are derived from the same trunk—a thing, however, which we see takes place in inflammation, so that we must allow the blood-vessels themselves to be en-

dowed with a certain vital action, by which the fluid which they contain is impelled in inflammation with an unusual degree of force."

The opinions, and indeed the expressions, of Stahl and of Gorter have been adopted by the greater part of succeeding pathologists, and are those which you will find adopted and explained in the writings of Dr. Cullen. The action of the blood-vessels, in producing irregular distributions of blood independently of the heart, and the important consequences which result from it in the animal œconomy, were among the favourite speculations of Dr. Cullen, and the truth of the doctrine has since received considerable support and illustration from the experiments and observations of Mr. Hunter.

The following may be regarded as examples of phenomena, arising from an action or state of the arteries independent of the heart, and occasioning irregularities in the distribution of the blood.

1st. The determination of the blood into the capillaries of the cheeks, which occurs during the act of blushing. 2d. The increased determination of blood which takes place to the head, from a variety of physical and mental causes, evinced by the pulsation of the carotid arteries and the redness and flushing of the face. 3d. The occurrence of spontanteous inflammation. 4th. The pulsatory state of the arteries immediately preceding and continuing during an attack of active hemorrhage. 5th. The pulsating state of the tumour, formed by the dilatation of the arterial and venous capillaries, denominated aneurism by Anastomoses. 6th. The increased vascular action which takes place during the growth of parts natural and preternatural. 7th. The state of the sanguiferous system in the testicles of animals which copulate at stated seasons, and of the arteries in the heads of those animals which shed their horns. 8th. The state of the uterine vessels during gestation. 9th. The state of the circulation in the penis during its erection. 10th. The periodic secretion of tears, saliva, milk, and bile. 11th. The sudden and instantaneous production of inflammation, by the local application of mechanical and chemical stimuli. And, 12th. The spontaneous contractions of the smaller arteries of frogs observed in experiments, the results of which I shall afterwards have occasion to mention.

These phenomena, and many more of a similar nature

which might be enumerated, seem to prove that, the action of the heart continuing the same, the arteries are, in consequence of the vital powers with which they are endowed, capable of altering the distribution of the blood, and of propelling or transmitting more or less of that fluid, according as they are more or less influenced by the particular stimuli which act upon them in the different states of health and disease.

Those who contend that inflammation consists in an increased action of the vessels of the part affected, usually adduce, in support of that hypothesis, the following facts and arguments:

1st. There is (say they) a considerable increase in the force with which the artery going to an inflamed part pulsates. If one of the fingers, for instance, be the seat of inflammation, the artery at the wrist of the hand to which it belongs will be found to pulsate much more strongly than the artery at the wrist of the other. This increase is often so great as to produce a sensation of throbbing.

2d. The artery going to an inflamed part not only contains more blood than usual, but if in this state the artery be opened, it will propel its contents to a much greater distance than the corresponding uninflamed artery. I have often seen examples of this increased propulsion in the division of the arteries of the fingers in whitloe, and in those of the prepuce in phymosis, accompanied with much inflammation.

3d. The increased force with which the vessels act in inflammation is not confined to the seat of inflammation, but extends itself to the whole of the sanguiferous system, producing or constituting that state so well known by the name of the diathesis phlogistica, or the inflammatory state or diathesis.

4th. Whatever lessens the force of this action in the heart and arteries tends to diminish the local inflammation, and whatever increases the action of the heart and arteries tends in the same proportion to augment the inflammation.

The opinion which supposes the action of the inflamed vessels to be diminished, or to be proportionally less than that of the trunk or trunks from which they are derived, was, so far as I know, first stated by Vacca, an Italian physician, in a small treatise on inflammation, published at Flo-

rence, in 1765, entitled, *Liber de Inflammationis Morbosæ quæ in Humano corpore Fit, natura, causis, effectibus et curatione.*

In that work, Vacca, delivers his opinions in the form of distinct propositions, and endeavours to give to them something like a scientific appearance, by the introduction of demonstrations, Scholia, Corollaria, and Lemmas. The three more remarkable propositions, however, and indeed almost the only propositions in the work that seem to be at all deserving of attention, are the following:

Prop. 1st. Inflammation never takes place in any part of the human body, unless there be in that part a congestion of blood in very nearly the state of rest. This proposition, Vacca conceives to be proved by the increase of bulk and redness of the small arteries, and by the increased flow of blood when an inflamed part is divided.

Prop. 2d. A congestion, or semi-stagnation of blood, cannot happen in any part of the body without either an absolute or relative debility of that part.

In the healthy state, the resistance to distention is equal to the impelling power, but when it becomes unequal, distention must necessarily take place. But a diminution of the resisting power can only arise from debility.

Prop. 3d. Any part of the body being in a state of debility, there will occur a congestion or semi-stagnation of blood, in the vessels not only of that part, but a part of the blood will be propelled into the lateral, lymphatic, and adipose or capillary vessels. In the state of health the orifices of these vessels resist the entrance of the red blood into them with a vigour proportional to the impulse, but when this resistance is lessened or destroyed by debility, or a loss of tone, the blood enters, opens, and dilates them.

I do not find that the hypothesis of Vacca has been adopted by any author upon the continent of Europe; but in this country, similar ideas to those which he has expressed with regard to the state of the blood-vessels affected with inflammation occurred to the late ingenious Dr. Lubbock, of Norwich, and to my friend Mr. Allen, lately lecturer on Physiology in Edinburgh. Dr. Lubbock has not, so far as I know, published any thing upon this subject; but that he entertained opinions similar to those of Vacca will appear from the following extract of a letter with which I have been favoured by his friend Dr. Reeve of Norwich, addressed,

in 1802, to that gentleman, while studying physic at Edinburgh :—"A vessel, considered as a hollow muscle, can have its cavity enlarged, or its fibres elongated in every dimension, only by debility direct or indirect, the effect of which is a diminution of tone or density, as a living solid, or a separation of the particles of matter composing it, to a certain extent. This is the state of the irritable fibre in inflammation of the vessels; in which, from the loss of density or greater elongation of their fibres, their cavities are increased, more blood is received into them, and their action is more feeble. The arguments which I made use of in my paper on the increment of the body will apply with little variation to a state of inflammation; for, strictly speaking, a state of inflammation is merely a growth of the vessels of the part so affected. If, therefore, the general increment is affected by a diminished excitement, a partial increment of vessels will be the same. But if a vessel has its diameter enlarged by a state of atony, or diminished contractile power, it follows not only thence that the motion of the blood should be retarded, but also from the established hydraulic principle, that fluids always move with less velocity in passing from tubes with a smaller diameter to a larger."

The statements and reasonings of Mr. Allen were chiefly confined to his Lectures. As I have reason, however, to think that he stated this doctrine in a manner much more precise than had, or indeed has hitherto been done, no apology, I conceive, will be necessary for endeavouring to give you some idea of his manner of reasoning with regard to the state of the blood-vessels in inflammation.

The velocity of the circulation, in any series of vessels, depends, according to the view which Mr. Allen took of this subject, on the muscular action of these vessels. Now, in the first place, this action may be equally and proportionally increased through the whole series; or secondly, it may be equally and proportionally diminished; or thirdly, it may be be irregularly increased or irregularly diminished, that is, the action may be increased in one part of the series, while it remains stationary or is diminished in the succeeding part; or it may be diminished in one part, while it remains stationary or is increased in the succeeding part.

1st. The powers which propel, and those which retard the blood in its circulation, are so exactly adjusted to one another, that, in the healthy state of the system, the quantity

of blood expelled from the veins is precisely equal to what had entered into the corresponding arteries. The forces and the resistances are balanced, so that no accumulation or congestion occurs. If the propelling force be equally and proportionally increased through the whole or any part of the series, the blood will move with greater velocity than before; it will be transmitted in greater quantity, but the vessels will contain at no time a greater quantity than usual. This is what is observed to happen after violent exercise. The action of the vascular system is increased, the pulse becomes more frequent and full; for a pulse which, when the body is at rest, does not beat more than 70 times, may be increased, by walking at the rate of four miles an hour, so as to pulsate 140 times in a minute.

In cases of acute or active inflammation preceded by what is called the phlogistic diathesis, there is an increase of the force of the circulation, but not so great as that produced by exercise. The pulse is more full and strong, but sometimes not more frequent than in health. The whole system has often a tendency to spasmodic or permanent contraction. The pulse is frequent, hard, and contracted, does not yield to the heart, and the artery going to an inflamed part feels hard like a cord.

2d. In the natural and healthy state of the system, the veins possess a power of impelling the whole of the blood transmitted to them by the arteries. If the muscular action moving the blood be diminished, the blood will circulate with less velocity, and will therefore be transmitted in less quantity. No congestion will occur, but the quantity of blood will remain unaltered till some change is induced in the structure and capacity of the vessels containing it; and this will happen at length, as occurs in paralytic limbs and in aneurism.

3d. If the action of the sanguiferous system be irregularly increased or diminished, be increased in the first, and remain stationary in the succeeding part of the series or continuations of their canals, the motion of the blood would still continue uniform, did the vessels form a rigid tube; but they are extensible and elastic, and therefore the velocity of the circulation will vary with the impelling power. When the impelling power is increased, the velocity will be increased, and *vice versa;* more blood will be conveyed to the second series than they can easily carry forward to

the heart, congestion will take place, and must increase till the resistance which it affords is in equilibrio with the impelling power of the preceding portions of the arterial canals.

It will follow, therefore, if this view be just, that the congestion will take place in that portion of the series of the arterial system, which is next to that acting with the greatest force, and this consequence of the irregular action of the blood-vessels, in whatever way produced, is the first symptom of topical inflammation.

But a simple inequality in the distribution of the blood is not of itself sufficient to produce inflammation, without the concurrence of other causes. To the production of inflammation, it is necessary that the congestion should stimulate, by its distension, the blood-vessels to frequent but ineffectual efforts to carry forward the excess of blood with which they are loaded. We have still to learn in what inflammations the quantity of blood transmitted through a part is greater than natural, in what less. The peculiarity of Mr. Allen's doctrine consists therefore, you will observe, in the assertion, that the vessels which are the actual seat of inflammation contract with less force than the vessels nearer to the heart, from which they receive their supply of blood.

If we admit this assertion, and I do not perceive upon what grounds it can be denied, we shall be obliged to admit also the following conclusions:—

1st. An increased force of contraction in the vessels of a part, provided the increase be equable, will increase the velocity of the blood in that part; will increase the quantity of blood transmitted through it, while the quantity of blood contained in it will remain the same.—2d. A greater increase in the force of contraction in the capillaries, than in the large vessels from which they are derived, will tend to diminish the quantity of blood in the capillaries, and cannot possibly occasion them to be over-distended with blood, unless some unusual resistance be opposed to the passage of the blood into the venous part of the circulation.—3d. A greater increase in the force of contraction in the trunks than in the branches will produce a congestion and accumulation of blood in the branches; and, in certain circumstances, may give rise to inflammation, during the whole course of which, a corresponding but not equal disproportion must continue between the muscular power of the mi-

nute vessels, which are the seat of inflammation, and the larger vessels from which they are derived.—4th. A diminished force of contraction in a larger artery, while the force of the heart continues unaltered, will be accompanied by a softness and fullness of the pulse, and followed by the effects which attend a languid circulation produced by any other cause.

It is obvious, from the account which I have given of these two hypotheses respecting the proximate cause of inflammation, that there are certain points in which they agree, as well as in which they differ.

The advocates for each hypothesis agree in admitting, 1st, that inflammation has its seat in the capillary vessels; and, 2dly, that the redness in inflammation is owing to an unusual quantity of blood in the vessels of the part inflamed, and consequently, that the capillary arteries are much dilated during the state of inflammation. The contractions of these vessels, indeed, it has been said, are increased also in a ratio proportional to the dilatations ; but this is an assertion which has not yet been proved, either in the way of experiment or of observation.

The sense of throbbing, which the advocates for the hypothesis of increased capillary action regard as the strongest proof of that action, Mr. Allen is disposed to attribute to the difficulty which the blood meets with in passing from the arterial trunk into the capillary branches. This sensation of throbbing and appearance of increased action may be produced in an instant, by applying a ligature to an uninflamed finger, so as to obstruct the motion of the blood through its point. Besides, this throbbing or pulsatory motion can afford us no criterion by which to judge of the force with which the artery contracts, for it is produced in the dilatation of the artery, and by a power foreign to the artery itself.

Perhaps we are not yet in possession of many of the data, upon which the proper determination of the question respecting the state of the blood-vessels in inflammation must ultimately rest. The structure and functions of the capillary vessels, which are acknowledged to be the seat of inflammation, are, in a great measure, unknown to us. In particular, we are ignorant of the precise share which this system (the capillary) has in propelling the blood ; we are ignorant how far their muscular coat, supposing them to have

one, can act independently of their elastic, and whether the contractions and dilatations of this coat are regulated by the same laws which govern the action of the muscular fibres of the heart; we are ignorant, also, what increase of diameter in these vessels is compatible with an increase of tone or vigour in their action.

Inflammation, like every other phenomenon occurring in animated bodies, is to be regarded not as a simple event, but as one uniformly arising from the combined and complicated operation of powers, some of which are known, others, at present, completely unknown to us. Simple views, whether of health or disease, however ingenious, can seldom be just. They have their origin in the spirit of system, not in the careful study and faithful enumeration of the complicated circumstances which concur in the production of all vital phenomena.

Attempts have been made to support the doctrine of the diminished action of the inflamed vessels by an appeal to experiment. You will find several experiments to this purpose in Dr. Philip Wilson's Treatise on Febrile Diseases. From the experiments which he made in company with Mr. Boraston, Dr. Wilson infers that the circulation is slower in inflamed than in uninflamed arteries. But the truth of this inference is not necessary to the establishment of Mr. Allen's hypothesis; and from a number of experiments which I have at different times made upon frogs, I am inclined to believe that a diminished velocity of the blood in the capillary branches is by no means a necessary, constant, nor even the most common effect of incipient and moderate degrees of inflammation. As the results of the experiments to which I allude bear directly upon the subject we have been considering, I shall take this opportunity of stating some of the more remarkable.

Having occasion, in the autumn of 1809, to inquire into the state of the blood-vessels affected with inflammation, I was led to hope, that perhaps some light might be thrown upon that subject, by exciting inflammation in the transparent parts of animals, and by observing the phenomena of that state with the microscope. My endeavours, however, to trace the origin and progress of these phenomena were not so successful as I could have wished; but, in making them, some appearances presented themselves which were new to me, and which, if observed, have not, so far as I

know, been hitherto accurately or fully described. A faithful statement of the difficulties which I met with may probably suggest to others the means of obviating them; or, at least, prevent those who may afterwards enter on the same investigation, from reposing much confidence in the calculations and reasonings of those pathologists who have speculated on the subject, without having experienced the obstacles attending it.

The phenomena of the circulation of the blood, it is well known, have been described by Haller with much more precision and minuteness than by any preceding physiologist. Indeed, his two *Memoires sur le Mouvement du Sang et sur les effets de la Saignee* still contain, notwithstanding the progress which physiology has made since his time, almost all that is at present known on this subject. Spallanzani, it is true, has multiplied Haller's experiments, and has extended his own researches to some points which had been overlooked by Haller; but, with the exception of the facts, that compression of the heart prevents or disturbs the circulation, and that the impulse given to the blood by the heart extends to, and may be perceived in the veins, it does not appear to me that he has added any thing very valuable to that ample and interesting stock of information which had been communicated to the public in so agreeable a form by the learned and judicious Haller.

Previously to attempting to excite and to observe the phenomena of inflammation, my attention was directed to the phenomena of the circulation, as they appear in the healthy condition of a part placed as much as possible in a natural and unconstrained position. Cold-blooded animals, it is well known, are the subjects in which these phenomena can be best seen. Haller made choice of the vessels in the mesentery of the frog for the subject of his observations; but the exposure of this membrane is accompanied by an unnatural and constrained position of the vessels to be viewed, and is necessarily followed by the death of the frog upon which the experiment is made. On these accounts I was induced to prefer the vessels in the web of the foot of that animal. This web, though not so transparent as the mesentery, is sufficiently so to allow, in a clear light, the phenomena of the circulation to be distinctly seen in its vessels, and it can be exposed to our view without much pain to the

animal, or any loss of blood. By enclosing every part of the frog, except the limb to be viewed, in a linen bag, I found that I could keep the web in view for any length of time, without injury to the animal, and without compressing its body, and consequently with much less disturbance to the circulation, than when the abdomen is cut open, and any of the viscera pulled out and exposed to our view in the microscope. By spreading out the foot, and by fastening the points of three of the toes to the holes in the end of the trough in which the limb is placed, an opportunity is at all times afforded of comparing the state of the circulation on the opposite sides of the middle toe—a circumstance of considerable consequence in those experiments in which substances of different kinds are applied to the vessels, as this toe prevents these substances, when applied to the vessels on one side of it, from spreading, and from affecting the state of the circulation on the other.

When we look at this web with the naked eye, or with a common magnifying glass, we see small blood-vessels distributed upon it, the larger of which run near to and parallel with the toes. These send off branches which ramify upon the web, and inosculate very freely with each other. The direct terminations of the arterial in the venous branches are most remarkable in the extreme parts of the web. The capillary vessels in the web of the foot of the frog seem to consist chiefly of minute ramifications of veins, and to form a net-work, or plexus of vessels, attached to and capable of being filled, from communicating arterial and venous branches.

The circulation of the blood, as seen in these three orders of vessels—the arteries, intervening capillary vessels, and veins, in the web of the foot of the frog, placed as has been already described, goes on in an uninterrupted stream. We perceive the globular structure of the blood, it is true, in the capillaries and in the venous branches, but we no where perceive in these three orders of vessels, during undisturbed circulation, any thing like impulse or oscillation. It is only when the animal struggles, or attempts to change its position, that marks of irregularity or disturbance can in general be perceived. Every time, indeed, that the animal struggles, or attempts to change its position, a temporary stop takes place in the motion of the blood, both in the arteries and

veins; but this stop is of very short duration, unless when the struggles are long continued, or the change of position such as to occasion somewhere a degree of pressure on the sanguiferous system.

By numerous trials I found that the circulation in the vessels of the web could be stopped altogether, rendered oscillatory, or be made to go on in progressive jerks, according to the degree of compression which I applied to the chest of the animal. Similar appearances were also repeatedly produced by applying different degrees of pressure with the finger to the vessels in the course of the limb, or by passing a ligature round this, and drawing it to different degrees of tightness. When the pressure was strong, or the ligature tight, the circulation, as might be expected, was completely stopped; a less degree of pressure or tightness produced the oscillatory motion, and a still less degree that state in which the blood moves forward in jerks, not followed by the retrocessions which occur in oscillation. The slightest pressure stops the circulation in all those capillaries which are not immediately derived from arterial branches. Even touching the body of the animal with the point of the finger generally occasioned a stop for an instant of time; a stop, however, which seems to depend chiefly, if not solely, on the effort which the animal makes to deliver itself from some new and unknown danger; for it was not after a first or second time produced, when the touches of the finger were slight, or frequently repeated; nor did this stop continue when the finger was kept applied to the body, though it occasionally took place at the moment the finger was removed. If pressure be made for a few seconds on the course of a limb, so as to produce retarded circulation in the artery, the blood will be seen to make a considerable retrocession in that vessel at the moment the pressure is removed. In short, a stop, and in some instances a very considerable retrocession of blood in the arteries, seemed to me to precede, in the frog, every attempt to move or to change the position of its body.

Finding that by pressure I could render the motion of the blood so slow, as that its particles became obvious both in the arteries and veins, I was very desirous to try to measure the velocity of the circulation in these vessels; but after many attempts I was not able to devise any means by which so desirable an object could be accomplished. I found

that I could not, in ordinary and healthy circulation, follow with my eye the same globules, for any assignable length, through the field of vision; and that, though I could have followed the globules with my eye through a distinct portion of space, yet that that portion must have been so small as to render it difficult, if not impossible, for me to adapt to it a measure of time.

This surprised me the more, that the learned and ingenious Dr. Hales does not appear to have found any difficulty in ascertaining the comparative velocity of the blood circulating in the capillary arteries of the muscles and of the lungs of a frog. He states expressly, that the velocity of the blood in the frog's lungs was forty-three times greater than in its muscles.* From the doctor's mentioning, however, in the paragraph following those in which these calculations are contained, that he could see the motions of the blood sensibly accelerated at each systole of the heart, not only in the capillary arteries, but also in their corresponding capillary veins, I am inclined to believe, that whatever the velocity of the blood may have been in his experiments, the motion of the blood through the lungs was not quite so free as he imagined; for visible acceleration in the capillary arteries, from the impulse of the heart, is a phenomenon which has never occurred in any of my experiments, unless when the circulating powers were either considerably weakened or obviously compressed. These accelerations, which Dr. Hales regarded as marks of the freedom of the circulation, I have uniformly found to arise from disturbed, compressed, and impeded circulation. They can be traced into the veins, and indeed, in most of my experiments, these accelerations from the impulse of the heart were more visible in the veins than in their corresponding arteries. In oscillation, again, the oscillations are more extensive in arteries than veins.

Haller and Spallanzani repeatedly mention, that they had found the velocity in the arteries three times greater than in the corresponding veins; but I am equally at a loss to ascertain how this comparison can be made, or the ratio of velocity ascertained. Certain it is that neither of these authors mention the means which they employed—a thing which is at all times so desirable, when number, measure,

* Hæmastatics, p. 68.

and proportion are to be expressed, or made the basis of speculation or reasoning in physical inquiries. In the larger arteries of the mesentery, or of the web in the foot of the frog, the globules of blood are never seen in ordinary and healthy circulation. It is only in their capillary extremities that the globules become visible; and in these the course of the blood is so irregular, and the anastomoses of the capillary vessels so frequent, as to render it extremely difficult to trace any one globule for any assignable space. That the velocity of the blood is, upon the whole, much greater in the arteries than in the veins, is a point concerning which there can be no doubt; for, by the laws of hydraulics, it is a necessary consequence of the greater capacity of the veins than of the arteries; and it is rendered obvious to the senses by our being able to distinguish the globules of blood in the branches of veins—a thing, I have already remarked, which cannot be done during healthy and unconstrained circulation in the corresponding arteries. Our being able to see and to distinguish the globules even in the capillary vessels, is at all times the consequence of diminished circulation; and it is the facility with which this can be done in the different vessels which has served me in all my experiments as a measure, though but a very imperfect measure, of the velocity of the blood.

The existence of a vital contractility, or *irritability*, as it has been termed by Glissen and Haller, in the smaller or capillary arteries of animals, has long been inferred from the functions which these vessels perform; though it must be acknowledged, that the direct proofs by which the existence of this property is established, are neither so numerous nor so satisfactory as one would naturally be led to imagine from the very frequent recurrence which is made to it in medical speculations. Haller, it is well known, failed completely in his attempts to establish, by direct experiment, the irritability of the larger arteries both in warm and in cold-blooded animals; and he appears to have been incautiously led, from the negative result of his experiments, to conclude that the arteries of cold-blooded animals in particular, are, like glass tubes, absolutely inert, and without contractile power. He mentions repeatedly having seen the arteries empty of blood, or the blood occupying only a small portion of the canal of an artery. Some of his disciples however, were more fortunate than their precep-

tor: for Verschuir's experiments, to be found in his excellent Thesis, *De Arteriarum et Venarum, Vi Irritabili, &c.* printed at Groningen, in 1766, leave us no room to doubt of the existence of this property in the larger arteries of warm-blooded animals. The experiments of which I am to state the results will, I trust, show that this property exists in a degree equally, if not more, susceptible of direct proof, in the smaller arteries even of cold-blooded animals.

In observing attentively the phenomena of the circulation in the web of the frog's foot, I repeatedly had occasion to observe, that when the blood was stopped by the struggles of the animal, or by any change of its position, that the small arteries in which it had circulated, sometimes became obviously less in their diameters, and in some instances contracted so as wholly to disappear. In a few instances this contraction took place without my being able to trace it to struggle or change of position; but this was, indeed, a very rare occurrence. Sometimes this diminution of diameter took place in all the arteries that could be perceived in the web between the same toes, and at other times only in a particular artery of that web. In a few instances I have seen the contraction of a particular branch of a small artery become so complete, that I could no longer perceive any trace of it, and this even when the diameters of the arteries in the web between the same toes, or in the web on the other side of the middle-toe, in the same foot, either seemed to become enlarged, or to remain unaltered. These are changes which it was possible, in some instances, to perceive by the eye alone, without the assistance of the microscope.

Phenomena differing so widely from the descriptions which have been given of the state of the smaller arteries in these animals, by Haller and by Spallanzani, and appearing to me to confirm in so remarkable a manner the opinions of those physiologists who attribute a greater degree of irritability to the smaller than to the larger arteries of animals, could not fail to arrest my attention, and to suggest the application to the smaller arteries of those stimuli by which the contractions of the larger may in most instances be produced.

I accordingly applied, with the point of a hair-pencil, weak and strong spirits of wine to the smaller arteries of the web in eight or nine different frogs, but without being able to perceive any sensible change in the diameters of the

arteries to which the spirits were immediately applied, though the general circulation through the web seemed to be increased by each application of the spirits.

The results were the same when tincture of opium was employed. The frogs seemed, by the struggles which they made, to feel uneasiness every time this tincture was applied in considerable quantity, either to their bodies, or to the limb in which the vessels were viewed.

Weak volatile alkali, or ammonia, was applied in the same manner as the spirits of wine and tincture of opium had been, and I had now the pleasure to observe a distinct, and in many instances a complete contraction, produced in the arteries to which it was more immediately applied. In upwards of one hundred experiments, in performing some of which I had the assistance of my friend Dr. Gordon, the contraction produced took place in less than two minutes after the application of the ammonia. In thirteen similar experiments, the contraction did not take place till after a period of three minutes. In three or four instances only, in which the ammonia was applied to the arteries of fresh frogs, were the contractions not induced—a proportion of failures surprisingly small when contrasted with the number of times in which the appropriate mechanical and chemical stimuli are known to fail in exciting distinct contractions in the larger arteries of warm-blooded animals. In one of the instances in which the ammonia failed to excite contraction, it was applied four times successively, at intervals of four or five minutes. Contractions, however, were readily excited in the arteries of this animal when the ammonia was applied to arteries running in the web of the same foot but situated on the other side of one of the toes. The contractions of the arteries, by the application of ammonia, could be repeated, I found, three or four times in the space of fifteen minutes. I have reproduced them eight or nine times in the course of an hour. In some instances I thought I could perceive an increase in the velocity of the general circulation immediately after the application of the ammonia. In others this increase, if it took place, was so small as to be imperceptible. But the first and most remarkable visible effect of the contraction of the artery from the application of ammonia, was a diminution in the velocity of the circulation in the capillary vessels with which the contracting artery communicates. When

the contraction is complete, a temporary stagnation in the capillaries, with which the contracted artery immediately communicates, is often produced. This diminished circulation in the capillaries often informs us of the contraction which is taking place, before the contraction itself becomes perceptible. Besides this diminution in the capillary circulation, the contraction of the artery is in most instances accompanied with an obviously diminished size of the corresponding veins. The contraction of the arteries from ammonia takes place chiefly in the place to which the ammonia is applied; but it almost in every instance extends for a considerable way above and below the place of immediate application. Where the contractions have been feeble I have repeatedly seen them overcome, by the increased circulation succeeding to the struggles of the animal. In cases where the contraction is partial and of small extent, the greater velocity of circulation in the contracted than in the dilated parts of the same artery, were often extremely apparent. This is an hydraulic appearance, the perception of which is greatly facilitated by the globular structure of the blood. In all the experiments in which ammonia alone was applied, a paleness rather than redness of the web in the foot of the frog was produced; but this paleness was only of short duration.

I tried to irritate the smaller arteries of the web with the point of a fine needle, but this irritation seemed to give pain, and always brought on such struggles as to prevent me from seeing the changes produced in the arteries. In three instances, however, I succeeded in producing complete contraction, by irritating for some time, though gently, the smaller arteries with the point of the needle. The general circulation through the web seemed to be always more or less sensibly increased by this irritation; but whether this was the effect of the local stimulus, or of the struggles of the animal, was a point not easy to determine.

The observations and experiments which I have just related prove undeniably, I conceive, the existence of irritability in the smaller or capillary arteries of cold-blooded animals, and consequently the possibility of irregular distributions of the blood in particular parts of the body being produced, independently of the heart, by the vital, contractile, or irritable power inherent in even the minutest branches of the arterial system.

In applying, with the point of the hair-pencil, a saturated solution of common salt to the arteries in the web of the frog's foot, I was not a little surprised to observe, that these arteries, instead of being contracted as they had so uniformly been by the application of the ammonia, were actually and sensibly dilated. The part of the web to which the salt was applied became of a red colour, and this redness, which was visible to the naked eye, lasted in general for a period of from three to five or more minutes. It was impossible to view the part with the naked eye, to which the salt had been applied, without conceiving it to be inflamed. The facility of producing, by the application of salt, a state so accurately resembling inflammation, induced me to hope, that, by examining the phenomena of the circulation in this state, I should be able to arrive at some satisfactory conclusions with respect to the comparative velocity of the blood in healthy and in inflamed vessels; but I did not, upon trial, find this so very easy a matter as I had at first imagined it would have been. The application of the salt gives pain to the animal, for in general it struggles a little after each distinct application.

One very uniform effect of the application of salt was a whitish appearance on the surface of the web, which rendered it more or less opaque, and consequently the motion of the blood in the smaller arteries less easily discernible. But the principal difficulty in ascertaining the comparative velocity of the blood in the sound, and in the red or apparently inflamed parts, arose from the very variable results which the application of salt produced in different animals, and in the same animal in different circumstances. The differences in the velocities, from the application of salt to the arteries, which I have had an opportunity of observing, may all be comprehended, I conceive, under the three following general results:—

First. The application of the salt produced an increased velocity in the dilated larger and smaller arteries and capillary vessels, to which it was more immediately applied. In nine experiments, the phenomena of which I have minutely recorded, the application of the salt was not only followed by a bright red colour, visible to the naked eye, and a sensible enlargement of the arterial and venous branches, but with an increased rapidity of circulation also in the capillary vessels; the globules becoming

less distinct than before the application of the salt, and obviously less distinct from the rapidity of their motion, than the globules in the capillary vessels in the uninflamed part of the web in the same animal. The repeated application, however, of the salt to the same vessels, was always sooner or later followed by retarded capillary circulation, or even by complete stagnation.

A second general result from the application of the salt was, an apparent increase of circulation in the arteries and veins, with a diminution of velocity in the capillary branches. The diminution of velocity in the capillary vessels seems in every instance to arise from a diminution of force in the circulating powers; and it is in most instances the first visible mark of diminished circulation in the larger vessels; yet in several experiments with the salt this diminished circulation in the capillaries seemed to be accompanied with increased velocity of circulation in the arterial and venous branches. Here the arterial blood moved most probably through lateral communicating trunks. In no one experiment have I been able to perceive any enlargement of an artery during the momentary influx of blood into its canal.

The third and most frequent result from the application of the salt was diminished rapidity of the circulation in arteries, veins, and capillaries. In seventeen experiments, the phenomena of which I have also minutely recorded, the circulation became so slow under the application of the salt as to stop altogether in the capillaries; and this stagnation, which usually goes off in a few minutes, continued in some instances for several hours. The enlargement of diameter in arteries, veins, and capillaries, is very conspicuous; they may be said to be distended; and the redness, in retarded or stagnant circulation, is of a somewhat darker colour than that which is accompanied with increased capillary circulation. In every experiment with the salt, whether the velocity of the circulation was increased, diminished, or stopped, the diameters of the blood-vessels were uniformly enlarged; and this increase of diameter continued till the redness spontaneously disappeared.

The most singular phenomenon which presented itself in the experiments with the solution of common salt, was undoubtedly the dilatation of the artery and its branches under the application of that stimulus; an effect, it is to

be remarked, directly the reverse of that which takes place from the application of ammonia or volatile alkali.

The state produced by the application of the salt exhibited the appearance of inflammation, though in most instances, like the redness excited in the act of blushing, it lasted only for a very short period of time: this period, however, was very variable in different frogs, and in the same frog under different circumstances. It seemed to increase in length in proportion to the weakness of the animal, and to the number of times which the salt had been applied. Conceiving the state which is induced by it in the web of the frog's foot to be analogous to inflammation, I am inclined to infer, from the results of the experiments which I have related, First, That the velocity of the blood, so far from being always diminished in inflamed vessels, is often increased, particularly in the commencement of inflammation; and that this increase of velocity may continue in the capillary vessels from the commencement to the termination of that state. This increased circulation occurs, I am inclined to believe, in a greater or less degree in that state which has been denominated active inflammation. Secondly. That a diminished velocity in the circulation through the inflamed capillary vessels, may take place in the very commencement of inflammation, and may continue during the existence and progress of that state. Thirdly. That this diminished circulation in the inflamed capillary vessels takes place, however, more frequently in the progress than at the commencement of inflammation in healthy and strong persons; and that it is probably a state which occurs in those inflammations which have been denominated passive. This inference I am inclined to believe is warranted by the diminution of velocity produced in the arterial branches by repeated applications of salt, or even in weakened animals by a signal application. If this view of the state of the circulation in inflamed vessels be just, it will follow, that inflammation is sometimes attended by an increased, and at others by a diminished velocity in the circulation through the capillary vessels of the inflamed part, and consequently that neither of those two states ought to be included in the definition which we give of inflammation.

CONSTITUTIONAL OR FEBRILE SYMPTOMS.

The human body, considered as an organized whole, is a very complicated system, comprehending in itself a great variety of subordinate systems, organs, and textures. In the different states of health and disease, these systems act and are reciprocally acted on by each other. No sooner, therefore, does any of the subordinate parts of the animal œconomy receive an injury, or become affected with disease, than changes are induced in the general system, corresponding in some degree to the nature, seat, and extent of the local affection. In many instances indeed, where the local affection is internal, and of course concealed from our immediate observation, these constitutional changes are often the chief, if not the only marks, which, previously to death, and to the dissection of the body, we have of the existence of internal local disease. The brain and nerves seem to be the common centre or general medium through which the reciprocal influences of the different parts of the animal œconomy are exercised, the organs which first sympathize with local affections, and which, by their reaction on the other organs and systems of the body, produce in them all the variety and diversity of morbid constitutional effects which we perceive to occur in disease.

That every sensible part of the body, has, through the medium of the brain and nerves, either a general sympathy with the whole system, or a particular sympathy with certain parts of it, are positions, the truth of which has been very generally acknowledged by medical men ever since Doctors Hoffmann, Whytt, and Cullen, first carefully investigated this subject, and collected and reduced into regular and systematic order, the various proofs of the agency of the nervous system in the states of health and disease,

and of the sympathetic connections which it forms among all the different parts of the animal œconomy. It will not be easy, I believe, to convey to you a juster or more comprehensive view of this agency and of these sympathetic connections, than is to be found in the following paragraphs, which I shall take the liberty to quote from Dr. Whytt's Observations on Nervous Disorders; observations which, like all the other writings of that author, display an extensive acquaintance with the phenomena of health and disease, habits of accurate observation, and a talent for abstract reasoning and philosophical analysis, not surpassed by any of those who have been employed in investigating the laws by which the œconomy of living systems is governed.

"That every sensible part of the body has a sympathy with the whole, will sufficiently appear from the following facts.

"Cold water thrown on any part of the body that is warm produces a sudden contraction of the whole vessels and pores of the skin, and by that means frequently puts a stop to small hæmorrhages. The effluvia of certain substances when smelled to, instantly communicate new life and vigour to the whole body, while others affect some delicate women with fainting and convulsions. By means of different musical sounds, various passions may be excited or calmed, and diseases are said to have been sometimes cured. By doleful stories or shocking sights, delicate people have been often affected with fainting and general convulsions.*

"When the brain is wounded, inflamed, suppurated, or otherwise hurt, almost every part of the body is liable to suffer, and vomitings, tremors, convulsions, palsies, &c. often ensue. In animals newly dead, the whole muscles of the trunk and extremities are strongly convulsed, when a probe is pushed down through the spinal marrow.

"When the stomach is in a sound state, and digestion is properly performed, the spirits are good, and the body is light and easy; but when that organ is out of order, a languor,

* Although in these cases, the changes produced in the body are owing to the passions of the mind, yet as the mind is only affected through the intervention of the optic and auditory nerves, they seem proper enough instances of the general sympathy that extends through the whole nervous system.

debility, melancholy, watchfulness, or troublesome dreams, the night-mare, &c. are the consequences. Grateful food, strong wine, or other spirituous liquors, no sooner touch the stomach of one ready to faint from emptiness, than they communicate new life and strength to the whole body: and, on the other hand, several poisons occasion violent sickness, vomiting, fainting, tremors, convulsions, stupidity, an intermitting pulse, difficult breathing, coldness of the extremities, and other symptoms. A fever, delirium, and violent convulsions, have been produced by a pin sticking in the coats of the stomach: and worms, affecting either this part or the intestines, occasion a surprising variety of symptoms.

"Epileptic fits have proceeded from a rough bone or cartilaginous substance irritating the nerves of the great toe, or the calf of the leg; and the wound of a tendon or nerve has been the cause of a fever, delirium, tremors, violent convulsions, a tetanus, and death.

"Many more examples might be mentioned, were it necessary, of that general sympathy which prevails throughout the whole body. But there is nothing which sets this matter in so clear a light, as the effects of opium: for a solution of this substance injected into the great guts of a dog, in a few minutes brought on a palsy of his posterior extremities, attended with a stupor and convulsions. Some days after, a like solution being injected, by a perforation through the teguments into the abdomen of the same dog, he became almost instantaneously paralytic, and died in a few minutes.

"A solution of opium injected either into the stomach or intestines of frogs, or even applied to the muscles of their belly laid bare, produces a paralytic weakness, a stupor, and death at last; although such is the nature of these animals, that opium does not kill them near so soon as it does dogs.

"From these experiments it appears, that not only those nerves, to which opium is immediately applied, are rendered incapable of performing their office, but that the brain, spinal marrow, and whole nervous system are affected in the same manner, solely by the action of the opium on the nerves which it touches. For its effects upon dogs are too instantaneous to allow of the supposition, that the more subtile parts of this poison are received into the blood, and by that means are conveyed to the brain: and in frogs, after the heart is taken out, and consequently a stop put to the circulation, yet a solution of opium injected into the stomach

and intestines has the same effect as when these animals are entire.

"Besides this general consent, which prevails throughout the whole body, there is a particular and very remarkable sympathy between several of its organs, by means of which many operations are carried on in a sound state, and pain, convulsive motions, and other morbid symptoms, are often produced in such parts as have no near connection with those that are immediately affected.

"To illustrate this, I shall give several instances, beginning with the head, and taking the parts in their order downwards.

"The Head. Violent pains in the head, which have their seat most commonly in the membranes of the brain or pericranium, are frequently attended with a sickness at the stomach and vomiting. The spasmus cynicus, locking of the jaws, and an universal tetanus, have followed a wound of the left side of the head, by which the temporal muscle was divided. Light and noise are offensive both to the eyes and ears in severe headachs. Wounds and contusions of the brain generally occasion bilious vomitings. Certain impressions made on the sensorium commune by external objects instantly give the eyes either a dull, a lively, or a fierce look.

"Grief, vexation, or fear, lessen the secretion of the saliva, destroy the appetite, and sometimes occasion a looseness. The great consent between the brain and heart appears from the sudden and remarkable effects of the passions on the latter.

"The Eyes. When one eye is affected with an inflammation, a cataract, or the gutta serena, the other is often soon after attacked with the same disease. The contraction of the pupil is not owing to light acting as a stimulus on the iris, but solely to the sympathy between this membrane and the retina.* There is such a sympathy between the two pupils, that even in a gutta serena, the pupil of the morbid eye, is observed to follow the motions of the sound one. We shut both eye-lids whether we will or no, as often as any thing threatens to hurt either eye. A bright light coming suddenly on the eyes sometimes occasions sneezing. Hippocrates has observed, that the unexpected sight of a serpent

* See Essay on the Vital Motions of Animals, § 7.

will make the countenance pale. The sight of grateful food occasions an uncommon flux of the saliva in a hungry person. Yawning and vomiting are often catching.

"The Ears. The noise of a file and other harsh sounds affect the teeth with an uneasy sensation. The whetting of a knife has caused the gums to bleed. Great and unexpected sounds, such as the explosion of a cannon or musket, make us instantly close our eye-lids. As the ear is frequently pained when the fauces are inflamed, so an irritation of the meatus auditorius will often excite coughing, and sometimes vomiting. A constant pain of one side of the head, with a numbness of the left arm and leg, a suppression of the menses, and epileptic fits, have all been occasioned by a glass-ball, not larger than a pea, sticking in the ear.

"The Nose. The effluvia of hungry water, or spirit of wine, drawn strongly into the nostrils, increase the derivation of the salival juice into the mouth, and sometimes stop a tickling cough. The smell of grateful food makes the saliva flow when one is hungry. Sternutatories not only increase the secretion from the nose, but also from the lachrymal vessels. After smelling to volatile salts, or eating too much strong mustard with one's meat, a pain is often felt above the eye-brows; and it is observable, that after taking a large draught of cold water in winter, that part of the forehead immediately above the nose is affected with a painful sensation. Acrid substances applied to the olfactory nerves bring the diaphragm, intercostal and abdominal muscles, into convulsive motions.

"Mr. Boyle mentions several who were purged by smelling to a cathartic medicine; and we are told, that in some the effect failed, when, from a coryza, or obstruction of the membrane of the nose, the olfactory nerves had lost their power of distinguishing smells.

"The Teeth. A rotten tooth will sometimes occasion a violent pain in a sound one, though at a distance from it; and the pain will cease as soon as the spoiled tooth is drawn, or its nerve destroyed. A pain in the teeth often affects the cheek-bone, one side of the head, the throat, and the corresponding ear. Children, from the irritation of the gums in teething, are liable to vomiting, purging, a cough, a fever, and convulsions.

"The Trachea. An irritation of the windpipe, or any

of its small branches, raises coughing, or a convulsive motion of the muscles employed in expiration; and a nausea, vomiting, and convulsions, are sometimes the consequence of a violent or long-continued irritation of these parts.

"The Lungs. The sympathy of the lungs with the diaphragm and intercostal muscles is evident from their motion, even in ordinary respiration, but still more so in the laborious breathing which is always the consequence of a difficult passage of the blood through the pulmonary vessels.

"The Diaphragm. When the diaphragm is inflamed, the stomach, brain, and muscles of the face are affected by sympathy, as appears from the delirium, vomiting, and risus Sardonicus which attend this disease.

"The Stomach and Intestines. A disordered state of the stomach and intestines, with wind or noxious humours lodging in them, will sometimes so affect the brain as to deprive people of their reason. At other times, the same causes will produce a vertigo, cephalæa, hemicrania, clavus hystericus, palpitations, intermissions of the pulse, difficulty of breathing, sudden flushings of heat, and sweating, &c. After hard drinking, or a large dose of opium, the eyes lose their lustre. The headach, after a debauch, proceeds chiefly from the stomach, as appears by the removal of the pain upon drinking a few glasses of strong wine. The disorder of the stomach will sometimes occasion dimness of sight. I know a lady, to whom every object appears as if covered with a thick smoke, as often as her stomach is loaded with an acid; and who, therefore, finds vomits, absorbent powders, and bitters, her best ophthalmic medicines. Another lady, with tender eyes, seldom has any considerable pain or sickness at her stomach, without her head being affected, and her eyelids or eyes becoming, in some degree, inflamed. In little more than half an hour after swallowing fifteen or twenty grains of the extractum cicutæ, I have been often affected with a weakness and dazzling of my eyes, together with a giddiness and debility of my whole body, especially the muscles of my legs and arms; so that, when I attempted to walk, I was apt to stagger like a person who had drunk too much strong liquor.

"A convulsive motion of the stomach and intestines often spreads to the throat, where it occasions a difficulty of breathing, and a sense of suffocation: On the other hand,

an irritation of the fauces, or pharynx, excites vomiting. A nausea, or disagreeable sensation in the stomach, makes the pulse quicker and smaller, raises a sweat, and sometimes greatly increases the secretion of the saliva, or urine. When the stomach is empty, and affected with a sense of hunger, the salival juice flows much more copiously into the mouth than after a full meal, or when the natural appetite for food is wanting. An inflammation of the stomach and bowels is attended, in the beginning, with a shivering of the whole body, and a great coldness of the hands and feet. Long continued vomiting and purging occasion violent cramps of the muscles of the legs and thighs; and the dry belly-ache brings on a palsy of the extremities. A tremor of the hands is often lessened or removed, for a while, by a dram, or some strong wine; and this effect is owing solely to the action of these liquors on the stomach, and not to their having entered the blood, which does not happen so soon. The particular sympathy of the stomach with the diaphragm and abdominal muscles, appears from their convulsive motions in vomiting, and in the hiccough. A violent spasmodic pain in the stomach or intestines often renders the pulse much slower than in a state of health.

"An inflammation of the intestines is frequently attended with vomiting, and a suppression of urine. An opisthotonus or a tetanus is often occasioned, in hot climates, by a retention of the meconium, or other acrid humours, in the bowels of infants. That itching of the nose, which is a common sign of worms, seems to indicate a particular sympathy between this part and the intestines; and the many other symptoms produced by worms, which I shall have occasion to mention afterwards, show a remarkable and extensive consent between the first passages and many other parts of the body.

"The Liver. Stones irritating the biliary ducts frequently occasion a nausea and vomiting. An inflammation of the liver is generally accompanied with a vomiting and the hiccup, and often with a pain between the vertebræ of the neck and top of the shoulder. In a suppuration of the liver I have twice seen the patients affected with a numbness and debility of the right arm, thigh, and leg.

"The Kidneys and Ureters. A nausea, vomiting, costiveness, and inflation of the bowels, are often produced by an inflammation in the kidneys, or stones in the ureters. A stone in the pelvis of the kidney, or in the ureter, some-

times occasions a frequent inclination to make urine, and a heat in the extremity of the urethra. When one of the kidneys is inflamed, little urine is separated by the other, probably on account of a spasmodic stricture of its secretory vessels. When a stone is passing through the ureter, the testicle of the same side is sometimes drawn upwards, and swells ; and an erect posture is then painful.

"The Bladder and Rectum. An irritation of the neck of the bladder, or extremity of the rectum, is the cause of a constant contraction of the diaphragm and abdomina muscles. A strangury and tenesmus mutually occasion each other. The pain of the hæmorrhoids is sometimes accompanied with a sickness at the stomach and faintishness. A stone or ulcer in the bladder is attended with a sharp pain near the end of the urethra, especially after making water. I had, some years since, a patient with an ulcer in the bladder, who, when he passed his urine, had not only a violent pain in the point of the penis, but this pain descended down his thighs and legs, and affected the soles of his feet, as if he had been standing barefooted on burning coals.

"The Genitals in Men. At the time of puberty, not only the voice, but the whole body undergoes a sensible change, which is probably owing to the stimulus communicated to the nerves of the genital parts by the semen ; for we certainly know that other stimuli, applied to the nerves of the nose or stomach, according to their nature, will either instantaneously impart new vigour to the whole body, or soon occasion a general stupor and debility. It is owing to a sympathy with the glands, that the vesiculæ seminales are contracted in time of coition ; and, when the membrane which lines the lower part of the urethra is stimulated by the semen, the acceleratores urinæ are excited into convulsive motions.

"The Uterus. The great variety of symptoms in the hysteric disease is the reason why a more extensive sympathy has been ascribed to the womb, than to any other part except the brain. But, although these symptoms proceed from the womb much less frequently than has been imagined, yet the vomiting which generally accompanies an inflammation of that organ, the nausea, and depraved appetite after conception, the violent contraction of the diaphragm and abdominal muscles in delivery, the headach, and the heat and pain in the back and bowels about the time of men-

struation, are sufficient proofs of the consent between the uterus and several other parts of the body. But there is no part so much affected by the different states of the womb as the breasts, which become more turgid before every appearance of the menses, and subside after the period is over. The changes that happen to the breasts in time of pregnancy, and after delivery, are still more remarkable.

"The Extremities. Straight shoes give some people a headach; while sinapisms applied to the soles of the feet, or blisters to the legs, often lessen, and sometimes remove a delirium. In an obstinate costiveness, cold water thrown on the feet and legs has sometimes opened the body, after many other remedies had failed. By tickling the soles of the feet, not only the muscles of the legs, but of the whole body, may be thrown into convulsions. An opisthotonus, with convulsions returning every day, has been owing to a wound in the sole of the foot by a nail; and the spasmus cynicus, to a violent pain in the toes. The locking of the jaws sometimes happens after amputations of the extremities, or lacerations of the nerves or membranes.

"Many other examples of sympathy, both in a sound and morbid state of the body, might be mentioned; but the above will be sufficient at present, as I shall have afterwards frequent occasion to touch on the same subject."*

All the different systems, organs, and textures, which enter into the composition of the animal œconomy, are liable to be more or less sympathetically affected by the occurrence of local inflammation, but perhaps the most remarkable and important of the constitutional effects arising from that state, may all with propriety be referred to one or other of the four following general classes of phenomena:

I. Morbid phenomena, occurring in and depending upon changes induced in the general or local action of the sanguiferous system. To this we may refer, 1st. Variations in the strength and frequency of arterial pulsations; 2d. Variations in the degree of temperature or of animal heat, either in the whole body or in particular parts of it; 3d. Variations in the state of respiration; 4th. Variations in the dryness or humidity of the skin; 5th. Spontaneous hemorrhages; 6th. Variations in the state of the different secretions.

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* Whytt's Works, p. 493.

II. Morbid phenomena occurring in the digestive organs, and in the organs subservient to the process of digestion. To this we may refer, 1st. State of salivary secretion; 2d. State of tongue as to moisture, colour, crust, &c.; 3d. Variations in the gastric fluid, want of appetite, indigestion; 4th. Nausea, oppression at stomach, and vomiting; 5th. Variations in the biliary secretion; 6th. Gripes, purging of fetid, mucous, bloody, and bilious matters.

III. Morbid phenomena occurring in the nervous system, considered as the organ of sense and of intellect. To this we may refer, 1st. Syncope, sudden sickness, shivering, coldness of the extremities; 2d. Watchfulness; 3d. Delirium, mild and ferocious; 4th. Mania; 5th. Coma; 6th. Apoplexia; 7th. Derangements, variations or deprivations in the sensations of sight, hearing, taste, smell, and touch.

IV. Morbid phenomena occurring in the organs of voluntary motion. To this we may refer all spasmodic or convulsive affections, such as, 1st. Subsultus tendinum; 2d. Spasms of the voluntary muscles; 3rd. Spasms of the involuntary muscles; 4th. Tetanic, hydrophobic, hysteric, and epileptic affections.

This enumeration of the constitutional morbid phenomena arising from local inflammation, is by no means intended to exhibit a complete view of these phenomena, but merely to point them out to your notice as objects most particularly deserving of your attention and study. It is in the knowledge and treatment of these, and similar morbid phenomena, that the boundaries which divide surgery from physic meet and are lost in each other; for whatever distinctions convenience or custom may have introduced among the practitioners of the healing art, there is no foundation for these distinctions, either in the nature of disease, or in the knowledge which every medical practitioner should possess of the appearances which different diseases exhibit, and of the means by which they are to be removed. Division of labour may, indeed, in this as well as in the other practical arts of life, be attended with many advantages to society; but in learning and in teaching the elements of physic and of surgery, it must never be forgotten that they are branches of the same art, have had the same origin, are governed by the same principles, and pursue entirely the same object.

More or fewer of the constitutional morbid phenomena,

which I have mentioned as arising from local affections, may in individual cases supervene to, or be produced by local inflammation, whether it occurs spontaneously, or is the effect of external injury; but it is chiefly to the morbid phenomena occurring in the state of symptomatic fever, and which are those of the first, second, and third classes, that I wish at present to direct your attention. The morbid phenomena occurring in the organs of voluntary motion, or fourth class of constitutional symptoms, I shall have occasion to consider in detail, when I come to treat of the nervous affections which may supervene to external injury.

In the definition which I gave of local inflammation, it may be remembered that I stated, that the co-existence of the four symptoms, redness, pain, heat, and swelling in any texture or organ of the body, was in general accompanied by a greater or less degree of fever, and that from this circumstance had arisen the distinction which had been made by medical men among the symptoms of inflammation, and of inflammatory diseases, into those which are local and those which are febrile or constitutional. It has of late, I know, been considered as improper by some physicians to give the name fever to the constitutional symptoms which accompany local inflammation; but in justification of my doing so I may remark, first, That this employment of the term Fever has been sanctioned by long use. The addition of the epithet Symptomatic to that which accompanies inflammation, whether it arises spontaneously, or is produced by external agents, prevents us in every instance from confounding the febrile symptoms arising from inflammation, or other local diseases, with those combinations and trains of symptoms which are produced by causes operating on the general system without immediately exciting inflammation, and to which nosologists have given the name of Idiopathic, or primary fevers. In the second place, I may remark, that the symptoms which occur in symptomatic or secondary fevers, resemble those of idiopathic or primary fevers so exactly, that, but for the local affection, it would in many instances be impossible to distinguish these two classes of fevers from one another; and, in the third place, I may observe, that not only are the constitutional symptoms which accompany local inflammation included in the definitions which are usually given of idiopathic or primary fevers, but we shall find that symptomatic fevers exhibit the

same forms of febrile phenomena with idiopathic fevers, hold the same course, undergo the same changes, possess similar characters, form similar species, and require the same means of cure. The terms Fever in physic and Inflammation in surgery are, it cannot be too often repeated, general abstract terms which do not denote any particular form of inflammatory or febrile diseases. They are used merely to express the occurrence, co-existence, and succession of phenomena which, by their particular combinations, constitute classes, orders, genera, and species of inflammatory and febrile diseases; and as no one form of inflammatory disease has a better claim to that appellation than another, so no one combination of the symptoms which constitute the state that has been denominated fever, appears to me to be exclusively entitled to that term.

In proof of the close and intimate relation subsisting between the state of fever and that of local inflammation, I may also remark, that as local inflammation gives rise to constitutional febrile symptoms, so idiopathic fevers of all kinds, in their turn, often give rise to, or at least are accompanied by local inflammatory affections. Indeed local inflammation may take place in all periods of idiopathic fevers, and in innumerable instances seems to be the more immediate cause of the dangerous or fatal effects which so frequently occur. In all febrile affections also, whether of an idiopathic or symptomatic kind, determinations of blood to particular regions and organs, are liable to occur and to give rise to hemorrhagy, from the vessels opening upon mucous surfaces. In these cases the arteries leading into the places where the determinations exist, pulsate more strongly than the corresponding arteries of the system, and a state in some respects resembling that of inflammation occurs. By some this state is denominated a hemorrhagic effort, by others a topical fever. This increased pulsation of the arteries not only precedes hemorrhagy, but continues with it, and generally goes off as the hemorrhagy ceases. It is denominated active hemorrhage, to distinguish it from that which occurs from the accumulation of blood and distention of vessels, without being preceded or accompanied in its progress by any increased pulsation of the arteries.

Idiopathic fevers have been distinguished by nosologists, from the combination, succession, and duration of their

symptoms, into ephemeral, intermittent, remittent, and continued. The distinctions taken from the order and duration of the symptoms constitute what are usually termed differences in the character or type of fevers; and hence we say fever of an intermittent, remittent, or continued type. Ephemera is a febrile state, which lasts, as its name imports, only for one or two days. In this country it often arises from an accidental exposure to cold; and when it does so, usually passes through the three states of cold, hot, and sweating stages. The ephemera from cold may be regarded as an idiopathic fever; but it may arise also from slight injuries; and though neither its character nor symptoms are changed, it then becomes a secondary or symptomatic fever.

Of fevers resembling intermittent, and arising from local diseases, we have examples in the febrile affections which not unfrequently accompany strictures in the urethra. I have repeatedly known these symptoms mistaken for, and treated as a true intermittent fever. Even hectic fever, a disease which arises in the constitution during long-continued processes of suppuration, often assumes an intermittent form; more frequently, however, particularly in its last stages, this fever puts on the appearance of a remittent. Whether the bilious or gastric fever, induced by so many local diseases, resembles the bilious remittent fevers of practical authors, is a point which has not hitherto, I believe, been inquired into; but from the prevalence of bile which occurs in the primæ viæ during the symptomatic as well as the idiopathic fevers of this name, I am inclined to believe that a resemblance will be found to exist also in the kind, order, and progress of the other symptoms of those fevers. Are symptomatic, gastric, and bilious affections more frequent in those districts in which bilious remittent fevers prevail, than in districts where these fevers are unknown? or do the symptomatic fevers attendant upon inflammatory affections assume the character and type of the endemial fevers of the districts in which they occur?

Of the three genera of continued fevers, which have usually been distinguished from each other by nosologists, synocha is allowed by all to be more frequently a symptomatic than an idiopathic affection. Indeed some authors (perhaps not without reason) seem inclined to doubt, whether, without local inflammation, synocha ever occurs as an ori-

ginal idiopathic disease. That a fever resembling typhus occurs in inflammatory diseases will not be doubted by those who have ever attended to the constitutional symtoms which occur in malignant small-pox, measles, scarlatina, and some species of gangrene. It is this combination of local inflammatory with constitutional typhoid symptoms which so frequently perplexes the practitioner in his choice of remedies and renders the best-directed exertions of the healing art unavailing, if not sometimes injurious. The differences, therefore, it would appear between idiopathic and symptomatic fevers are not to be found in the kind or degree of the symptoms by which they are characterised, but only in the cause from which they are supposed to originate, in the affections with which they are complicated, and in the name. For these and other reasons, which must be obvious to those who have attended to this subject, I am inclined to doubt whether our knowledge of the genera and species of idiopathic fevers, of the modifications which they undergo from the influence of climate, and from combination with other diseases, be indeed yet such as to enable us to distinguish them in every instance from symptomatic or secondary fevers, or to determine in febrile diseases, as they occur in nature, whether they belong to the idiopathic or symptomatic division.

In describing the febrile symptoms which accompany inflammation, I shall not attempt to follow the order in which they occur either with respect to the local symptoms, or with respect to each other, for this order is far from being invariable or uniform. It differs in the different species of inflammatory diseases, and is, perhaps, never precisely the same in any two patients affected even with the same species.

In some instances of inflammation the febrile symptoms precede the local in the order of their appearance. We have an example of this in erysipelas, where the febrile symptoms often take place in a very high degree two or three days before the local inflammation appears. The febrile symptoms precede the local also in small-pox, measles, and in all the class of eruptive or exanthematous diseases.

In most inflammatory affections arising from external injury, the constitutional or febrile symptoms succeed to the local after a distinct interval of time, in some cases shorter,

in others longer. In these cases the febrile symptoms would appear to be dependent on the local affection, for when the inflammation is removed the febrile symptoms of themselves in general disappear. There are, however, it must be confessed, external injuries of a nature so very severe, as to induce the febrile at the same time with, or at least very soon after, the local symptoms of inflammation. We have examples of this in burns, in very painful operations, in some injuries of the head, and in some of the more severe cases of compound fracture.

In other inflammatory diseases, again, as in those depending upon inflammation of the pleura and peritoneum, there is reason to believe that the local and constitutional symptoms are often simultaneous events, and that sometimes the one, sometimes the other class of symptoms takes the order of precedence.

But in whatever order the febrile symptoms may occur in inflammatory diseases, either with regard to each other, or with regard to the local symptoms, they often exist in such a degree as to demand the principal attention of the practitioner; and this circumstance must serve as my excuse for entering a little more fully into the detail of these symptoms, than has been usually conceived to be necessary in courses of surgery.

1st. One of the most obvious and constant of the constitutional symptoms occurring in inflammatory diseases, is an increased action of the heart and arteries, indicated by a strong, full, and, in general, frequent pulse. This strong, full, and quick pulse, is one of the most characteristic marks of symptomatic inflammatory fever. Taken by itself, indeed, it does not indicate with certainty the existence of the febrile state; for it may be readily produced, as you all know, by exercise, or by sudden emotions of the mind; but in these cases, as it is usually of short duration, it can scarcely be said to indicate the actual existence of fever. If, however, the increased action of the heart and arteries continues for some time after the exercise has been discontinued, or the emotion of the mind has passed over, we then say that the person has been thrown into a fever, or that the febrile state exists.

In inflammatory diseases, this increased action of the heart and arteries may consist in an increase of strength, as well as in an increase of frequency in the contractions of the heart

and arteries, or it may consist in an increase of the frequency, but not of the strength of these contractions. In the local inflammations attended by an increase of the strength, as well as the frequency of contraction, we say that the fever is of the inflammatory type, or that the phlogistic, or, as it has been more recently termed, the sthenic diathesis, prevails; but when the frequency of contraction is increased, while the strength is diminished, we give the name of typhoid or nervous fever to the constitutional symptoms, and in speaking of the general state of the body, say that the asthenic diathesis or disposition prevails. The febrile symptoms which accompany local inflammation, partake more or less, as we have already remarked, of the character or type of particular idiopathic fevers; and it is this difference, it may be remarked, in their types or characters, which occasions so much dispute with regard to the nature, and so much uncertainty with regard to the treatment of febrile diseases.

Idiopathic fevers, like inflammatory diseases, have been found to vary from each other more in the number, combination, and degree, than in the kind of symptoms by which they are characterised. They differ also remarkably in the methods of treatment which they require. The constitutional symptoms attending local inflammation have been found to exhibit the same differences in their symptoms and method of treatment as idiopathic fevers, and, as it becomes necessary to express these differences by some common term, fevers symptomatic as well as idiopathic have not unfrequently received their characteristic appellations from the degree of strength or weakness with which the heart and arteries seemed to act in these fevers. Hence the distinction which I have already pointed out to your notice, and shall afterwards have occasion to employ, of symptomatic fevers of the inflammatory, phlogistic, or sthenic type; and symptomatic fevers of the nervous, typhoid, or asthenic character.

This is a distinction which has been regarded as the most important that has ever been made among the phenomena of inflammatory and febrile diseases, because it is one which is supposed to be founded upon an essential difference in the nature of the diseases in which they occur, in the state of the animal economy from which they proceed, and in the very different effects of the means by which these phenomena are to be prevented or removed. It is a distinction

which has probably been recognised, in some degree or other, in the practice of the well-informed of all ages; but it has of late years, and particularly in this country, been attempted to be pushed much farther than seems to be warranted by a careful comparison of inflammatory and febrile phenomena, as they occur in individual diseases, or by the actual results obtained from the employment in inflammatory and febrile diseases of different, if not opposite, modes of practice. That there are only two forms of disease, sthenic and asthenic; two kinds of remedies, stimulant and debilitating; that the indication of cure of the sthenic diathesis is to diminish, that of the asthenic to increase excitement, and that we must go on doing so till that degree of excitement which is a medium betwixt the extremes, and suitable to health, be restored, may appear to the young and inexperienced to be a doctrine as useful in its tendency as it is simple in its views. But opinions in practical medicine so very universal in their application, and so precise in their statement, though they may be convenient for the indolent and merely speculative student, cannot long be entertained by those who have talents or opportunities to observe diseases as they occur in nature, the variations produced in them by the disturbance of different organs and functions in the different individuals affected with the same species of inflammatory or febrile affections, the counter-indications which so frequently present themselves in the treatment of these diseases, and the infinitely diversified effects which result from the same articles of food or medicine when administered to different individuals, or to the same individual in the different periods of the same disease. Views so very simple of the state of disease, have certainly not had their origin in the careful study and contemplation of the numerous and complicated relations which exist among the different systems, organs, and textures, which enter into the composition of the animal œconomy; nor in the diligent observation of the endless diversities which are produced in diseases by the constitution and manner of living of the patient, by the character of the prevailing epidemic, by climate, situation, season of the year, and by various other modifying causes, which it is at present unnecessary to enumerate.

All knowledge which is the result of experience in the practice of medicine, must be derived from the observation

of an extensive series of similar and dissimilar instances; but in communicating this knowledge to each other, and in endeavouring to mark the analogies and differences of diseases, we are obliged to have recourse to the use of general terms. It is not, however, it must ever be remembered, in the study of medicine, by the use of general terms, often remotely, slightly, and partially applicable to the phenomena to which they are applied, but by the minute, patient, and continued investigation of the concourse, succession, and combination of morbid phenomena as they occur in nature, that we can acquire a knowledge of diseases. It is, perhaps, by marking the features in which diseases differ from each other, rather than by tracing general, and but too often vague analogies between them, that the method of distinguishing and treating local as well as constitutional diseases is to be improved.

But to return from this digression, into which I have been insensibly led, I have to observe to you, that though the fever accompanying local inflammation be in many instances purely inflammatory, and in others purely typhoid, it is often of a mixed nature like the fever denominated synochus by Dr. Cullen, inflammatory at its commencement, but becoming typhoid in its progress and termination. Each of these three forms of symptomatic fever, the inflammatory, typhoid, and mixed, is liable, it deserves also to be remarked, to be more or less complicated with derangements of the biliary organs, and when these derangements are very obvious and prominent, the symptomatic affection gets a new appellation, and is not unfrequently termed, particularly by the continental practitioners, bilious or gastric fever. To discriminate the symptoms which characterize these different forms of symptomatic fever, as they may occur in particular inflammatory diseases, and to treat them so as to secure the greatest possible safety to those in whom they appear, requires an extensive knowledge of the symptoms, effects, and modes of treating idiopathic fevers; such a knowledge as can be acquired only by careful study, and assiduous application to the practice of physic. It would lead me away from the proper business of these Lectures to enter farther into the consideration of this subject. I must content myself, therefore, with having pointed it out to your notice, and warned you of its importance.

2dly, Increase of warmth in the skin, or of the tempera-

ture of the body, is another constitutional symptom occurring in symptomatic inflammatory fever. This is probably the first symptom of fever which attracted the attention of mankind, and it is that also from which fever appears to have got its name. To be hot and to be feverish are still in common language expressions nearly synonymous. Increase of warmth or temperature probably depends, in the commencement at least of fever, upon the increased rapidity of circulation produced by the more frequent contractions of the heart and arteries. It is often the symptom which is first observed, and may occur without, though it is generally preceded by a cold stage.

The local temperature in inflammation has, as I have already had occasion to remark, been very accurately ascertained by Mr. Hunter. It never exceeds the standard heat of the body; or, in other words, the temperature of the blood issuing from the left ventricle of the heart. In health this temperature is found to be usually about 100° of Fahrenheit's thermometer. In febrile diseases the thermometer has been occasionally employed also to ascertain the degrees of temperature, but neither so often nor so extensively as could be wished.

From the trials which have been made, it appears that the temperature of the body in fevers is very variable. Indeed, the circumstances which may affect it are infinite—as season of the year, quantity and quality of bed-coverings, degree of exposure, nature of the fever, constitution of the patient, and articles of diet or medicine. In all experiments, therefore, on the temperature of the body in fevers, whether symptomatic or idiopathic, these and many other circumstances must, in order to render the experiments accurate, be carefully noted. One thing is certain, that the sensations of the patient are never to be trusted to; for while some patients in fever have complained of heat, a thermometer placed under their tongue did not indicate a temperature greater than 94° or 95° of Fahrenheit's scale, that is, five or six degrees below the temperature of health. Other patients again have been known to complain of cold, when the thermometer placed in the same circumstances indicated a temperature equal to 105°, or even 107°.

The temperature in Intermittent Fever, during the cold stage, as ascertained in the axilla, and under the tongue, is sometimes as low as 94°, 93°, and 92°, and many degrees

lower than this in the extremities. In the hot stage it rises to 102, 3, 4, and even 105°.

In hectic fever the temperature seldom rises two or three degrees above the natural or standard temperature.

In the fever after intoxication, which bears in many respects a strong resemblance to symptomatic inflammatory fever, the temperature rises to 105°. The late Dr. Alexander of this place found it so high in his own case as 107°.

In natural, mild, or benignant small-pox, the temperature has been observed as high as 107°. In confluent small-pox 96, 7, 8, 9, 100° of Fahrenheit's scale. These two extreme temperatures, 94 and 107° of Fahrenheit, may be regarded, I believe, as nearly the extreme temperatures in febrile diseases.

It deserves to be remarked, that a very unequal distribution of blood, and of course of temperature, frequently occurs in febrile affections. Thus the skin is sometimes cold when the interior parts of the body indicate a considerable rise of temperature, and one region of the body, as the feet for example, may be cold to the touch, while the head or some other part, equally, or even more exposed, feels uncommonly warm. In these irregular distributions of blood, therefore, we observe two states of vascular, or arterial action, one of which resembles inflammation in the heat, and increased pulsation ; and another state, which is the very reverse of this, in which the capillary vessels are probably much diminished in size from the contraction of their muscular fibres.

3d. Diminished perspiration is another symptom by which the state of symptomatic inflammatory fever is usually ushered in ; and hence it is that we say the skin feels dry as well as hot. The late Dr. Cullen, who attributed all the phenomena of fever to a spasm, which he conceived to be induced in the extreme or capillary vessels, found a ready explanation of the diminished perspiration in this spasm ; but unfortunately for this hypothesis, though it is one which seems to be justified by many of the morbid phenomena occurring in the animal œconomy, there have been fevers in which a copious perspiration was among the first symptoms which indicated the approach of fever ; and certainly still many more fevers, in which a profuse perspiration from the exhalents on the surface of the body, formed one of the

most troublesome and permanent symptoms with which the practitioner had to contend during the continuance of the disease.

But, though diminished perspiration is not to be considered as a symptom essential to the existence of fever, as Dr. Cullen supposed, yet it occurs sufficiently often in symptomatic inflammatory fever, to justify us in classing it along with the more constant phenomena of that disease; and the restoration of the perspiration, it may be remarked, is almost in every instance accompanied by the abatement of the other symptoms of fever. It is with a view, therefore, to produce this effect, that we shall afterwards find diaphoretics have been so warmly recommended, and so frequently used among the means of cure.

The perspiration is not the only secretion which is diminished during the continuance of the febrile state. There is great reason to believe, that all the other secretions of the body are similarly affected. The flow of saliva, for instance, into the mouth is diminished, and ulcers secreting pus on the surface, or into the internal canals of the body, are dried up upon an attack of fever. The urine is not only diminished in quantity, but its chemical properties appear to undergo considerable alterations. Though of a high colour, it deposits upon standing no lateritious sediment or uric acid, as the red power of urine is now termed—a phenomenon which it almost never fails to exhibit, the moment the fever is beginning to abate.

4th. The loss of appetite, nausea, and vomiting, which occur in symptomatic and other fevers, are perhaps also to be referred to the suppression of the secretion of the gastric liquor in the stomach, or to some change induced in its qualities by the presence of the fever. Want of appetite and nausea are among the more common and constant symptoms of fever; but the vomiting which is occasionally excited, probably depends for its cause on the quantity of food remaining in the stomach after the commencement of the attack, or upon changes induced in the quantity and qualities of the bile and other fluids secreted into the alimentary canal.

The furred tongue is an extremely frequent symptom of fever. Taken along with nausea and loathing, it is one of the best guides which we have in judging of the state of the

alimentary canal, and in enabling us, in most instances of fever, symptomatic as well as idiopathic, to determine with much accuracy, whether the patient is likely to receive most benefit from animal or vegetable nourishment. A furred tongue, I believe, will, in most diseases, be found to be as natural a symptom of derangement in the digestive organs, as an increase in the strength or frequency of arterial pulsations is to be regarded as an indication of the strength and number of the heart's contractions. The fur which covers the tongue in febrile diseases, occurs chiefly about the middle and back parts of this organ. It is of a whitish, yellow, or brown colour, variable however in shade, and of a firm consistence. It does not admit of being wholly scraped off, but as the fever abates, it comes away spontaneously. It is not easy to account for the origin of this crust; for did it arise entirely from a change in the nature of the saliva secreted, instead of being found on the upper, middle, and posterior parts of the tongue, we should find it incrusting the whole internal parts of the mouth. It is probably secreted, therefore, from the papillæ to which it adheres. Furred tongue occurs in many derangements of the stomach and bowels, in which, if any fever exists, it is in a degree so small as not to be perceptible. Derangements in the digestive organs are sometimes very suddenly produced. The eating of an article of food which disagrees with the stomach, the infliction of an external injury, or the occurrence of a spontaneous inflammation, shall each of them in a few hours be followed by fever, a furred tongue, and an increased secretion of bile. In other instances again, as from sedentary life, high living, and slight local irritations, the derangements are more slowly produced, and their existence manifested only by the occurrence of symptoms, which are either equivocal in their nature, or present in so mild a degree as to escape the observation of the patient or his medical attendant. You will find many proofs and illustrations of these remarks in Mr. Abernethy's Observations on the Constitutional Origin and Treatment of Local Diseases, a work highly deserving of your studious perusal, not only on account of the valuable information which it contains, but also on account of the excellent example which it exhibits, of unremitting diligence and successful effort in observing and in describing the phenomena of local and con-

stitutional diseases, and in tracing the relations which exist among these phenomena.

5th. The head-ache, pain of the back, anxiety and restlessness, which occur in symptomatic fever, are most probably affections of the nervous system. They seem to be almost essential symptoms, as they are present in a greater or less degree, during the commencement and progress of almost all fevers.

The intellectual functions also are, in fevers of the symptomatic kind, often disturbed by the occurrence of *reverie;* and this sometimes increases to such a degree as to terminate in delirium or mania. Delirium and mania, when they occur in symptomatic fever, are often connected with an increased action of the heart and arteries, and with a particular determination of blood to the head. At other times these symptoms occur, without the local circulation appearing to be much, if at all, disturbed.

Nothing can be more various than the progress and termination of the different kinds of symptomatic fevers. In some diseases they occupy distinct periods of time; in others, their duration, as well as their severity, is modified by constitution, mode of management, climate, and season of the year. Many of these fevers terminate favourably of themselves, some never without the judicious interference of art, and in others again it is often difficult to say, whether it be art or nature which contributes most to bring about a favourable termination. If very long continued, most symptomatic fevers show a tendency to pass into a remittent or hectic form—a species of fever which I shall have occasion to describe to you, when I come to treat of the constitutional symptoms which accompany the process of suppuration. But for the more minute consideration of the symptoms which indicate the presence of symptomatic fever, I must refer you to the books which have been written on this subject, and to the lectures on the practice of physic, which are delivered in the university. The order, combinations, and number, in which these symptoms occur in local inflammatory diseases, we shall frequently have occasion, in the course of these Lectures, to remark; but in whatever inflammations, or other local diseases, the whole or the greater part of the constitutional symptoms I have enumerated may occur, I shall not scruple to apply to them the terms Febrile

and Fever, any more than I should hesitate to give to co-existence of redness, pain, heat, and swelling in any part of the body, the epithet of inflammation.

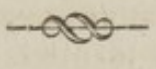
There is still one other circumstance respecting local inflammatory diseases which requires to be mentioned. I allude to the particular appearance which the blood exhibits after it has been drawn from the veins of patients affected with this class of diseases. This appearance, with which I presume you are all sufficiently well acquainted, has been long known by the name of the inflammatory crust, or buffy coat of the blood. The propriety of the first appellation may be doubted, because this appearance has been found to take place in people who have no symptom of local inflammation, as in pregnant women for example, and it has occasionally been found wanting in cases (though it must be confessed these are but few in number) in which inflammation undoubtedly existed.

Many attempts have been made to explain the cause of this appearance, few to examine the nature of the buffy coat, or to ascertain the precise circumstances in which it is produced. The buffy coat has not generally been found on blood at the first attack of inflammation. I have repeatedly observed, in bleeding patients affected with pleuritic complaints, that at the same bleeding, the blood first drawn had little or none of the buffy coat, while that which was last drawn was completely covered with it. By receiving the blood in three different cups, I have seen none or very little in the first cup, some in the second, and a large quantity in the third cup.—See Hunter, page 314.

What the circumstances are which induce this state of the blood, it may be difficult to discover, though the immediate cause of the appearance of the buffy coat seems to depend on the slowness with which inflamed blood coagulates, and the facility with which, in consequence of this circumstance, the red particles, from their greater specific gravity, sink towards the bottom of the vessel in which the blood is contained. Mr. Hunter regarded, and I believe justly, this inflammatory crust as formed of coagulable lymph or fibrine. Deyeux and Parmenter, in their analysis of sound as well as of diseased blood, consider it as of an albuminous nature. Still more recently, Fourcroy and Vauquelin speak of it as of a gelatinous nature. It is not easy to conceive what

should have produced this diversity of opinion, for it is a matter which may be easily determined by chemical experiment. A very diligent pupil of mine, the late Mr. James M'Donald, boiled the buffy coat in water, but no solution of it took place, an event which must have happened had it consisted of gelatine. Neither was any sensible precipitation occasioned in the water in which it had been boiled, by adding to it a solution of tanin. In these experiments the matter of the buffy coat exhibited no properties different from those of the ordinary coagulable lymph of the blood.

TERMINATIONS OF INFLAMMATION.



The local phenomena which inflammation exhibits in its progress, and towards its termination, are more diversified than those which appear at the period of its first commencement. These phenomena are, however, sufficiently uniform in the combinations which they form, and in the order of their appearance, to enable us to refer them to distinct heads or classes, usually denominated the terminations, or, perhaps more properly, the local effects of inflammation. Thus inflammation is said to terminate in resolution, effusion, adhesion, suppuration, ulceration, granulation, cicatrization, and mortification.

These different terminations may all, except the last, be regarded as so many vital processes excited in the different parts of the animal œconomy by the state of local inflammation—processes which produce effects, and exhibit phenomena peculiar to themselves. You would, therefore, form a very erroneous notion of the appearances usually called the terminations of inflammation, were you to suppose that inflammation, as the word termination would seem to import, can end only in one of these ways. In resolution, it is true, whenever it is complete, the phenomena of inflammation disappear, but more or fewer of the other terminations may be either co-existent states, or successive stages in the progress of the same inflammatory disease. Resolution, strictly speaking, is the only way in which inflammation can terminate, so that the other appearances denominated terminations are to be regarded as so many different stages, states, or processes of inflammatory action, according to the views which we take of the order in which they occur, the phenomena which they exhibit, or the effects to which they give rise.

The termination in resolution is sometimes altogether the work of nature, but it may be promoted by art. It is the most desirable termination, because it is in fact the spontaneous cure of inflammation. It may be defined to be that termination, in which all the symptoms, local as well as constitutional, gradually subside, in which no very sensible evacuation takes place, and in which the part that had been inflamed assumes by degrees its natural state, without suffering any derangement of its organization or functions.

The termination in effusion, or, more properly speaking, the effect of inflammation termed effusion, seems to consist in the separation or secretion from the circulating mass of blood, either of a greater quantity than usual of the liquors which the exhalent vessels constantly pour into all the shut sacs or cavities of the body, or in the production of liquors specifically and chemically different from those which they naturally secrete. The liquor which those vessels usually pour into the interstices of the cellular texture during the state of inflammation, bears a strong resemblance to the serum of the blood, and may therefore be denominated a serous fluid. Its presence in the cellular texture produces that state which I formerly mentioned under the name of œdema.

In particular textures, and in certain degrees and kinds of inflammation, instead of serum, a substance resembling the coagulable lymph of the blood is secreted. The properties of this substance secreted during the state of inflammation have not yet, so far as I know, been chemically investigated. They seem to differ widely, however, according to the degree and kind of the inflammation, and according to the texture also in which it occurs. In some instances of inflammation, we find this lymph forming a dead inorganizable substance, and in others an organizable and living solid. The mucous liquor which is secreted from the surface of the natural passages of the body, and the synovial liquor which lubricates the joints, are converted by inflammation into substances resembling pus, or the matter of sores.

The termination by adhesion is a very frequent occurrence, and one which, from the effects that it produces, may be regarded either as a healthy or as an unhealthy, as a morbid or as a salutary process. By this process, parts which have been separated by nature, by accident, or by design, are made to unite together, and by the mutual penetration of their uniting surfaces with blood-vessels, nerves, and absor-

bents to form a continuity of living solid. Every thing which relates to the process of adhesion is an object of such extreme importance to the surgeon, that it will be necessary for us to enter into a minute account of the phenomena which it exhibits, the effects which it produces, and of the means by which the occurrence of a vital event so desirable in itself may be best promoted and secured.

The termination by suppuration is that process in animal bodies, by which the matter of sores or pus is formed. Suppuration is indeed an exceedingly common effect of inflammation, and seems to consist, in whatever part of the body it takes place, in the separation of a peculiar liquor from the blood, by a process analogous to, if not the same with secretion. It can be artificially excited on the surface of the body, by the application of a blister, or by the infliction of a wound, and in the canals which naturally secrete mucus, pus may be very readily produced either by mechanical or chemical irritation. Pus is often formed spontaneously in the substance of almost every texture and organ of the body, and produces, by its accumulation in these textures and organs, the appearance denominated abscess. When pus again is formed, as it not unfrequently is, on the surfaces of membranes lining cavities, such as those of the head, chest, or belly, it gives rise to diffused internal suppurations.

The next mode of termination which I have to mention to you, is that by ulceration; the process itself, and the singular effects which it produces were, so far as I know, first taken notice of by Mr. Hunter. Ulceration, in the sense in which we now use that term, signifies a solution of continuity produced in any of the textures or organs of the body by the action of the absorbent vessels—an action by which these vessels remove a greater or less, but always a perceptible portion of the living solids. This is the process by which sores and ulcers are produced, and it appears to be also, as I shall have occasion afterwards more fully to state, the means by which nature brings extraneous matters to the surface, that have been introduced into or generated within the body, and by which she separates dead from living parts.

When a wound has been inflicted, and is left to itself, when an abscess bursts, and its internal cavity is exposed, or when a living or dead portion of the body is removed by the knife, or by the process of ulceration, we in general perceive that

the surface of the wound, abscess, or ulcer, is gradually covered with a layer of coagulable lymph, which exhibits at first a smooth surface, but which in time is raised up into little red eminences, which bleed readily on being rubbed or otherwise roughly handled, and which are well known to surgeons by the name of granulations. The formation of these granulations is one of the most curious and important processes in the animal œconomy, and one, the various appearances and effects of which are particularly deserving of the attention of the medical surgeon.

When surfaces covered with granulations are brought together and retained in contact, a union between them is formed, and this mode of healing up wounds has been denominated re-union by granulation. There are two modes, therefore, you perceive, in which nature accomplishes the reunion of parts which have been accidentally or intentionally divided; the first is by adhesion without granulation; this Galen termed re-union by the first intention: the second is re-union by granulation, to which the same author gave the name of re-union by the second intention.

When granulating surfaces, however, instead of being brought into contact, are simply covered over with substances which exclude the air, the granulations are, in healthy persons, soon covered with a whitish exudation that is gradually converted into skin, the formation of which completes the process of healing, and is known among medical men by the name of cicatrization. The circumstances which prevent, and the means which promote this process, are objects of much consequence in the practice of surgery.

When in any case of inflammation the constitutional symptoms become violent, while the local manifest no disposition to terminate in resolution, adhesion, or suppuration, we have reason to dread the approach of that state which has been technically denominated mortification. This is a term which includes under it all the varieties of morbid phenomena which occur in those inflammations in which the vigour of the inflamed part is lessened from the slightest apparent diminution of vigour in the part, to the complete destruction of its vitality. This mode of termination has been usually, and, I think, properly distinguished into two states or stages, denominated gangrene and sphacelus. In the first the local symptoms of inflammation continue, but are somewhat modified in their appearances and

character. The redness becomes of a darker hue, the sensibility is in general diminished, the heat of the inflamed part is, I believe, less than in the earlier stages of the inflammation; but this is a point concerning which we still need information. In the progress of the affection the cuticle is raised in blisters, the skin, acquiring a livid hue, mortifies, and passes, together with the parts under it, into the state denominated complete local death, or sphacelus.

I have not said any thing of the termination, which you will find described in books under the name of the termination in scirrhus; and this, first, because I am not inclined to regard scirrhus as one of the usual effects of ordinary inflammation; and, secondly, because, in the cases in which the affection now termed scirrhus occurs, you will always find a peculiar diathesis, which generally manifests, in its progress, a tendency to pass into cancer. The term scirrhus, as used by the older medical writers, is extremely indefinite, having been sometimes used to express every kind of induration which remained after an attack of inflammation, as well as the morbid incipient state of parts about to become affected with cancer. Surgeons now usually limit the use of the term to the last of these significations.

PROGRESS AND VARIETIES OF INFLAMMATION.

The local and constitutional symptoms of inflammation are never stationary, but vary at every instant of time. They have their periods of increase, occasional aggravation and remission, acme and decline; so that, from their commencement to their termination, they may be said to be in a state of constant progression or change.

The order in which these changes succeed each other is denominated the course or progress of the inflammation; and this succession of changes is, as has been already remarked, in some instances rapid, in others more gradual and slow.

When the phenomena of inflammation succeed each other in quick succession, and particularly when the constitutional symptoms are severe, the inflammation is termed acute. When the symptoms, on the contrary, are milder in their form, and appear in slower succession, it is denominated chronic. Employed in the sense which has just been affixed to them, the terms acute and chronic are merely relative, and express, first, a difference in the period of time which different inflammatory diseases comparatively occupy; and, secondly, a difference in the severity or mildness of the symptoms, particularly the constitutional, with which inflammatory diseases are accompanied.

But though the terms acute and chronic, in their strict signification, express merely differences in the duration and degree of the symptoms of inflammatory affections, they are often employed by medical men to express other differences which occur in inflammation, and differences which

appear to be more essentially connected with the nature of inflammatory diseases than with the periods of time which they comparatively occupy. Thus, for instance, chronic inflammations are found to differ from the acute, not only by the greater degree of mildness, but, in some instances by a real or apparent absence of the constitutional symptoms or fever by which inflammation is usually accompanied. The chronic inflammations have, from this last circumstance, been denominated passive—a term by which it is meant to express, that there is no very evident increased action of the heart or arteries, no increased pulsation nor throbbing to be perceived in the arteries going to the inflamed part; the redness and distention of the blood-vessels of the part affected continuing, but without any very remarkable increase of heat or fever, and without any very severe feeling of pain. Passive inflammation, according to this meaning of the term, would seem to consist in a simple dilatation of the capillary vessels, and in the distention of these vessels with blood; but, like the dilatation of capillary vessels which occurs in some species of varix, and in the affection denominated aneurism by Anastomosis, the dilated capillaries in passive inflammation have not unfrequently their periods of pain and of aggravation, their acute and active, as well as their indolent and passive states.

After this explication of the meaning which has been annexed to these terms, I shall not at present enter into any discussion of the question that has been started whether these states which have been denominated chronic and passive, be entitled to the appellation of inflammation; since the facts which I shall afterwards have occasion to mention will, I hope, serve to show, that the limits which divide the acute from the chronic inflammations are not very precisely marked by nature, and that these states may, and often do pass into each other by insensible degrees. The correlative terms, acute and chronic, are, like most other general terms in pathology, employed to express differences in the degree, rather than in the kind of the appearances or effects of disease.

Every inflammation, I am inclined to believe, may be regarded as more or less acute in its nature; but there are inflammations, which from their commencement partake more or less of the chronic or passive characters. We

shall find innumerable examples of this, in inflammations occurring in persons of relaxed and debilitated frames, and in persons also of scrofulous constitutions. An inflammation, it may be remarked also, which in its origin was of the acute or active kind, may in its progress have its nature so far changed as to become chronic or passive; and you will find that it is often an extremely difficult point in practice, to decide when this change has actually taken place. The change from active to passive, or from acute to chronic inflammation, is frequently seen in the progress of ophthalmia or inflammation of the tunica conjunctiva of the eye; and very different remedies, we shall find, are required in these two states of the disease.

In studying, therefore, the phenomena of chronic and passive inflammations, you will not fail to observe, that though they possess some of the essential characters of inflammation in a small degree only, they still retain enough of these characters to assimilate them in their nature to the state of inflammation, or at least to justify us in classing them along with the phenomena of that state.

Besides being distinguished into acute and chronic, inflammations have also been divided into simple and specific. You will not find that very definite ideas have always been annexed to these terms. An inflammation, however, is said to be simple when there is nothing peculiar in the constitution of the person affected by it, nor in the nature or operation of the exciting causes by which it is induced.

The word specific, as applied to inflammations, seems to have been used in two senses, by practical writers. According to the one of these senses, the term specific is expressive of something peculiar in the operation of the exciting cause of inflammation. Thus small-pox, measles, scarlatina, syphilis, &c. as arising from distinct morbid animal poisons, may be considered as specific inflammations. According to the other sense of the term specific, it expresses certain modifications of inflammation produced by constitutional peculiarities, states, or dispositions, which are sometimes hereditary and sometimes acquired, but which, under certain circumstances, manifest themselves in persons of all temperaments. We have examples of the dispositions or diatheses to which I allude, in rheumatism, gout, scurvy, and scrofula. The symptoms and effects of the

inflammation which occur in rheumatism and gout seldom require the attention of the surgeon—not so those of scrofula.

This is a disease of so frequent occurrence, one which exhibits so great a variety of morbid appearances, and is the source of so many local affections, that an accurate knowledge of its characteristic symptoms, and the best methods of treating them, become objects of the first importance in the practice of surgery. Not only does this disease appear to arise without the appearance of any other disorder in the system, but it very readily forms an alliance with almost every morbid affection occurring either from external injury or from internal disease; it modifies the appearances of other diseases, and seems to convert them gradually into its own nature. Indeed there are few of the local inflammatory affections that occur in this country, in which the symptoms and effects of these affections, and the operation of the food and remedies employed for their cure, are not more or less modified by the degree of scrofulous diathesis which prevails in the constitution of those who are affected by them. The scrofulous diathesis, wherever it exists, usually gives more or less of a chronic character to local inflammatory affections; and this circumstance renders it often extremely difficult in practice to determine, whether the form and continuance of these affections depend upon inflammation, simply so called, or upon a certain kind and degree of scrofulous diathesis existing in the constitution.

A greater or less degree of local inflammation occurs, I am inclined to believe, in every form and stage of scrofulous diseases. In confirmation of this opinion, I may observe, that the swellings which occur in scrofula are very often attended from the first with a sensible increase of heat and of redness, and that the pain, though seldom acute, is always present in a greater or less degree. You may readily satisfy yourselves of the truth of this fact by pressing upon a scrofulous swelling, for the pressure never fails to occasion more or less pain; and the temperature of the skin covering the swelling is usually two or three degrees higher than that of the contiguous parts. This increase of temperature in the skin covering scrofulous swellings, is often the only external mark which we possess of internal disease, and may, as in diseases of the joints, assist the surgeon in distinguishing real from pretended disorders.

In the commencement of scrofulous disorders, it deserves also to be remarked, that the inflammation which occurs has often so great a resemblance in its symptoms to simple inflammation, as to render it difficult, if not impossible, to distinguish between these two states. In these cases the constitutional, as well as the local symptoms, seem to be equally severe and acute with those of simple inflammation; and we often first learn from the inefficiency of the means which we employ for their cure, and from the appearances which present themselves in the progress of the disease, that a scrofulous diathesis exists in the constitution of the person affected by inflammation, and is the cause of the indolent and chronic state into which the inflammatory affection passes.

The term scrofula is used by medical writers in two senses, first, to express the existence of a disease which seems to possess certain distinctive characters, in whatever part of the body it may appear; and, secondly, to indicate a disposition, diathesis, or state, which predisposes some part or other of the body to become affected with scrofulous diseases. It is by overlooking this distinction, I conceive, that a question respecting scrofula has of late years been much agitated in this country, namely, whether it be a hereditary disease. It had from time immemorial been observed that the children of those parents who themselves have had scrofula become sooner or later affected with this disease; and from this uniform observation and experience, it was inferred that scrofula was a hereditary disease. This conclusion, however, has been denied, upon the grounds that children are never born with the disease actually existing; and that it is improper to give the name hereditary to a disease which is not immediately communicated from the parent to the child. By keeping in view the distinction I have already mentioned of scrofula, as a disease which has actually manifested itself by attacking some part of the general system, and as a predisposition, diathesis, or state, liable to be attacked with or to pass into the disease, you cannot fail to perceive, that the dispute with regard to the hereditary nature of scrofula is merely a strife about words; and that this controversy must cease, as soon as you affix any thing like a precise and determinate meaning to the terms which you employ. If, by applying the word hereditary to scrofula, you mean to express that the

disease is communicated directly by the parent, so as to appear in the child from the first moment of its existence, or, in other words, that the child must actually be born with the disease obviously existing, the question, it is evident, whether scrofula be hereditary or not, can only be resolved by an appeal to experience. I have not heard of any very decided example of a child being born with scrofulous glandular tumours in any part of the body, though the circumstance does not in itself appear to be at all impossible. But it is well known that the children born of scrofulous parents are often, at the time of their birth, or immediately after it, affected with an ophthalmia, which is of a scrofulous nature, and eruptions and ulcerations appear behind the ears, accompanied, or soon followed, by apparently scrofulous enlargements of the glands of the neck. The spina bifida is a congenital disease, which is found to occur most frequently, if not always, in the children of scrofulous parents. But whether these instances be or be not allowed to constitute examples of scrofula born with children, all that the advocates for the hereditary nature of scrofula contend for is, merely that a disposition to this disease is communicated from parents to their offspring; and that this disposition or diathesis seldom fails to manifest its existence in the progress of life, in the growth or gradual developement of the general system. Scrofula as a disease, it is true, may never manifest itself in the child; but it does not from this follow that a scrofulous diathesis has not been communicated, or that it cannot, when the proper exciting causes are applied, be readily brought into action; for numerous are the instances in which this disease, like gout and like phthisis, passing over one generation, seizes, as if with redoubled fury, upon the unwary and unsuspecting descendants of the generation succeeding.

Scrofula may be introduced into families by intermarriages, and by a very small leaven, if I may use the expression, of the disease. Like mania, with which it is not unfrequently connected, scrofula can often be traced in its origin to a very remote, but distinct hereditary communication.

The scrofulous diathesis is said to be marked by the following characters. The skin is generally thin and delicate, the upper lip thick and swollen; and this swelling often extends to the partition of the nostrils. The last joints of the fingers have, in many instances, been observed to be

enlarged; and the belly is generally larger than usual. These appearances, it is said, occur most frequently in persons of a florid complexion, who have fair hair and blue eyes; though some of the worst cases of scrofula which I have seen, occurred in persons whose complexions and hair were of a very dark colour.

Scrofula has usually been defined to be a disease of the lymphatic absorbent system. This system, it is true, seldom or never fails to become affected in the progress of this disease; but there is reason to believe, that scrofula frequently appears, for the first time, in parts which are not of a glandular nature. There are perhaps, but few, if any, of the textures of the human body, or of the organs which these textures form, that are not liable to attacks of scrofula, and to scrofula as an original idiopathic affection. We should therefore, I conceive, limit too much our notion of this disease, by defining it to be a morbid state of the lymphatic glandular system. I am unable to define scrofula, or to comprehend, even in a short description, the various symptoms by which, when it occurs in the different textures and organs of the body, it is to be characterised; but I shall endeavour afterwards to lay before you such a detailed account of the appearances which it exhibits when it attacks different textures or organs of the body, as will enable you, I hope, to recognise its existence, when it actually breaks out in the general system, and assist you in distinguishing it from the syphilitic and carcinomatous affections, with which it is most liable to be confounded.

The definitions which you will find of scrofula in books and in systems of nosology, apply in general only to one particular form of scrofula—to that form in which it appears as an original idiopathic affection of the lymphatic and lacteal absorbent glands. This form of scrofula has not improperly, by some authors, been termed scrofula glandulosa, and may be defined to be a cachectic disposition, usually manifesting itself in chronic inflammatory swellings of the absorbent glands, which have in most instances, but not in all, a tendency to suppuration. The glandular swellings which occur in syphilis are of a more acute character than those which proceed from scrofula. They arise from the absorption of a specific poison; and they do not, like those of scrofula, admit of a spontaneous cure. Chronic swellings of the lymphatic absorbent

glands occur also in carcinoma, but these manifest little or no disposition to suppuration ; they succeed most frequently to carcinomatous indurations, or ulcers, existing in the neighbourhood of the glands affected ; and they are accompanied in their progress and growth by a peculiar lancinating pain.

Scrofula passes through all the stages of common inflammation, but in each of these stages it exhibits phenomena which are peculiar to itself. The swelling, in general, is in a greater proportion than any of the other three local symptoms; the heat, as I have already remarked, is often considerable, and the constitutional symptoms which in the commencement of an attack of scrofula, are often so mild as not to be perceptible, become very marked and violent in the progress or towards the termination of the disease. Many scrofulous inflammations admit of a spontaneous cure, others pass in succession through the states of adhesion, suppuration, and ulceration. Mortification is a much less frequent effect of scrofulous, than it is of ordinary acute inflammation.

Though there be no part of the body which is not liable to attacks of scrofulous inflammation, yet it would seem to attack certain parts in preference to others, and this becomes particularly manifest in the progress of life. It seldom attacks the glands in children under two years of age. I have seen it, however, occur earlier than this. Dr. Cullen used to mention a case, in which the disease broke out in an infant only three months old ; but this is an uncommon event. But, though glandular scrofula occurs most frequently in children, it is by no means confined to that period of life, for you find the lymphatic absorbent glands affected in all periods ; and accordingly, I have even found the lacteal or mesenteric glands affected with scrofulous inflammation in persons of a very advanced age.

Among the causes which predispose to scrofula, there is none (hereditary descent excepted,) which seems to have a more powerful influence than climate. This is so much the case, that the disease may be justly enough said to be endemial in some countries ; and, if we may trust to observation, these countries lie nearly within the same parallels of latitude.

We see scrofula prevailing almost universally in certain districts, and cannot help believing that its production

is some how connected with the local peculiarities of the places in which it prevails, or appears to be endemial. Scrofula is said to occur chiefly in moist situations subject to frequent changes of temperature. It occurs, however, in the Highlands of this country, fully as much as it does in the low and moist countries of Holland and Germany. We are every day interrogated by those who are anxious about appearances in themselves or their relations, which they suspect to be scrofulous, whether scrofula ever occurs in the children of parents who themselves have not been affected with the disease, and the question does not admit, in many instances, of an answer more satisfactory to the medical practitioner than to the inquirer. Some, I know, believe that scrofula is in every instance an hereditary disease, and that though it may not have appeared in the constitution of the immediate, it may always be traced to some of the more remote progenitors of those who are affected by it. This may be allowed, I believe, to be the case in this and in other countries where scrofula prevails, but I doubt much whether there be any races, or families, in the countries in which it prevails, that are wholly exempted from attacks, in one form or other, of that disease. In the climates and districts in which it occurs, scrofula, I am convinced, is an endemial as well as an hereditary disease; and those who would effectually and permanently secure themselves and their posterity from its attacks, must migrate from the climates and districts in which it prevails. What the scrofulous diseases are, which respectively prevail in the different latitudes of the southern and northern hemispheres, and whether there be any favoured spots, the inhabitants of which are exempted from attacks of this malady, are points which must be left for future investigation. We are far from having facts sufficiently numerous and precise to enable us to determine them.

In persons disposed to it by hereditary descent, scrofula is often induced by very slight causes. An external injury, as a blow, a wound, or a burn, shall in some instances produce it directly, and in other cases it shall succeed slowly and imperceptibly to the injury by which it has been originally excited.

Fever of every kind often acts as an exciting cause of scrofula, as may be seen in its succeeding to the fevers attendant upon difficult dentition, upon small-pox, measles,

scarlatina, and the other febrile affections to which children are liable.

It would appear also to be excited by improper or defective nourishment: thus, it has been observed to occur in children, who, instead of being suckled at the breast of the mother, are fed with the spoon ; and in children who, though suckled at the breast, have had only a scanty allowance of old and vitiated milk. It has been observed to occur very frequently in those who, while young, could obtain only a watery vegetable aliment.

Another very frequent exciting cause of scrofula in this country, is to be found in the impure air of crowded schools, hospitals, and manufactories.

Too warm clothing in bed, and too little when exposed to the air, may prove the exciting cause of this disease.

There is nothing which seems to give rise to scrofula so certainly, as living in moist situations, which are much exposed to variations of temperature. It is in moderate climates chiefly (where these variations occur) that scrofula makes its appearance, and its occurrence may often be prevented in those who are disposed to it, by their going into a warm, and, it has been said, into a cold climate.

Mercurial frictions have often been known to excite scrofula. Every thing, it has been said, may prove an exciting cause of scrofula which can tend either more directly or more remotely to weaken the general system, or to induce debility. Debility is undoubtedly a state which occurs in many cases of scrofula, and has by some authors been regarded as its proximate cause ; but it may be doubted, whether it be the only condition of the body that is required for the production of the disease. That debility sometimes induces, attends, and supports scrofula, I do not by any means pretend to deny ; but debility may, and often does occur in the most extreme degree, without any mark of scrofula appearing in the constitution.

There is no term in all pathology more vague in the meanings annexed to it, than that of debility. If you examine minutely what it is that is usually meant by the term, either in common conversation or in books of pathology, you will soon perceive that this word is a general expression for a variety of morbid sensations and appearances that may all individually be familiar to your observation, but which are still, nevertheless, very different from each other in their

nature, progress, and effects. There is therefore but too much reason to suspect, that the term debility, by which of late years every morbid symptom has been supposed to be explained, is a mere *asylum ignorantiæ*, into which the pathologist resorts, in order to conceal the defects and the paucity of his knowledge.

In the same spirit it has been disputed, whether scrofula be originally a disease of the solids or of the fluids. When it arises from an improper or indigestible food, it may certainly be alleged to have its origin in the fluids; and it may even be doubted whether it may not be directly produced in the glands of the mesentery, by the irritation of an ill-assimilated and probably acrimonious chyle. Those who have been disposed to refer scrofula to an acrimony of the fluids, have been led to consider it as of a contagious nature. But where the matter from a scrofulous sore has been rubbed into the skin, or inserted below it with the lancet, it has not been found that scrofula was produced. The direct experiments, however, which have been made upon this subject are too few and too inconsiderable to determine the point, and they are experiments, which, in a moral point of view, cannot be regarded but with abhorrence.

The pathological state of the body in scrofula is but little known. It has been said, that the arteries in scrofulous persons are more enlarged and more full of blood after death than the veins, and that they are also very readily torn by injections. But whether these appearances be general or particular, I am unable to say. The lymphatic absorbents connected with scrofulous glands, have often been found dilated, and as it were varicose; but this is an appearance which may be regarded, perhaps, rather as an effect of the obstruction in these glands than a cause of the disease.

The period of time which different inflammatory diseases occupy is, in some more, in others less definite; but in every inflammatory disease, whether of long or short duration, we shall find that the local and constitutional symptoms will be modified, and their progress accelerated or retarded, first, by the particular constitution and general state of the system of the patient affected with inflammation; secondly, by the nature and action of the exciting causes which produce inflammation; and, thirdly, by the structure and functions of the parts in which inflammation occurs.

In inflammatory affections, where the local symptoms are present only in a very slight degree, or to a very limited extent, there the constitutional symptoms may either not exist at all, or may be so slight as to be scarcely discernible. These cases, however, are but few in number; more frequently we find the local and constitutional symptoms bearing, as it were, a certain proportion to each other. The proportion, however, between the degree of local and constitutional symptoms is neither constant nor uniform in inflammations of the same parts, nor in inflammations of the same apparent extent of surface; for in some cases, the local affection appears to be but trifling, while the constitutional symptoms are exceedingly severe, and in other instances again, though the local affection seems to be such as to threaten the destruction of the part in which it occurs, the constitutional symptoms are so mild as to be with difficulty perceptible.

The general varieties of particular constitutions, and their influence in modifying the phenomena of health, as well as of disease, I have already had occasion to point out to your notice, under the names of temperaments, idiosyncrasies, and diatheses.

By the general state of the system in which inflammation occurs, I wish to express those variations in each of those temperaments and diatheses, which may be induced by the climate or region in which we reside, by the air which we breathe, by the food upon which we live, by the liquors we drink, by the kind and degree of labour we perform, or by the pleasures in which we indulge. The influence of these circumstances, which have been absurdly denominated the non-naturals, in modifying the appearances of diseases, but particularly of inflammatory affections, in rendering them violent or mild, acute or chronic, active or passive, have been remarked in all ages, and are too well known to require illustration. Neither will it be necessary for me, I conceive, to take up your time at present, in considering the diversities produced by differences in the nature and action of the exciting causes of inflammation, for this is a point to which we shall constantly have occasion to refer, in the consideration of each individual inflammatory disease.

The influence of structure, in modifying the phenomena of inflammation, must have been obvious to every attentive observer; yet it is a subject which has been little cultivated

in many respects, and which, it is to be regretted, has not hitherto obtained that attention from medical men which its importance seems to deserve. The subject is in itself so extensive, and would conduct me, were I to pursue it in detail, into so many paths of research not immediately leading to the proper object of these Lectures, that I must content myself with only very general, and, I may add, superficial views.

The human body is a very complicated machine, in the composition of which a number of lesser systems or subordinate machines co-exist, which, by their united operations, conspire to produce the phenomena of life. Each of these lesser machines, in the general system, is characterised by the physical and vital properties which it exhibits, and by the functions which it performs. Thus we have the sensitive, the locomotive, the assimilating, circulating, and absorbing systems. But each of these systems, though possessing properties and performing functions peculiar to itself, is not found to be simple in its structure or composition, for every organ in the body is formed of several textures or structures, which may be regarded as the elements of which it is immediately composed.

Few attempts have hitherto been made to determine the number of the primary or simple textures which enter into the composition of the human body, or to ascertain in what physical and vital properties their specific differences consist. Some of them indeed, such as cellular membrane, nervous and muscular fibre, bone, cartilage and tendon, are sufficiently well known, and their properties sufficiently distinct, to enable us to perceive the advantages which may be obtained from attending to the modifications which inflammation undergoes in these particular structures. But, besides those I have mentioned, there are other textures, which, in the present state of our knowledge, must be regarded as simple, though they are perhaps formed of those which I have already mentioned, or of textures, the nature and properties of which are still to be discovered. In this light, I conceive, we are to view the textures of arteries, veins, absorbents, secreting glands, and the various kinds of membranes which enter into the composition of particular organs.

Every organ in the human body, however simple in appearance, is composed of more or fewer of these textures.

Thus, the stomach for example, which at first sight appears to be a simple uncompounded organ, will, when examined attentively, be found to consist of several textures, all differing in their structure and other properties from each other. The external surface of the stomach is covered by a membrane, the peritoneum, denominated serous; distinct layers of muscular fibres are seen imbedded in a net-work of cellular texture, and its inner surface is lined by a membrane, which, from the fluid it secretes, is termed mucous. These four textures, arranged so as to form the hollow bag or cavity of the stomach, are again interwoven with, or penetrated by several other textures, such as arteries, veins, absorbents, and nerves; and though it is upon the united co-operation of all these textures that the functions of the stomach necessarily depend, yet each of them is liable to its own mode of derangement, each of them may be affected differently in the state of inflammation. The same remark is applicable, I conceive, to the intestines, uterus, secreting glands, lungs, and organs of sense, in short, to all the parts which are composed of a variety of textures.

Inflammation in all the different textures and organs of the body may, in one point of view, be regarded as forming one and the same specific disease; yet, as the appearances which it exhibits, and the effects which it produces in the body, are uniformly modified by the textures and organs in which it occurs, it becomes necessary to ascertain, if possible, in what these modifications consist. I am not prepared by my own observation, nor sufficiently instructed by the observations which I have been able to find in the writings of others, to enter so fully into the consideration of this subject as I could wish; I must, therefore, content myself with endeavouring to direct your attention to it, by taking a very general view of some of the more obvious properties of these textures in the sound state, and of their more remarkable appearances when inflamed. In the present imperfect condition of our knowledge respecting them, the order in which they are mentioned must be a matter of very subordinate consideration.

As one of the most familiar, though certainly not one of the most simple of these textures, I may begin with the skin. This texture is the seat of a multitude of inflammatory diseases, all differing from each other in many essential particulars, but all exhibiting more or less of the same visible

appearances from the structure of the part in which they are seated. This common character in the inflammations affecting the skin, some authors, in particular Dr. Carmichael Smith* and M. Pinel, have endeavoured to express, by saying that it is of the erysipelatous kind. But this is obviously too limited and superficial a view of cutaneous inflammation. Erysipelas is only one mode of the existence of inflammation in this structure, and we shall have occasion to describe inflammations of the skin differing so widely in their local and constitutional symptoms from erysipelas, as to form many separate and specific diseases.

The redness in inflammatory affections of the skin, may occur in a single spot of a size just visible to the eye; or, in several spots with intervening uninflamed interstices, or, as in erysipelas, it may occupy, by continuous extension, the whole, or only a part of the surface of the body. The inflamed spots may be on a level with the surrounding skin, or they may be more or less elevated above it. By the form in which they appear, or by the manner in which they terminate, inflamed spots of the skin, therefore, may require to be distinguished into pimples, rashes, pustules, vesicles, or tubercles.

From injection as well as from inflammation, it would appear that the cutis, besides other parts, consists chiefly of a net-work of fine capillary vessels, which are filled with red blood in the state of inflammation, but which are not in that state always distinguishable from each other. These vessels are situated chiefly in the exterior layer; for when we press upon inflamed skin the redness disappears, a phenomenon which could not be so easily produced did the inflammation extend to the subjacent structure.

The pain which accompanies inflammation of this texture is usually hot, sharp, and pricking. The swelling of the skin itself, from the nature of its structure, is never very great, but cutaneous inflammation is often attended with great swelling of the subjacent cellular membrane. The constitutional symptoms are in general severe, but extremely variable both in degree and duration. They are sometimes of the sthenic, though most frequently of the asthenic character. Hence it is that we have so seldom occasion to employ venesection in cutaneous inflammation. Some inflam-

* 2d. Vol. London Medical Communications.

mations of the skin seem to proceed from, and others to be connected with, derangements of the digestive organs.

The most remarkable circumstance attending inflammatory affections of the skin is, that several of them occur only once during life, and that by this occurrence the body seems to be rendered incapable of any future attack of the same specific inflammation. In many inflammations of the skin, the duration of the local, and sometimes also that of the constitutional symptoms, is limited to a fixed period; in others these symptoms have no fixed duration.

It is unnecessary for me to say much of the cellular texture lying immediately under the skin, as you must be sufficiently well acquainted with its general structure, and with the very great share which it has in the formation of almost every organ in the human body. By the authors to whom I lately alluded, the cellular membrane has been considered as in a peculiar manner the seat of phlegmon or boil, and accordingly they have given the name of phlegmonous to the inflammation of cellular texture. The phenomena of phlegmon have indeed been more attended to than those of any other form of inflammatory disease, and hence it is, that almost all the general descriptions which we find in books, either of physic or surgery, of the appearances, progress, and terminations of inflammation, are taken from and are chiefly applicable to the state of phlegmon, and have often but very little relation to the other no less distinct forms of inflammatory diseases. But though phlegmon be the most common form in which inflammation appears in this structure, it is by no means the only form, as I shall afterwards have occasion to mention to you, when we come to treat of erysipelas extending to this structure, and of carbuncle. By the cellular membrane every where extending from the surface of the body inwards, and by its entering so largely into the composition of almost all the organized parts of the body, we readily perceive why inflammation, when it occurs in this structure, becomes in some instances so very widely diffused. The constitutional symptoms in the inflammatory affections of the cellular membrane, like those attending inflammation of the skin, are usually of an asthenic character. They are almost all accompanied by derangements of the digestive organs.

Of membranes, besides the cellular, a great variety enter into the composition of different parts of the body, though,

for the sake of arrangement, they may all perhaps be referred to the following, viz. Mucous, serous, synovial, and fibrous membranes.

At the openings of all the internal canals of the body, the existence of an epidermis, or cuticle covering the canal, is evident. It becomes thickened by pressure ; it may be dissected off by a careful management of the knife, and it may be separated by maceration in cold, or by the action of boiling water. This epidermis appears, however, to extend only for a short way into these canals, for its existence cannot be shown either by the knife or by maceration on the inner surface of the œsophagus, stomach, intestines, or bladder ; nor does any exfoliation or desquamation of the internal membrane of these canals ever take place in inflammation. The preternatural membranes, which are occasionally formed during the state of inflammation in these mucous canals, and which have sometimes been supposed to be formed by the exfoliation of the membrane lining them, are an exudation from the secreting vessels of a substance resembling, in many of its properties, coagulable lymph. They have been formed in the œsophagus, stomach, intestines, and urinary bladder, and usually put on the appearance of the cavity or canal in which they are formed. This exudation, however, is to be regarded as rather an uncommon appearance ; and in all the instances in which it has been observed, has never, so far as I know, exhibited any marks of vascularity.

The inflammation of these parts usually occasions, according to its degree, and according to the cause by which it has been excited, greater or less changes in the composition of the fluids which they naturally secrete. In the commencement of an attack of inflammation in mucous membranes, the formation of these fluids is often for a time suspended ; as the inflammation, however, proceeds, a colourless watery-looking discharge comes on, which is sometimes of an acrimonious nature, heating and excoriating the parts over which it passes. This is in its turn succeeded by a whitish, yellowish, or greenish discharge, which has much of the appearance and most of the common qualities of pus. Lining, as the mucous membranes do, all the internal canals of the body, nothing could be more injurious than a disposition in their surfaces, during the state of inflammation, to adhere together. Nature has carefully guarded against this,

by not giving mucous surfaces any disposition to adhere in the inflamed state, and by interposing between their surfaces the fluids which they secrete.

The constitutional symptoms accompanying the inflammation of mucous membranes are extremely variable, according to the degree in which the inflammation exists, and according also to the structure and functions of the organ in which these inflamed membranes are to be found. These symptoms must in every instance be treated according as they seem to partake more or less of the sthenic or asthenic character.

The inflammations of mucous membranes, like those of the skin and cellular membrane, may arise from specific contagion; but inflammation of cellular membrane from specific contagion does not secure the body against the possibility of a second attack; neither does that of mucous membrane effect the same purpose in any instance with which I am acquainted, unless in the case of scarlatina anginosa.

Serous membranes take their name from the fluid which they secrete in the diseased, and perhaps, also, in the sound state. They cover parts which are destined to move, but without much friction, on each other. They line the three great cavities of the head, chest, and belly, and are, at the same time, reflected over the surface of the viscera which these cavities contain. Hence their great extent and importance in the animal œconomy. Concealed necessarily by their situation from our view, we judge of the presence of inflammation in these membranes by the pain with which this affection is usually accompanied, and by the occurrence of the febrile or constitutional symptoms with which inflammation of these membranes, or of the organs which they cover, almost never fails to be attended. When we lay these membranes open in the state of inflammation, or when we artificially excite it in serous membranes already exposed, we perceive that they not only acquire a red colour, but that their surface is often covered with an exudation which, in many of its properties, resembles coagulable lymph. In many instances this substance is secreted in an organizable condition; and in this state it is the presence of coagulable lymph which enables us to understand readily why serous membranes have such a tendency to adhere together in the state of inflammation. Sometimes when the degree or mode of inflammation is changed in serous mem-

branes, pus is thrown out without any mark of previous ulceration : of this some very striking instances are now on record. Granulations sometimes form on the surfaces of inflamed serous membranes ; but this is a still more rare appearance than the formation of pus, and they are probably the effect of a scrofulous disposition. Inflammations of the serous membranes are more frequently the subjects of medical than of chirurgical treatment, but they occur sufficiently often from accidents and operations, particularly on the cavities of the chest or belly, to render the study of their phenomena objects of the very first importance to the surgeon. The febrile symptoms which accompany inflammation in serous membranes, have almost always a high degree of the phlogistic or sthenic character, and hence the necessity which so often occurs for copious and repeated blood-lettings.

Synovial membranes, such as the capsular ligaments of joints, sheaths of tendons, and bursæ mucosæ, all secrete a liquor which is remarkable for its lubricating quality, and which serves to facilitate the motions of the articular surfaces of the joints upon each other. This liquor, the synovial, differs from the serum of the blood, in containing less albuminous matter, but though in a less proportion, it contains, like the serum, a matter coagulable by heat and by acids. The synovial membranes bear, in some respects, a strong analogy to the serous, but we perceive real distinctions between them, first, in the fluids which they secrete ; secondly, in the diseases to which they are liable. A dropsical disposition in the serous membranes is not attended by any increased effusion of synovia into the joints, nor is dropsy of joints attended by dropsy of the serous membranes as a concomitant affection. The synovial are much less frequently the seat of inflammation than the serous membranes. During the state of inflammation, the synovial membranes, like the mucous, very seldom contract adhesions by the interposition of a layer of coagulable lymph. When they do adhere, as sometimes happens in anchylosis, it is usually by means of granulations forming upon their ulcerated surfaces. Inflammation may be excited in the synovial membranes by wounds, by the irritation of bodies formed in the joints, and by different morbid affections occurring spontaneously in their articulating surfaces. These inflammations in general are of the chronic, while those of serous membranes are generally of the acute kind. The synovial sheaths of tendons,

which possess a structure similar in all respects to the capsular ligaments of the joints, are the seat of inflammation in whitloe. In this affection the symptoms are more violent than from spontaneous inflammation, either in the capsules of the joints or in the bursæ, and this probably from the parts inflamed not admitting readily of extension. The constitutional symptoms which accompany the inflammation of synovial membranes, are in general extremely different, according as this state happens to be the effect of external injury or of internal disease. When from external injury, the symptoms both general and local are almost always of the acute kind, and require the most powerful antiphlogistic treatment. But when the inflammation proceeds from internal disease, the constitutional symptoms are at first much milder in their nature, though they frequently terminate in an incurable hectic fever.

Fibrous membranes, such as periosteum, dura mater, sheaths of muscles and of tendons, aponeuroses, ligaments, and tendons themselves, have all a common structure. In the sound state these membranes are naturally insensible, and possess but few red blood-vessels. In the inflamed state they become highly sensible. They are sometimes the seat of rheumatic inflammation, as when it attacks the joints. The inflammation of fibrous membranes seldom or never terminates in suppuration; but when it does so, the affection is very severe, and the matter which is formed is generally confined by the sheath which covers it. The local and constitutional symptoms attendant upon inflammation in fibrous membranes vary exceedingly ac cording to the degree of that affection, but perhaps still more according to the nature and functions of the part with which the inflamed membrane is connected. Inflammation of the periosteum and sheaths of the tendons is accompanied with extreme pain; that of the dura mater by fever, delirium, and a greater or less disturbance of the intellectual functions.

Cartilage has no red blood-vessels, and is but little susceptible of the state of inflammation. In certain chronic affections of the joints this substance often disappears, or is taken up by the absorbents, without our being able to say that it has been inflamed.

Inflammation runs through all its stages in bone, and produces in that texture a greater variety of appearances

than in any other texture of the body, with perhaps the exception of the skin. The adhesive inflammation of bone manifests itself in the enlargements of bones from disease, and in the re-union of their fractured extremities. Suppuration is more frequently the effect of an inflamed state of the membranes which cover the surfaces and line the cavities of bones, than of the structure of the bone itself. Suppuration in bone is in general preceded by ulceration, and by the formation of a soft substance resembling granulation. The death, necrosis, or sphacelus, of a greater or less portion of bone, is a very common effect of inflammation, whether this be produced by external injury, or proceeds from internal disease. Nature always attempts, and often accomplishes, the separation of the portion of dead bone, and its ejection from the system, by setting up the process of ulcerative absorption in the whole line of contact between the dead and living substance; and afterwards by removing by the same ulcerative process, the soft parts which cover the portion of bone thus detached. The morbid changes which occur in bone, from the existence of inflammation in that structure, are very slow in their progress. Nothing can be more diversified in kind and degree than the constitutional symptoms which accompany inflammation in bone. When the inflammation is simple, as from fracture, the febrile symptoms are often very violent, and possess much of the sthenic character. In specific inflammations of bone, the febrile symptoms are of a less acute nature, and in general show a tendency to pass into hectic fever, in which they often actually terminate.

Muscular fibre is often the seat of inflammation, as in rheumatism, and in abscess when it has its seat in muscle.

Dr. C. Smith, in the essay to which I formerly alluded, considers the inflammation of this texture as a distinct species. The inflammation of rheumatism never terminates in suppuration, and of course it cannot be regarded as a chirurgical disease. Suppuration, indeed, appears to occur but seldom in true muscular structure. In many instances, in which we find muscles affected by that process, the suppuration most probably begins in the cellular membrane which connects the sheaths of muscles together, or these sheaths to the muscles which they cover. The most remarkable and complete destruction of muscle which occurs from suppuration, is that which is seen in the disease called psoas abscess,

where the whole or the greater part of the muscle often disappears, and its capsule is filled with the matter of suppuration.

The nervous system, strictly so called, or the medullary matter of the brain and nerves, is perhaps but seldom the seat of inflammation. It is usually in the neurilemma or membrane, in which the medullary matter is contained, that inflammation presents itself. This seems to be the case in the very painful affection which arises in inflammation from a partial division of a nerve. In the neighbourhood of parts which had often been inflamed, I have observed that the nerves were sometimes more vascular and much thicker than usual. Arnemann has made a number of experiments, which show that the extremities of nerves which have been divided re-unite, and that the place of their re-union is marked by a considerable degree of swelling, which occurs in each extremity of the nerve. A similar enlargement of the extremities of nerves occurs where a ligature has been put round a nerve, or where nerves have been divided, and afterwards attacked by inflammation, which they not unfrequently are after the operation of amputation.

Arteries sometimes inflame spontaneously, at other times this state is produced in them by chirurgical operations or experiments. I have seen the carotid in the dog obliterated by inflammation which had been artificially excited. The coats of the artery are thickened during inflammation, while its inner surface is sometimes covered with a layer of coagulable lymph. An inflamed artery is very easily ruptured. This is a fact which I first learned in making experiments upon the wounds of arteries in company with Dr. Jones.

The inflammation of veins has been more attended to than that of arteries. Mr. Hunter was the first who discovered, that the symptoms usually ascribed to the prick of a nerve or tendon, in blood-letting, are in fact often owing to the inflamed state of the vein. In some constitutions the inflammation extends, from the puncture made by the lancet in bleeding, from the elbow to the wrist, and from the elbow sometimes to the larger venous trunks terminating in the heart. In this case the inner coat of the larger veins is covered by a layer of coagulable lymph. In some instances the inflammation proceeds to suppuration, and abscesses are formed in the course of the veins. This inflamed state

of vein has sometimes been produced by the simple application of a ligature for the cure of varix, or dilated vein.

The vascular and glandular parts of the absorbent system are often the seat of inflammation. Inflamed absorbents often form a disease no less dangerous than inflamed veins. The inflammation, in severe cases, extending from the seat of the injury to the termination of these vessels in the trunks of the veins, and from these trunks probably to the heart. In inflammation of the subcutaneous absorbents, the disease is almost always communicated to the skin, so that the course of the inflamed absorbent may be traced by a line which is red and exquisitely painful.

The constitutional symptoms which accompany inflammation of arteries have never, so far as I know, been accurately observed or described; but this is by no means the case with regard to the symptomatic fever, which is so often excited by inflammation of veins and absorbents. But, though often observed, I doubt whether its real character and treatment have been at all times properly understood; for, in the histories recorded of this fever, its progress seems to have been often accelerated, if a fatal termination has not actually been induced, by the local and general use of heating and stimulating medicines.

Inflammation sometimes occurs spontaneously in absorbent glands; but it seems to be more frequently excited in these bodies by some morbid poison, or by irritation of some sort conveyed to them by the absorbents: inflamed glands, or buboes, as they are usually termed, occur in so many local and inflammatory diseases, acute and chronic, that I shall have very frequent occasion to describe the appearances which they exhibit.

To this enumeration of textures I shall only add, that I am inclined to believe it will be found, that as there are no two parts of the human body precisely the same in structure, or which possess vital properties in the same degree, so there is no texture or organ in which inflammation follows exactly the same progress, and produces the same local and constitutional effects. But for a fuller account of these textures, particularly in the sound state, I must refer you to the Anatomie Generale of the late most ingenious Professor Bichat of Paris. It is to be regretted that Professor Bichat should no where in that work have acknowledged the obligations which he lay under to Mr. Hunter,

of whose facts and reasonings he has made a liberal use. How familiar the effect of structure in modifying the phenomena of inflammation was to the mind of Mr. Hunter, must appear to any one who will take the trouble to read what he has said with regard to it in various parts of his Treatise on Inflammation.

To fill up, in some measure, the view which I have taken of the effect of structure in modifying the appearances and effects of inflammation, I ought perhaps, before concluding this subject, to consider a little more, in the way of detail, the appearances which chronic or scrofulous inflammation exhibits when it attacks different textures and organs of the body, and the progress of the symptoms, local and constitutional, by which its existence in these textures and organs is usually accompanied.

In many instances of scrofula the lymphatic glands appear to be secondarily, not primarily affected. That the appearance of scrofulous diseases in parts not glandular, is, sooner or later, followed by an affection of the glands, is true; but since this affection of the glands does not always exist from the beginning, it ought not, I conceive, to form an essential part in our definition of the disease; for, so far is the affection of the lymphatic glands from being the first symptom in the order of the appearance of scrofula, that I remember but few instances comparatively of the disease appearing in the external glands of the body, where it had not been preceded by some local affection of the contiguous and communicating parts. But when the disease is once produced, it seems to be readily communicated from the original seat of the affection to the lymphatic glands, and probably also from one gland to another. Indeed, I am very much disposed to believe, that this disease very seldom occurs primarily in glandular parts. Scrofulous swelling of the mesenteric glands will readily occur to you as an example of glandular parts being primarily affected. But even here, perhaps, the vitiated state of the chyle may be regarded as the exciting cause of the disease. A blow given to a lymphatic gland will induce scrofulous inflammation in that gland, but the same affection will be communicated to the gland, though the injury be done to a part situated at a considerable distance from it. The exciting cause in the one, as in the other case, may be foreign to the gland. Swellings of this kind, arising from external injury, have been denominated *false* or *symptomatic* scrofula, in order

to distinguish them from those that occur as original idiopathic affections.

The effect of the absorption of different morbid substances upon the gland is sufficiently singular. The absorption of the matter of venereal ulcers produces venereal swellings of the glands; of scrofulous matter, scrofulous swellings; and of cancerous matter, cancerous swellings. This would seem to indicate not only that there is something specific in the disease, but also that the glands are affected readily by local irritation.

The lymphatic glands most frequently affected with scrofula are those which are situated on the neck. These glands are much exposed to the vicissitudes of temperature, and it is this circumstance, perhaps, that renders them so liable to become the seat of scrofula. Sometimes only one or two of the cervical glands become diseased, in other instances a number of them are affected, either simultaneously or in succession. In some instances these glands swell to such a size as to threaten suffocation; or, by preventing the return of the venous blood from the head, produce an apoplectic death. These swellings of the cervical lymphatic glands occur sometimes as original idiopathic affections; at least we are unable to trace them to any morbid affections in the contiguous and communicating parts. I am, however, disposed to believe, that they are truly symptomatic, or, in other words, that they arise from irritation in parts not glandular, in many cases in which, without due attention to the history of the disorder, we should be disposed to regard them as original and idiopathic affections; because, in inquiring into the circumstances which preceded these swellings, we not unfrequently find that some local injury or disease had actually existed, though it might be too slight to arrest the attention of the patient at the moment of its occurrence, or too remote in point of time, from the appearance of the swellings, to lead to the belief that they were connected with it. We every day see examples of this in those who are predisposed to scrofula from slight and transitory injuries and affections of the hairy scalp, ears, eyes, nose, and most particularly from slight and transitory affections of the teeth, gums, and other parts situated within the cavity of the mouth. The decay of the first teeth is often connected with the occurrence of glandular scrofulous swellings in the neck, but their eruption seldom or never, though this eruption not

unfrequently gives rise to much local irritation, to high degrees of symptomatic fever, and in some instances to fatal convulsions. The swellings of the cervical glands seldom appear before the end of the second year, but after this period they may be readily excited in those predisposed to them by every kind of local irritation. They often succeed immediately to febrile and eruptive diseases, such as small-pox, measles, and scarlatina. In whatever way they may be induced, these swellings are accompanied by, or perhaps I should rather say they proceed from a certain kind and degree of inflammation in the parts in which they occur. This inflammation I have already had occasion to describe under the name of the chronic or scrofulous inflammation. When the cervical glands are affected with it, they pass through the different stages of inflammation, and exhibit in these stages the phenomena which have already been described under the heads of resolution, extravasation of coagulable lymph depending upon adhesive inflammation, suppuration, in some instances mortification, very frequently ulceration, granulation, and cicatrization.

The glands of the groin and axilla are less frequently affected with scrofula than those of the neck; seldom indeed, I believe, unless where these glands seem to become diseased in consequence of the lymphatic absorbents passing through them having taken their rise from a part already affected with the disease. I remember to have seen or read of but few instances of idiopathic scrofulous swellings of the glands of the groin or arm-pit.

The glands of the mesentery are often the seat of scrofulous inflammation. The disease in these glands impedes the progress of nutrition. I have seen them affected in children of two years of age, in persons between twenty and thirty years of age, and in those who had passed their sixtieth year. In some cases the glands are greately enlarged in size, soft, and seem as if they had received an addition of bulk from coagulable lymph; in others their glandular structure is destroyed. Some of them are soft, and contain something like a white milky fluid; others are found of a caseous consistence, and contain frequently an earthy substance, which I suppose to be phosphate of lime. In this disease the appetite is often increased, and the stools white and fetid; but I have seen these glands affected without the stools being at all sensibly altered.

There are two forms in which scrofulous swellings appear in the subcutaneous cellular texture. In one of these, the swellings are soft and puffy, and manifest but little or no disposition to pass into the state of suppuration; they often appear very suddenly, and from the absence of pain and discolouration they may exist a long time without being perceived; they are usually of an oval figure, and seem to be produced by the effusion of a fluid into the interstices of the cellular texture; they are very variable in their size, being one day more prominent and tense, and the next more sunk and flaccid. I do not know of any dissection of this species of tumour. The second form in which scrofula appears in the subcutaneous cellular texture, is in that of chronic phlegmon and abscess. These swellings, which are often exceedingly slow in their progress, are accompanied by slight increase of heat, and by an increase of sensibility rather than of pain; the skin soon becomes red, and the swelling, instead of being circular, as in ordinary phlegmon, is usually of an oval figure. The pus in these abscesses is often serous and curdy, though I have found it in many instances quite healthy in its consistence and colour. Subcutaneous scrofulous abscesses may form on every part of the surface of the body. I have seen them in the same individual on the hairy scalp, neck, chest, belly and extremities. The abscess which forms in a lymphatic absorbent gland often gives rise to the production of a fistulous sore, while that which occurs in subcutaneous cellular texture most frequently terminates in an open scrofulous ulcer.

Scrofulous ulcers have characters peculiar to themselves. Their edges are smooth, pale, and tumified; the granulations, or rather raw flesh, which covers them, has a glossy appearance; they yield an unhealthy discharge, and are slow in cicatrizing; the scars which they leave behind them are smooth and pale, though raised above the surface of the skin, and always of very irregular figures.

Mucous membranes seem to be liable to attacks of scrofula; those lining the nose in particular swell, inflame, and yield an unhealthy discharge. I have seen the scrofulous inflammation terminate in ulceration in the mucous membrane lining the bladder. Gonorrhea is well known to be exceedingly obstinate and difficult to heal in persons of a scrofulous constitution.

The synovial membranes are very frequently the seat of

scrofula, in the affections well known by the name of white swellings. These affections occur sometimes spontaneously, though they are often produced by external injury. When white swellings arise from external injury, they have, in general, in the first stages of their progress at least, a more inflammatory character, than when they occur spontaneously. The disease seems usually to begin in the synovial membrane, and from this to extend itself to the ligaments, cartilages, and bones. In some cases again it would seem as if the disease began in the bones, and was from them communicated to the joints. In scrofulous affections of the extremities the bones often swell, and become so soft as to admit of being cut with a knife.

Rickets, perhaps mollities ossium, curved spine, and lumbar abscess, are all diseases which, if not scrofulous in themselves, occur most frequently in persons of scrofulous constitutions.

The morbid alterations of structure produced in the brain and nervous system by scrofula have been but little investigated. There is much reason to believe that the disease termed Hydrocephalus is, in many instances, produced by, or connected with, a scrofulous diathesis; for hydrocephalus is well known to be a very frequent occurrence in scrofulous families. In some instances, hydrocephalus has been found to be connected with scrofulous swellings in the mesenteric glands, and in others, with the presence of scrofulous tumours or abscesses in the substance of the brain itself. Scrofulous tumours are sometimes found growing in the dura or pia-mater. We know them to be such, from their being accompanied with other marks of scrofula in the constitution, and from their containing a curdy pus when they pass into the state of suppuration.

Scrofula affects also the organs of sense, and the parts which are connected with, or subservient to these organs. The inflammation which it produces in the eye is termed Scrofulous Ophthalmia, and is perhaps the most frequent cause of the permanent morbid alterations which occur in that organ. When scrofula attacks the eye-lids, it has usually its seat in the Meibomian glands. This is often a very obstinate form of the disease, and occurs in old as well as in young subjects, producing often incurable specks and ulcers of the lucid cornea.

Scrofula commits great havock on the organs of hearing,

both before and after the meridian of life. Chronic suppurations in the ear destroy the tympanum, and the malleus, stapes, and incus come out. The delicate expansion of the auditory nerves in the membranous linings of the different cavities of the vestibulum, cochlea, and semicircular canals, are either partially or wholly destroyed, and either a partial or total deafness produced. Scrofulous affections of the ears often run in families, so as to produce a family deafness.

There are few scrofulous diseases more certainly fatal in this country than phthisis pulmonalis. I will not say that every person who dies of purulent abscesses in the lungs is affected with scrofula, but I can have no doubt that at least nineteen out of twenty of these abscesses occur in persons of scrofulous dispositions. These abscesses do not first begin, as was at one time supposed, in the lymphatic glands of the lungs, but in its parenchymatous or fleshy substance. Dr. Baillie's Observations on Abscesses and Tubercles of the Lungs (the two most common forms in which phthisis pulmonalis appears) are by far the most accurate and instructive of any I have yet seen. Indeed his Compend of Morbid Anatomy is a work which ought to be in the possession of every one who is desirous of investigating the various alterations of structure, which diseases produce in the different organs of the body.

The secreting glands are often the seat of scrofula. I have met with scrofulous abscesses in the lachrymal and in the salivary glands. These abscesses occur frequently in the mammæ of women. There is reason to believe that scrofula of the mamma has often been mistaken for scirrhus, and that many of the cures of scirrhus in this organ, which have been supposed to be effected by the use of internal medicines, were, in reality, cases of spontaneous recovery from attacks of scrofula.

Scrofulous inflammation occurs very frequently in the testicle, and gives rise to tedious and painful suppurations. When slow in its progress in this organ, it is liable to be mistaken for scirrhus.

I shall say nothing of the appearances which scrofula produces when it attacks the liver, spleen, pancreas, kidneys, and urinary organs, because these are appearances which you will find extremely well described in Dr. Baillie's Compend of Morbid Anatomy. I have entered into the enu-

meration of the textures and organs in which scrofula appears in the human body, merely to convince you how frequent and how universal this disease must be in the climates in which it prevails. In this climate, at least, I think it may be fairly doubted whether there be any individuals, who, in some period or other of their lives, are not liable to attacks of scrofula in some of the various forms which it assumes.

I shall not trouble you with many remarks on the constitutional symptoms which accompany scrofulous affections, as these symptoms are extremely various, according to the age and temperament of the patient, and according to the textures or organs of the body which are affected with the disease. In some instances of scrofula, little or no febrile affection can be perceived; in others, the febrile affection is very violent, though in these cases it is usually of a typhoid or asthenic character. The most remarkable circumstances respecting the constitutional symptoms of scrofula, is the tendency, whatever their type or character may be, which, in the progress of the disease, they have to pass into the state of hectic fever. This is a state which is always accompanied with a high degree of danger; but its symptoms and treatment I shall afterwards have occasion to describe when we come to treat of suppuration.

TREATMENT OF INFLAMMATION. GENERAL AND LOCAL MEANS OF PROCURING RESOLUTION.

After the view which we have taken of the local and constitutional symptoms of inflammation, of its usual terminations, and of some of the more remarkable variations which it undergoes in the different textures of the human body, we are next to proceed to consider the means by which the symptoms already enumerated are to be removed, and the injurious consequences to which they often give rise, cured, alleviated, or prevented.

The first and principal object which the surgeon proposes to himself in the treatment of inflammation, is to moderate the local and constitutional symptoms of that state, so as to procure, if possible, a termination in resolution. This, which is often a natural termination of inflammation, may render the interference of art unnecessary, if not improper. But in many inflammatory affections, resolution is obtained only by the judicious use of artificial means. In the cases requiring them, when the artificial means are not used or used ineffectually, the inflammation may pass on to suppuration or gangrene, or it may even produce what it not unfrequently produces, a fatal termination.

The general remarks which I have to make upon the treatment of inflammation in its incipient state, before it has passed through any of its usual stages, will all be comprehended under one or other of the three following general divisions:—1st, Of the treatment of inflammation attended by a strong phlogistic diathesis, or symptomatic fever of the inflammatory or sthenic character. 2dly, Of the treatment of inflammations accompanied with fever of the typhoid or

asthenic character; and 3dly, Of the treatment of chronic or scrofulous inflammations.

I am aware that it is not possible to form general divisions that shall include all the variations of treatment which different inflammatory diseases require. These variations must be explained when we come to treat of particular diseases. But I have adopted the present division partly because it corresponds in some measure with the order in which I have had occasion to consider the symptoms of inflammation, and partly also because we shall find that each of the three kinds of inflammation I have mentioned agree not only in certain characters common to the class, but coincide likewise in the general plan of treatment which each inflammation, or rather class of inflammations, requires.

The means which experience has shown to be best adapted for the cure of inflammation are generally divided into two kinds; those which act upon the inflamed parts more or less directly, termed the Local or Topical means, and those which seem to produce their beneficial effects by acting primarily upon the general system, usually termed the General or Constitutional means of cure.

This division, though sufficiently convenient for the purpose of arrangement, is not in all respects accurate, for several of the local remedies employed for the cure of inflammation seem to act only through the medium of the general constitution. We have examples of the class of local remedies to which I refer, in those applications that are made to parts situated at a greater or less distance from those which are inflamed.

The general means of cure are more particularly required in those inflammatory affections which are accompanied by a high degree of febrile or inflammatory symptoms. We trust to the efficacy of the local remedies chiefly in those inflammations, in which constitutional symptoms either do not occur at all, or occur only in a very slight degree. Some inflammatory affections require for their cure the employment only of the constitutional means, others are relieved, chiefly by the local. In many, however, both means of cure are required. We shall first consider the constitutional means of cure.

The general or constitutional means employed for the cure of inflammation, attended with the phlogistic or sthenic

diathesis, are described in medical writings under the name of the Antiphlogistic Regimen or plan of cure.

The first of these means to be mentioned is general blood-letting. By this we diminish the quantity of blood circulating in the vessels of the human body, and at the same time the strength and often the frequency of the action of the heart and arteries. In many inflammations, particularly those of the parts contained in the three great cavities of the head, chest, and belly, general blood-letting, if not the only, is the principal remedy to which we can trust for a cure. The quantity of blood, which in these inflammations it is necessary to take away, varies according to the violence of the inflammation, the temperament, strength, and habits of the patient, and according to the structure, functions, and situation of the organ in which it occurs. From twelve to twenty ounces, or even more, ought generally to be drawn every time we have occasion to use the lancet in the cure of inflammation, and bleeding to this extent may be repeated two or three times in the course of the first twenty-four hours, according to the effects which it seems to produce, as well as according to the violence and urgency of the symptoms. In inflammation of internal parts, we judge of the effect of bleeding, and of the necessity of a repetition, from the feeling and continuance of pain, from the state of the pulse, and also from the appearance of the blood which has been last drawn.

A partial and in some instances an almost complete cessation of pain takes place even during the operation of blood-letting. This is always a favourable symptom, and indicates that the inflammation has made no great or very alarming progress. In other instances, the relief from pain, though inconsiderable at the time of bleeding, becomes afterwards more sensible, and the other symptoms of inflammation abate in nearly the same proportion; while in other instances again, the pain is either not relieved by the bleeding, or, if relieved, the relief is but of short duration. These last are cases in which, the other symptoms of inflammation continuing unabated, recourse must be had again to the use of the lancet, and as much blood drawn as can be done with safety to the patient.

The changes which take place in the state of the pulse, either with regard to its frequency or strength, during, or

soon after, the abstraction of blood, though they afford criteria, by which we may judge of the state of the inflammation and of the effects of the bleeding, are by no means marks so sure of the advantage which has been obtained as that derived from the cessation of pain.

In some inflammations of the head, for example, the pulse is slower than natural, though it beats with its accustomed or even with an increased degree of strength. In inflammations also of the peritoneum and of the intestinal canal, we find the pulse not much quicker than natural, small, and contracted. We should deceive ourselves, therefore, were we to infer that an increase of inflammation had taken place, because, in the first instance, the pulse had become quicker, and in the second, fuller and stronger during or soon after the abstraction of a quantity of blood.

The pulse, it may be remarked, has often a contracted cord-like feel in inflammation, and it may always be regarded as a favourable event when it becomes softer, fuller, and slower, during or soon after blood-letting.

The presence of the buffy coat, I already had occasion to remark, is not always a certain test of the existence of inflammation, though, when taken along with other symptoms it is often one of the circumstances to which we must trust in forming our opinion with regard to the state of that disease. In examining the blood drawn, therefore, it is not by the buffy coat alone, but by the buffy coat in conjunction with the quantity and firmness of the coagulum, that we must judge of the propriety of any farther detraction. When the buffy coat has a firm and tenacious consistence, and when the pain continues unabated, there is reason to dread that the inflammation has not been subdued. But when, on the contrary, the coagulum is soft, easily broken, and when the colour of the buffy coat is changed from a yellowish to a greenish hue, whatever progress the inflammation may have previously made, little or no advantage is to be expected from the farther detraction of blood.

Hitherto I have spoken only, it will be obvious, of that detraction of blood by which the mass of circulating fluids is diminished. But it has been conceived that considerable advantages are to be obtained, in the inflammation of particular parts, by drawing the blood from the larger vessels going more immediately to, or returning from these parts. Thus, that in an inflammation of the brain, the same quan-

tity of blood taken from the external jugular or from the temporal artery, would produce a much more salutary effect, than if it had been taken from the arteries or veins of the arm. This opinion is in some respects undoubtedly just, but whether to the extent which has been imagined, I am unable, from my own observation, to confirm or to refute. It seems to derive some support from the effects which result from topical blood-letting. For this, we know, is often more powerful in removing particular inflammations than any general bleeding that can be employed.

The remarks which I have made with regard to blood-letting, relate chiefly to its employment in inflammations arising from variations of temperature, or from external injury in the deeper seated organs of the body. There are, however, many inflammations attended by fever, partaking, in some instances, of a considerable degree of the sthenic or phlogistic diathesis, where, if the lancet be used, it ought to be used sparingly and with caution. This is the case in most inflammations of the skin, and in most of the eruptive exanthematous inflammations. In these diseases, the necessity for blood-letting must be determined in individual cases by the particular circumstances of the case, and not by any general rules of practice; for these diseases are attended by very different constitutional symptoms, in patients of different temperaments, and in these patients the same disease may, in some rare instances, require different or even opposite modes of treatment.

The inflammatory fever succeeding to external injuries, or to chirurgical operations, undergoes a kind of natural crisis by the appearance of suppuration. In these instances therefore, unless when the patient is strong and in full health, when the disease is seated in an organ of much importance to life, or is in danger of spreading, as is the case in all inflammations of the membranes lining the three great cavities of the body, the lancet ought to be used with caution. For we may, by too free a detraction of blood, produce a sudden sinking of the powers of life, and convert the existing constitutional symptoms into fever of a different type or character. But in all cases of inflammation in which any doubt arises with regard to the farther general detraction of blood, it may, I believe, be laid down as a general rule, that it is safer to employ local than general blood-letting.

Blood-letting in inflammatory diseases, I may finally remark, is to be regulated in all cases by the knowledge which we have of the nature of the prevailing epidemic, and of the remote causes by which the inflammation has been induced, by the season and climate, by the degree of phlogistic diathesis existing in the constitution, by the period of the disease, by the age and usual habits of the patient, by the knowledge which we have of his former diseases and of the effects of blood-letting in them, by the appearances of the blood itself, and by the first effects of venesection.

The second general means to be employed for subduing inflammation are purgative medicines. These are means of subduing inflammation which are much less powerful than the lancet, but they are often necessary and most useful auxiliaries.

Of purgatives adapted for the treatment of inflammation we have a great variety. But the purgatives usually employed in the commencement of that state are those of the saline class. Phosphate of soda, tartrite of potass and soda, or the sulphates of soda and magnesia, in doses from two drachms to half an ounce, may be given every half hour till a sufficient evacuation has been obtained. These substances, besides possessing a cooling quality, seem to produce a beneficial effect, by the copious discharge of fluids which they occasion from the secreting mucous surface of the alimentary canal.

Purgatives are a class of remedies which it is necessary to employ in almost every species of inflammatory disease. But the kind, the form, and the quantity of these, must be varied according to the effects which we wish them to produce, and according to the age, strength, peculiarities of constitution, or even according to the prejudices of our patients. Not only in inflammatory affections, but in almost every disease to which the human body is liable, the period of twenty-four hours should never be allowed to pass without a stool. I deem it, however, the less necessary to dwell upon the beneficial effects to be obtained from the use of purgative medicines in the treatment of diseases, that you will find so many new and convincing proofs and illustrations of these effects in Dr. Hamilton's observations on this subject; observations the more deserving of your attention, that, like those of Hippocrates and Sydenham, they are founded solely on the basis of experience; and, to the credit of

the age in which we live, have done more to overthrow some false theories in medicine, than could have been effected by many volumes of the most ingenious and plausible reasoning.

Purgatives are more or less required in almost every species of inflammation, but they are more peculiarly necessary in those which are accompanied with a high degree of fever, or with derangements of the digestive or biliary organs. In cases of inflammation, which have a tendency to spontaneous resolution, they are almost always the best, and often the only remedies that are required.

A third means of subduing inflammatory fever, is the use of diluent drinks, of diaphoretic medicines, and the warm bath topically or generally applied. These seem all to have a common effect in diminishing the heat, and promoting the perspiration of the skin. They prove useful in inflammation, perhaps, not only by restoring the natural secretion from the surface of the body, but also by the evacuation which they occasion.

The form of the diluent drinks, the basis of which is water, may be varied in an infinite number of ways to suit the taste of the patient; but in whatever form they are given, nothing of a heating or stimulating quality should be added to them. When they are intended to allay thirst, as well as to promote perspiration, the addition of some vegetable acid, such as lemon-juice or cream of tartar, renders them in general very palatable to patients. In the earlier stages of inflammation, and where the object is to induce a moisture on the skin, the mineral acids, though they might serve to quench thirst, are not to be employed, as they tend rather to check than to promote the flow of sweat.

Of diaphoretics there is a very great number; but the citrate of potass and the acetate of ammonia, with the different preparations of antimony, such as the tartris antimonii and James's powder, are those which are most commonly employed in the treatment of acute inflammation. These antimonial diaphoretics, from their effects in producing sickness and weakening the pulse, may, in some cases, have a superior efficacy. In the inflammatory affections, accompanied with bilious or gastric symptoms, these substances may be employed in small and repeated doses, so as to produce also an emetic or purgative effect. The late Mr. Dease, of Dublin, and M. Desault, used to give a weak

solution of emetic tartar for the cure of bilious erysipelas. I have often imitated their practice in this particular, and with the most beneficial effects, though the medicine, during its employment, often occasioned a considerable and distressing degree of sickness.

Those diaphoretics, into the composition of which opium enters, seem to be better adapted for inflammation attended by fever of a typhoid character, or for cases where the inflammation has existed for a considerable time before diaphoretics are employed. Given at an early period in acute inflammatory diseases, opium never fails to excite vascular action, and to aggravate all the symptoms of fever. Opium, therefore, is not to be used, unless to allay the pain and irritation from a chirurgical operation, or from the recent infliction of an external injury. Indeed, unless when the patient is very nervous, and complains much of pain, its use, even after chirurgical operation, had, I believe, in general, better be abstained from, as it almost never fails to add to the violence of the symptomatic fever, which is the necessary consequence of the operation. Its effects are often very beneficial, when the period of this fever has passed over. Though opium, when combined with antimony, or with ipecacuanha, may, and often does, act as a diaphoretic, yet even in these combinations it is apt to increase the action of the heart and arteries by its stimulating and heating qualities. It was from the utility of opium in diminishing pain, and from its beneficial effects in some inflammations attended with typhoid fever, or which indicated a strong disposition to gangrene, that some authors have been led into the erroneous opinion, that, if used in sufficiently large doses, it might be safely employed in all kinds of inflammatory complaints. But an opinion more incorrect, and likely to prove more injurious, cannot well be entertained.

The warm-bath seems to act not only by increasing the tendency to perspiration, but also by occasioning a determination of blood to those parts of the body to which it is more immediately applied. It is in this way that bathing the feet seems to relieve inflammatory affections of the head and throat. I have not seen any experiments, nor am I acquainted with any which have been made with a view to ascertain its use in the inflammations of the chest; but in all inflammations of the belly, and of the viscera contained

within that cavity, there are no other means of cure, blood-letting excepted, which afford such sudden and permanent relief as that which is obtained from hot fomentations and warm-bathing. The warmth of the water should be made agreeable to the feelings of the patient. In most instances, this warmth will be found in a temperature varying from 85° to 95° of Fahrenheit's scale. A temperature higher than this begins to stimulate, and may increase, rather than tend to diminish the constitutional inflammatory fever. The time also which the patient is to remain in the bath must vary always according to circumstances. It may extend from ten minutes to an hour, or even longer. But it must not be continued so long as to induce fainting, for the coldness of this state is almost always followed by a degree of heat and febrile reaction. After coming out of the bath, great care must be taken to prevent the access of cold air, otherwise more harm than good will result from its use.

As one of the most powerful of the diaphoretic remedies to be employed in some inflammatory affections, some of you may perhaps be surprised by my mentioning to you the affusion of cold water. When properly used in the commencement of most inflammatory eruptive diseases, the cold affusion produces an abatement of febrile heat, a remarkable diminution in the frequency of the pulse, and, in most instances, a tendency to perspiration. I can refer you, with a confidence confirmed by extensive trials, to the late Dr. Currie's Reports, for an accurate account of some of the diseases and particular circumstances in these diseases, in which the cold affusion may be not only safely, but advantageously applied to the surface of the body. I do not know of any medical practice, which effects more sudden, extensive, and important changes in the feelings and condition of the patient on whom it is employed, than are produced by the cold affusion; nor any medical work in the English language, from the perusal of which you are likely to receive more instruction and pleasure, than from Dr. Currie's Reports; whether you attend to the liberal spirit of inquiry that pervades it, the superior elegance of the work considered as a literary composition, or the accuracy and importance of the observations which it contains.

To the means already mentioned, I have to add low diet. By this term is understood, total abstinence from animal food, and from every liquor containing alcohol in its com-

position, and the use of only a small quantity of the milder and more easily digested farinaceous vegetable substances. Nature commonly guards us sufficiently against any improper use of animal food, by the loathing which occurs in the commencement of an inflammatory or febrile attack; but we must not trust implicitly to this loathing, for it occurs in very different degrees in different persons; and I have repeatedly seen patients attacked with inflammatory diseases, who had still a very keen appetite for animal food. When indulged, this appetite never fails to add to the violence of the complaint, by the increased degree of heat and of vascular action which animal food occasions. Even in diseases where no symptom of inflammation occurs, as in low typhous fever, and in typhoid inflammatory affections, animal food must always be abstained from in their earlier stages, on account of the heat and increased vascular action which it excites. Yet incalculable mischief is every day done in the practice of our art, by inattention to the immediate and direct effects which the use of animal food produces in febrile and inflammatory diseases.

Liquors, containing alcohol, have all a similar tendency with animal food. They seem to differ in their operation from animal food, chiefly in producing their effects more suddenly. You can never be sufficiently cautious in guarding your patients from their pernicious use. They often, and in a few minutes, rekindle inflammations which had been nearly extinguished. They are hurtful in all inflammatory complaints, but particularly so in inflammations of the brain and its membranes whether arising spontaneously, or from external injury.

Farinaceous, or vegetable mucilaginous substances, to which a little saccharine or acid matter has been added, dissolved in a large proportion of water, and this proportion increased according to circumstances, should form the only diet in the commencement and during the progress of an acute inflammatory disease. The fructus acido-dulces, or sweet acid fruits, when they can be procured, may be used also as a substitute for food, or occasionally between meals.

Even milk, as partaking of an animal nature, is, in the commencement of inflammations, almost always improper; when used it should be largly diluted with water, or deprived of its albuminous, or caseous part by coagulation. But for more minute information on the articles of diet which

may be safely used in inflammatory complaints, I must refer you to the books which have been published, and to the lectures which are given on dietetics, and on the practice of physic. I have introduced the subject merely to warn you of its importance. Attention to the ingesta in disease is often of more consequence than any remedies you can employ; and the situation of your patient will often require that you should not only know the particular kinds of food which are best adapted to his constitution or complaint, but also that you should be able to suggest a variety of agreeable forms in which this food may be conveniently taken. To pander for a sickly appetite may seem to be a degrading occupation; but, in the practice of our art, nothing is to be considered as mean or contemptible, that can take from the misery, or add to the comforts of those who entrust their lives and their health to our knowledge and our care.

2dly, Of the treatment of inflammatory affections, attended by constitutional symptoms, or fever of the typhoid or asthenic type: We have examples of this kind of fever in the inflammations which appear in cutaneous texture, such as the fever which accompanies confluent small-pox, the malignant measles, scarlatina, typhous fever, plague, carbuncle, some forms of erysipelas, very severe burns, and the state of gangrene, &c. In the asthenic, or typhoid symptomatic fever, the heart and arteries contract more frequently, but with less force, than in the sthenic or phlogistic state. Between the extremes of these two states, however, there are many intermediate degrees, and the practice therefore in particular cases must be regulated by the notion which we entertain of the prevailing and essential character of the fever, and by the knowledge which we have of the age, strength, and constitution of the patient.

When the asthenic character prevails, that is, when the fever is attended by evident symptoms of debility, the antiphlogistic plan is, in many respects, inadmissible. For the patient is apt to sink rapidly after any powerful evacuation, but particularly after the loss of blood. Even the presence of the buffy coat must not, in inflammations of this class, be regarded as an indication indispensably requiring bloodletting, if the state of the pulse, and the character of the disease, seem in other respects to forbid it.

But that part of the antiphlogistic plan which relates to abstinence from animal food, particularly in the earlier

stages of this fever, is almost in all cases to be strictly enjoined. Nothing is so injurious in idiopathic typhus as animal food; nothing, I believe, produces, in the recovery from that disease, so many relapses; and I have had but too frequent occasion to observe its injurious effects, when given at too early a period, in cases of symptomatic typhoid fever. This is one of those points in the practice of physic and surgery, however, of which it is scarcely ever possible to convince patients or their attendants. That a little beef tea, or chicken broth, should do a person any injury, who may have tasted nothing for some days, appears to them so absurd, that they will rather hazard the trial than believe it. A well-informed and experienced practitioner can in general discover whether animal food has been given, by the increase which, in the course of two or three hours after taking it, almost never fails to occur in the frequency of the pulse, in the heat of the skin and general uneasiness, in short, in all the symptoms of the fever. This is the period in which the practitioner must take occasion to point out the injurious consequences, and hint to the attendants in private, the danger of the experiment which has been hazarded.

In a few rare instances, where a tendency to sinking occurs from the commencement of the attack of a typhoid symptomatic fever, wine and other cordials may be given; but, in general, it is better to clear out daily the alimentary canal by gentle laxatives, and to allow the violence of the first attack to subside before any very powerful cordials are employed.

When the bowels are kept open, opium may often be given in the progress of symptomatic typhoid fevers, not only with safety but with much advantage. In many instances it is by far the best remedy that can be employed. Blisters are less useful than in the sthenic fever, for the parts to which they are applied sometimes show a manifest disposition to gangrene. An early use of bark and sulphuric acid has been supposed to be often useful, by obviating the tendency which occurs in typhoid fevers to mortification. I have never seen any decided benefit produced by the bark in the earlier stages of these fevers. The sulphuric acid, sufficiently diluted, forms often an excellent cooling drink. But I am unable to generalize the few observations which are to be found scattered in the writings of surgeons with regard to

the general treatment of this fever, and must therefore content myself with having pointed it out to your notice. In considering the particular inflammatory diseases in which it occurs, I shall endeavour to delineate more fully the peculiar features of this species of fever, and the modifications in the plan of treatment which it requires in individual diseases.

The local or topical treatment of inflammation is often an object of equal, and, in some cases, of even greater importance than the general or constitutional. It consists in the judicious use of a variety of means which are termed local or topical remedies; but it is to be regretted that the choice of these means, the place and manner of their application, their proper combination, the length of time they should be persisted in, and the modes in which they should be varied, in order to procure the resolution of different inflammatory affections, require more practical skill, and more attentive observation, on the part of the practitioner, than usually fall to the share of most of those who administer them. "Of the virtues of these external remedies," as has been justly remarked by Mr. Hunter, "we know nothing definitely; all we know is that some are capable of altering the mode of action, others stimulating, many counter-stimulating: some even irritating, and others quieting, so as to produce either a healthy disposition and action in a diseased part, or to change the disease to that action which accords with the medicine, or to quiet where there is too much action; and our reasoning goes no farther than to make a proper application of those substances with these virtues. The difficulty is to ascertain the connexion of substance and virtue, and to apply this in restraining or altering any diseased action; and as that cannot be demonstrated a priori, it reduces the practice of medicine to experiment, and this not built upon well-determined data, but upon experience resulting from probable data. This is not equally the case through the whole practice of medicine, for in many diseases we are much more certain of a cure than in others; but still even in them the certainty does not arise from reasoning upon any more fixed data, than in others where the certainty of a cure is less, but it arises from a greater experience alone; it is still no more than inferring, that, in what is now to be tried, there is a probable effect or good to arise in the experiment, from what has been found serviceable in similar

cases." Unfortunately practitioners are not agreed with regard to the usual and specific effects of some of the local means to be employed in inflammatory affections, nor of course with regard to the particular affections in which they ought to be employed.

In the local treatment of inflammation, our first object should be the removal of the exciting causes, whether mechanical, chemical, or specific, upon the agency of which the inflammation depends, whether these be any foreign body, dislocation of a limb, fractured piece of bone, tight bandage, acrid substance, &c.; for so long as these exciting causes are permitted to act, we can have little rational hope of benefit from the application of remedies.

Of local remedies employed for the cure of inflammation, you will find a great number mentioned by practical writers. They may all be divided, perhaps, 1st. into remedies applied to the parts immediately inflamed; 2dly. to parts directly connected with those inflamed; 3dly. to parts contiguous to, but not directly connected with, those inflamed; and, 4thly, to parts at a distance from those inflamed and unconnected with them, unless through the medium of the brain and nervous system.

Of the local remedies applied directly to inflamed parts, cold is undoubtedly one of the most powerful. In reducing the temperature, cold diminishes the morbid sensibility and pain of inflamed parts; and probably, in consequence of this, the action also of the vessels by which the inflamed parts are supplied with blood. The most common mode of employing cold is by the application to the part inflamed of cloths which have been dipt in cold water. These are to be repeated as often as they become warm, or any relief is experienced by the patient from their use. When the inflammation is seated on the remote parts of either the upper or lower extremities of the body, the inflamed part itself may be immersed in water. This immersion, as I shall afterwards have occasion to mention, has often been found useful in superficial burns. In order to increase the effect produced by cold, it has been proposed to reduce the temperature of the water below that of the surrounding atmosphere, by a proper mixture of saline bodies, as some of these are known to produce cold during their solution in water, or even in very urgent cases to apply ice or snow. The ice, however must not be employed too long, nor in too large a

quantity, for it very quickly reduces the temperature of the part to which it is applied ; and, in some instances, has been known to occasion gangrene, speedily followed by sphacelus. Some caution is necessary in applying cold to the trunk of the body, particularly to the chest, for there it is apt to occasion a translation of inflammation from the skin to the pleura or peritoneum. In hernia, attended with a disposition to inflammation, cold applications have often been found particularly useful, when employed along with general blood-letting, in retarding the progress of that state. In the inflammation which succeeds slowly to injuries of the head, a species of inflammation not more insidious in its approach than dangerous in its consequences, cold is by far the most efficacious remedy that has yet been discovered. In ophthalmia, and in some cases of inflammatory swellings of the testicles, it is also a remedy particularly useful.

It has been proposed to produce cold by pouring æther or volatile spirits on the inflamed part, in cases of strangulated hernia. I am ignorant of the particular advantages which this mode of treatment affords. Whether any of the æther be absorbed, or whether it acts merely, as would seem most probable by the cold which is induced by its evaporation, are points still to be ascertained.

There are many inflammations in which the use of cold applications, so far from being beneficial, must necessarily prove hurtful. This must be the case, I believe, in all inflammations which have their seat in the pleura or peritoneum, if we except hernia, in rheumatism, and probably also in many of the inflammations which have their seat in the skin. In treating, however, of the effects of cold, we must always attend to the distinction to be made between the temporary and the continued use of this power. Even in employing cold in the cases of local inflammation, in which experience has shown it to be useful, it must be remembered that it is in the first stage, and in the first stage only, that its use is required. Employed in the latter stages of inflammation, it may either retard the process of suppuration, where that process is inevitable, or induce and hasten on a tendency to gangrene. When the local symptoms, therefore, do not yield to the application of cold, it had better be withdrawn ; but in doing this, and in applying heat, we must always consult the feelings of the patient, as they are often the best guide which the surgeon has in applying

cold or hot substances in the different periods and states of inflammation.

The acetite of lead is often used in conjunction with cold as a local remedy for the cure of inflammation. This substance has been said to prove directly sedative when applied either to the sentient extremities of the nerves, or to the irritable fibres of the blood-vessels. But the manner in which it operates in curing inflammation is not known to us, nor is it at all times easy to distinguish between the share which the lead has in allaying inflammation, and that which is to be attributed to the coldness of the water in which it is dissolved. No one, however, will doubt of the efficacy of this remedy who has ever felt in his own body, or witnessed in others, the soothing and agreeable effects which it produces in excoriations of the skin, or in the inflammation of mucous membranes. Lead is a remedy which is often highly useful in excoriations from friction, in punctured wounds with inflammation of absorbent vessels, veins, nerves, &c. in slight burns, in cutaneous heat eruptions of the face, in fractures and dislocations, in the inflammations attending scirrhus and cancer, syphilis and gonorrhæa, in wounds accompanied with excoriation from the discharges which they emit, and in wounds attended with a burning sensation of pain. This enumeration of the cases of inflammation in which the acetite of lead may be expected to prove useful, though far from being complete, will be sufficient, I hope, to satisfy you that the study of its effects is a subject highly deserving of your attention.

In some instances in which it has been used as an external remedy, lead has been said to have produced injurious effects, —effects similar to those which occasionally arise from its internal use. I have never myself seen this, though I have seen this substance applied times without number to every form, state, and extent of inflamed surfaces. The effects to which I allude are known by the name of the dry belly-ache, or colica pictonum. This affection comes on with a violent colic, and is soon followed by a loss of voluntary motion, and wasting of some of the muscular parts of the body, attended by a change in the colour and consistence of the muscles. It not unfrequently appears in those who drink liquors, holding lead in solution, and in people employed in working with the ores of that metal. Some persons appear to be more easily affected by it than others, but we are

ignorant of those conditions of the body upon which this difference depends. If, therefore, during the application of lead to the surface of the body, any of the symptoms I have mentioned should come on, it ought immediately to be discontinued.

Several other saline substances besides the acetite of lead are occasionally employed as local remedies, in order to procure the resolution of inflammation, such as solutions of the acetite and muriate of ammonia, the sulphate of zinc, &c.; but these remedies are far less generally useful for this purpose than the acetite of lead, being adapted only for particular kinds and stages of inflammation. The solutions of the muriate and acetite of ammonia are used chiefly in the treatment of chronic or passive inflammatory swellings. In the first, or more acute stages of such inflammations, these solutions are applied cold; but in the progress of the affection they are often rendered more agreeable to the feelings of the patient, as well as more efficacious in promoting resolution, when they are made tepid or warm before using them.

Besides the remedies hitherto mentioned, all of which require in their application to be continued for some time before we become sensible of their effects, there are various other substances which produce a resolution of inflammation in certain textures, by being applied only for a few minutes, and at longer or shorter intervals. We have examples of this class of remedies in the injections used in gonorrhæa, and in the washes employed in different inflammations of the eye. The continued application of most of these substances, so far from subduing, would aggravate inflammation; they would even excite that state where it did not previously exist. Indeed, even in the cases in which they ultimately prove useful, they almost always excite a certain degree of pain and temporary inflammation at the time of their application.

Of the local remedies to be applied to parts near to, and connected with those inflamed, topical blood-letting may be regarded as the principal. This is performed by puncture with the lancet, or by the application of leeches. The effects produced by topical bleeding in alleviating the constitutional, as well as local symptoms of inflammation, are often much greater than, from the quantity of blood drawn, can be well explained. Indeed, the manner in which topical

blood-letting acts in subduing inflammation has been made the subject of much controversy among medical men. It seems now, however, to be very generally allowed, that the opening of an artery or vein must necessarily occasion an increased flow of blood into the vessel which has been opened, by its diminishing the resistance which the blood meets with in passing through that vessel, and that this increased determination of blood into any one vessel, must be accompanied with a proportional diminution in the quantity of blood sent into the contiguous and communicating collateral branches. These effects of topical blood-letting are expressed in some of the older medical writings by the terms Derivation and Revulsion. The term derivation signifying that a greater quantity of blood than usual is brought into a part; and revulsion, that, in consequence of this derivation, a less quantity of blood than usual is sent into some other parts of the body. Thus, for instance, by opening the jugular vein, not only will the blood returning from the head flow more fully than before the opening was made, but a portion greater or less, according to the state of distension, will flow back from the portion of vein below the orifice, even from the superior cava and right auricle of the heart.

It is only by this derivation of blood to the opening, and revulsion from the other parts of the body, that we can form any conception of the manner in which a deep-seated inflammation is relieved by drawing off blood locally from the surface of the body. To understand this, let us suppose the local inflammation to be seated in the pleura costalis. Puncture with the lancet, or the application of leeches, by opening the cutaneous blood-vessels, and by taking off the resistance, will relieve the inflammation by the determination or derivation of blood which must take place to the open cutaneous vessels, and by the revulsion which is at the same time produced from the pleuritic arterial, or venous branches.

In almost every case of inflammation in which we deem it proper to employ topical blood-letting, seldom fewer than from eight to twelve leeches should be employed, and even this number may be increased according to circumstances. When the relief is only partial, or the symptoms of inflammation are very severe, they may be repeated two or three times in the course of a day. The punctures with the lan-

cet are generally made at once by a number of them fixed in a case, and moved by a spring. This mode of drawing off blood, which is termed scarification, requires the use of the cupping-glass, in order to induce it to flow. But there are many situations where leeches can be used, in which topical bleeding by scarification is inadmissible.

Local bleeding is particularly useful in the inflammations which attend or supervene to injuries in all the regions and organs of the body. The use of leeches in ophthalmia is too well known to need any comment. In inflammation of the testicles in men, and of the mammæ in women, in contusions attended by inflammation, in inflammations of deeper seated parts, and particularly in the inflammations which attack the joints, local blood-letting is strongly indicated. It is seldom used in pleuritic or peritoneal inflammations, except where the inflammation appears to be confined to one spot, as in inflammations of the bladder for instance, succeeding to the operation for the stone.

Scarification and leeching are seldom had recourse to in those cases of inflammation in which it has already attacked the skin, because it has been observed that punctures and leech-bites in inflamed cutaneous texture are liable to aggravate the inflammation already existing, or even to bring on the state of mortification. The leech-bites are in many individuals followed by a high degree of swelling, but this is usually of an œdematous rather than an inflammatory kind.

The application of cold, either alone or in combination with lead and the saline substances, I have already mentioned, may be useful in many of the cases in which local blood-letting is required. We have every day proofs of their efficacy in producing the resolution of inflammations seated in the substance of the mamma, testicle, inguinal, or axillary lymphatic glands, before it has been communicated to the cellular membrane or skin covering these organs.

As belonging to the local remedies, to be applied to parts in the neighbourhood only of those inflamed, I ought to mention blisters, rubefacients, and warmth. Blisters are never applied to a part which is actually inflamed. They seem to be chiefly useful by exciting inflammation in a contiguous part. It is from this tendency which blisters have to produce inflammation, and of course a certain degree of fever, that they are seldom to be employed in

acute inflammatory fevers, till the constitutional symptoms are by other means in some measure subdued. Applied in the commencement of the attack, they would add to its violence, and the salutary local effects which may be derived from them in a latter stage of the disease, would be more than counter-balanced by the evil which they must produce. Practitioners, therefore, seldom have recourse to blisters, till the violence of the constitutional symptoms have been subdued, by blood-letting and by cathartics. In cases where the constitutional symptoms are moderate, they may be had recourse to in a more early stage of the disease; and when judiciously and timely applied, they often render the use of the more powerfully debilitating means unnecessary.

Of the same nature, though milder in their operation than blisters, are the whole class of rubefacients. They produce a determination of blood to the parts to which they are applied, and, in a manner not yet well understood, occasion a diminution in the action of the vessels, and consequently in the quantity of blood with which the inflamed parts are supplied. This influence is exerted more or less directly in different instances. The extremities of the intercostal arteries may open both on the pleura lining the chest, and on the surface of the skin covering it, and whatever excites an increased flow of blood into one of these textures, may be conceived to be attended with a proportionally diminished flow into the other texture. But blisters are found by experience to be efficacious in removing inflammation, where no communication whatever can be traced between the blood-vessels of the inflamed part and that to which the blister is applied. We have examples of this mode of action in the beneficial effects obtained from the application of blisters in inflammation of the brain and the membranes immediately covering it, of the lungs and intestines, or of any of the viscera contained in the cavity of the abdomen. The nearer in such instances the blister or rubefacient can be applied to the part inflamed the greater is the relief obtained; and in general, I believe, it may be laid down as a rule, that the relief which they afford will be proportional to the degree of inflammation which they excite.

After having mentioned cold as one of the most powerful topical means of repelling inflammation, it may seem strange that I should now mention heat or warmth. But however contradictory this may appear, it is nevertheless

true that fomentations or embrocations with warm water are often a very powerful means of abating internal inflammations. This effect is very apparent in some of the deeper seated inflammations, as in the inflammation of the urinary bladder, intestines, or other viscera contained within the cavity of the abdomen. The warmth in this case may be applied to the surface of the abdomen by bath or by fomentation, or, in the way of injection, by the anus. Perhaps the warm water in the instances in which its application gives relief, acts in a manner similar to rubefacients and blisters; for in the cases in which one of these remedies is required, the others will seldom, I believe, be found unnecessary or improper.

In some inflammations of the joints, warmth also is found very useful. These, however, are inflammations which have a tendency to the chronic state. Warm water may be used alone, or medicated by herbs: but herbs are now seldom used in the way of fomentation, unless in compliance with ancient custom, or with the prejudices of particular individuals. The discutient power of the warm water may be increased by the addition of various substances, such as vinegar, spirits of wine; saline substances, such as common salt, acetite, and muriate of ammonia. But these warm and stimulating embrocations are used chiefly, as I shall afterwards have occasion to mention, in the passive, chronic, or more indolent species of inflammations.

The fourth division of local remedies includes those which are applied to parts at a distance from those inflamed and unconnected with them, unless through the medium of the brain and nervous system. We have examples of the remedies to which I refer in the use of sinapisms, blisters, and issues. The irritation of a sinapism applied to the foot, may relieve from an attack of gout in the head or stomach. Bathing the feet and legs gives relief in inflammation of the bowels; and the application of a blister or caustic to the neck may cure an inflammation of the eyes, or prevent an attack of apoplexy. In these cases, instead of pretending to explain the relief obtained upon the principle of derivation and revulsion, we say that the cure of the inflammation, and alleviation of the internal pain, arise from the counter-irritation which the blister or caustic excites. Many proofs of the operation of counter-irritation are to be found in the healthy and diseased states of the animal œconomy; but these have not

hitherto, so far as I know, been collected or arranged so as to enable us to reduce them to any thing like a general fact or principle.

In treating of resolution, and of the means of procuring it, I have all along regarded it as a desirable event. But, before concluding this subject, perhaps we ought to inquire whether there be any inflammations in which it is improper or unnecessary to attempt to bring about resolution. If any such inflammations exist, they are few in number. We sometimes excite inflammation artificially as a means of cure in particular diseases and injuries, such as hydrocele and the soft union of fractures; but in these cases it is only a certain degree of that state that is safe or proper for accomplishing the object we have in view by its excitement. If the inflammation exceeds this degree, it may threaten danger to the patient, or defeat the purpose for which it was excited; and on this account, it may become necessary to employ the means best adapted for procuring resolution.

Inflammation undergoes a kind of resolution, in many instances, by passing into the state of suppuration. This is the case in contused wounds, in wounds the edges of which cannot, from the loss of substance, be brought into contact, and even in wounds in which, though their edges be brought into contact, adhesion does not occur. In wounds of this kind we endeavour to procure a resolution of the inflammation by bringing on the process of suppuration. Even in the cases in which the local remedies of inflammation employed to procure resolution fail in producing that effect, they are often extremely useful in preventing the increase, and in diminishing the degree of that state, which occurs in the parts surrounding the point of suppuration.

Eruptive exanthematous diseases run through a distinct and limited course, and terminate most frequently in spontaneous resolution. In the treatment of these affections, therefore, it is as unnecessary as it might be hurtful to attempt to accelerate or retard the progress of that termination. It is only when the inflammation becomes violent in these diseases, and threatens to terminate in suppuration or gangrene, that it is either proper or necessary to have recourse to the use of the local and constitutional means which are calculated to promote resolution.

3dly. Of the treatment of scrofulous inflammation; from scrofulous inflammations occurring in so many parts of the

body, and producing so great a variety of effects, it must already have occurred to you that there can be no general plan of cure, no mode of treatment equally applicable to the varying seat and symptoms of scrofula, and none equally proper in every stage of the disease.

Wiseman, whose writings upon this subject are very deserving of your attention, remarks, that in order to the cure of scrofula, three intentions are required; the first consists in the regimen of diet, and other non-naturals; the second in pharmacy, or internal prescriptions; and the third in the application of externals. I shall follow this arrangement in describing the means of cure.

Scrofulous inflammation may possess in its origin more or less of an acute character, and it is by this circumstance chiefly that its treatment at that period should be regulated. If the action of the heart and arteries be strong, and the local symptoms severe, recourse must be had to the use of the antiphlogistic regimen. It is seldom necessary, however, to employ general blood-letting, and in the cases in which it is employed, still less necessary to repeat it.

I formerly mentioned unwholesome and scanty food as one of the remote causes of scrofula, so that wherever we have occasion to suspect that the disease arises from this cause, we are to seek for a cure in the amelioration of the food, rather than the employment of medicine. Indeed, there are very few cases of scrofula in which the regulation of the diet is not an object of equal, if not greater, importance than any course of medicines that can be employed. The food used in the progress of scrofulous inflammation should be light, easily digested, and nourishing. A considerable proportion of animal matter may be allowed, I believe, in most cases of scrofulous inflammation, unless in that which is the cause of phthisis pulmonalis. But the more or less free use that is to be made of animal food in scrofula, is a point which must be determined by the knowledge we have of the manner in which the patient has been previously nourished; the degree of fulness and vascular action existing in the system; and the effects which upon trial we perceive to result from courses of diet more or less animal. Whatever kinds or quantity of animal food occasion or increase febrile heat are improper, and ought to be avoided.

A moist atmosphere, liable to considerable vicissitudes of

temperature, was mentioned also as one of the causes of scrofula. On that account therefore the patient, wherever it is possible, should be removed from the moist situation in which he lives to a dry pure air. Going to a warm climate generally prevents the occurrence of scrofulous inflammation; and the same effect has been said to be produced by going to a cold climate; for in cold climates the air, though colder, is drier than in those which are more moderate in point of temperature.

It is scarcely necessary for me to remark, that every kind of exercise should be used in scrofula, which, without irritating the part affected, or quickening in any remarkable degree the circulation of the blood, tends in any respect to strengthen the general constitution; but that every occupation or exercise which fatigues, or produces febrile action, must have the effect of supporting and of aggravating the disease. In good weather this exercise should be taken in the open air, the patient at all times avoiding carefully exposure to cold, rain, or dampness of any sort.

Cleanliness, particularly among the lower orders, cannot be too rigidly enjoined. One of the best means of promoting this, and at the same time of preventing and curing scrofulous inflammation, from the general good effects which it produces in the constitution, is the frequent use of tepid and cold bathing. But the kind of bath, the degree of its temperature, the mode of using it, and the frequency of its employment, are circumstances which at all times must be regulated by the season of the year, by the state of the patient's health and strength, and by the effects which the bath itself, when used, seems to produce. Most practitioners prefer sea to fresh water for the purpose of bathing. I am unable to say how far this preference is well founded.

We have in this country no means of protection against scrofula more powerful than warm clothing. Flannel should always be worn next the skin, unless perhaps in the hottest weather of summer, and it should be applied so as to cover the chest and neck, as well as the other parts of the body. Nothing can be more truly absurd than the light and thin dresses in which the children of this country are usually clothed during the period of their lives in which, of all others, they are most liable to attacks of scrofula. It is often easy to trace the origin of this disease to thin clothing,

and to accidental exposure to cold; and its symptoms are sometimes observed to disappear, merely by defending the body by means of warm clothing, against those frequent and sudden vicissitudes of the weather which occur in this climate.

So late even as the beginning of the eighteenth century, it was conceived that an infallible cure for scrofula was to be found in certain miraculous powers vested in the kings of France and England; and hence the origin of the terms *king's evil*, and its cure by the *royal touch*. The account which you will find of the effects produced by the royal touch in Wiseman's Surgery, will serve to show how we ought to estimate the value of human testimony, when it relates to events of an extraordinary nature; and how far reliance may be placed on the evidence of medical men strongly prejudiced in favour of any particular remedy.

With respect to internal medicines, I should be obliged to go over the whole of the materia medica were I to attempt to enumerate the various substances, which at different times have been recommended, and are still supposed by many practitioners, to be useful in the cure of scrofula. Some of these medicines have been supposed to possess specific virtues; others to produce their good effects only by the salutary changes which they produce in the state of the general health and constitution of scrofulous patients. The latter are now, I believe, the only medicines in which practitioners of experience repose any confidence.

Emetics have often been employed by those who believe that scrofulous inflammation admits of being cured by internal remedies; but, except by relieving the stomach from the crudities with which it may be occasionally loaded, and in this way promoting digestion, it is not easy to conceive any advantage that can be expected from their use.

Purgatives of all kinds have often been, and still are, in much repute for the cure of scrofula. They become indispensably necessary in patients affected with constipation and other derangements of the chylopoietic viscera, and are often of great service by the effects which they produce upon the digestive organs. Some practitioners prefer the bitter and resinous, others the mercurial or saline. Perhaps there are constitutions, with which one kind or class of purgatives will always be found to agree better than another.

In general, however, the mercurial or saline have been preferred, and have even been supposed to possess specific virtues.

Mercury has been used in every form of preparation, and in every variety of manner and dose. From the great apparent similarity of the symptoms, progress, and seats of scrofula, to those of syphilis, and from the well-known effects of mercury in curing syphilis, it need not seem strange, that medical men should have been a little obstinate in their attempts to obtain benefit from the use of mercury in scrofula. These expectations are in general abandoned, and mercury is now given for the cure of scrofula as a purgative only. A long continued, or improperly administered course of this medicine, has often been known to aggravate all the symptoms of scrofula; and, in many instances, to excite these symptoms in persons in whom they did not previously exist.

Almost every neutral salt possessed of any purgative qualities, has been administered, either alone or in combination with other substances, for the cure of scrofula; and each has been found useful, and of course has had its respective admirers. These medicines, however, unless in constipated states of the bowels, are seldom given in large or full doses. From one sixth to one tenth of an ordinary dose is the quantity which is usually administered; and in this quantity, if largely diluted with water, they are found to keep the bowels open, and, in general, to promote digestion. The neutral salts are often prepared so as to resemble natural mineral waters, a class of substances which, however different in their composition and sensible qualities, have almost all been held in high repute for the cure of scrofula. To question whether mineral waters ever produce beneficial effects in scrofula, would argue an unreasonable degree of scepticism with regard to the operation of medicines in this disease, though it must be confessed, that it is as purgative and as tonic remedies, and not as specifics, they are now usually employed. In employing them it is often difficult to distinguish between the effects which they in reality produce, and those which are to be attributed to the slow operation of time, to the season of the year, to change of situation, to alteration in the mode of life, or to exercise in the open air.

Three of the neutral salts have acquired great celebrity

for the cure of scrofula; and it is remarkable enough that these three should all have been muriates. The first of these was muriate of soda, given as it exists in sea water. Nothing can be more satisfactory than the evidence which is on record of its efficacy. In reading this, one only wonders how so efficacious a remedy should ever have fallen into neglect. The second, the muriate of barytes, was introduced to the notice of the public under the most favourable auspices, and its antiscrofulous powers extolled by all degrees of men in the medical profession; yet it has had a much shorter lived reputation than sea water, or its successor, the muriate of lime. How long this third muriate will be permitted to enjoy its present fame, I shall not venture to say. Not much longer however, I should imagine, from what I have seen of its use, than till a new remedy shall be found out by those who are still sanguine in their hopes of discovering a specific for scrofula. To such of you as are but imperfectly acquainted with the past history of the materia medica, and the uncertain nature of medical evidence, in so far as it relates to the operation of remedies for the cure of chronic diseases, the accounts which are already before the public, of the virtues of muriate of lime in curing scrofula, must appear most satisfactory and complete. It will be well if a little reading or experience does not soon lead you to suspect, that the reporters of its efficacy have not, any more than the reporters of the efficacy of the muriates of soda and barytes, learned to distinguish, in every instance, between a *cure* and a *recovery*. Till that distinction however is made, and is adhered to more strictly than appears to have been hitherto done in reporting the effects of the remedies employed for the cure of scrofula, a little scepticism, even with regard to the antiscrofulous virtues of muriate of lime, may, I conceive, be safely enough indulged.

Of tonic remedies, two have been very universally employed in the treatment of scrofulous affections. These are Peruvian bark and iron. Given after, or even sometimes along with, a course of purgative mineral waters, these remedies often produce beneficial effects by their action on the digestive organs, and by improving and strengthening the general state of the constitution. In this way they prove useful, as other medicines of the same class probably would do, not from any specific virtues which they possess

in destroying the nature, or in eradicating the symptoms of scrofula. Each preparation of these substances has now, you will find, its respective admirers. Regarding them all, however, as merely useful tonics, it is often, I am convinced, a matter of indifference what preparation of these remedies is employod. If, contrary to their usual operation, any of the preparations of bark or iron should seem to weaken rather than improve the digestive powers, the form of the medicine must be altered, or its use entirely given up. This is oftener required, I believe, with bark than with iron.

The mineral acids, diluted with water, are often used from views similar to those which guide us in the employment of tonic remedies. Their medicinal powers appear to be nearly the same; but the nitric acid has of late been preferred; particularly in the scrofulous affections which are sometimes induced by the action of the mercury.

Of the class of narcotics, several medicines have at different times been in great repute for the cure of scrofula; such as opium, hyoscyamus, the solanum dulcamara, &c. The conium malculatum, cicuta, or hemlock, was long employed, and is still supposed, by many of the older practitioners who have seen it used, to be a remedy of considerable antiscrofulous powers. The various writings which have appeared, and the contradictory evidence which has been given respecting the efficacy of cicuta in curing scrofulous and scirrhous affections, since the attention of the public was first particularly called to this drug by Baron Stork, of Vienna, would fill many volumes. Indeed the history of hemlock for the last fifty years affords many undeniable proofs of the conjectural nature of medical science, and but too many melancholy examples of an evil against which, as you grow older, you will become daily more and more on your guard. I allude not to instances of self-deception alone, for that is an evil to which we are all liable; but to fraudulent attempts to acquire professional reputation, by the publication of cases that never existed, and of cures that never were performed.

Baron Stork had promised, in one of his publications, to use his endeavours to discover some new remedies among poisonous plants, and he appears from the preface to the work, in which he gives an account of the cures which he supposes he had performed by the use of cicuta, to have had great satisfaction in thinking that he had most successfully,

as well as conscientiously, executed this voluntary undertaking. His mode of proceeding in the discovery of new remedies, was not more ingenious than simple. To a middle-sized dog he gave a small dose at first, of any of those remedies the effects of which he wished to ascertain, and increased this dose daily, so long as the dog did not appear to suffer any injury from it. When he had ascertained by trial, that the drug employed did not excite any great or sudden commotions in the constitution of his dog, he was encouraged to try it upon himself, which he did, by beginning with an extremely small and almost insensible portion. That portion was increased daily, till at length it produced some perceptible effect. By the changes and effects which the remedy thus tried produced upon himself, he was enabled, he assures us, to determine in what disease that remedy would be found efficacious. These trials being premised, he then, without any remorse of conscience, ventured to try his remedies in a cautious manner upon his patients. Such is the short and faithful relation which Baron Stork gives of the circumstances which led him to try the use of cicuta in scrofula, scirrhus, and cancer. Were the private history of the first introduction of the various articles with which our books on materia medica are filled as faithfully recorded, we should possess no very uncertain criteria by which to judge of the effects likely to result from the use of many remedies that have been no less strongly recommended.

By this mode of trial, Baron Stork discovered that cicuta possessed a dissolving power, and that wherever obstruction existed, or tumours from obstruction appeared, there cicuta was indicated. These tumours gradually melted away like ice, as he himself expresses it, under the action of cicuta, and among the great number and endless variety of tumours in which this remedy was tried, it was singular enough that no one instance is recorded in which it failed in producing a cure. But universal success, I need scarcely remark, is always one of the most suspicious circumstances which can be mentioned in the history of the effects produced by any new remedy.

No great dependence seems ever to have been placed in the use of diaphoretic medicines for the cure of scrofula. The different preparations of antimony, indeed, have been occasionally administered, but chiefly in cutaneous affections supposed to be of a scrofulous nature. The guaiacum, sar-

saparilla, sassafras, and mezerion, either singly or in combination, have all been supposed to be useful in the cure of scrofula; but they are now seldom given with this view, unless in those forms of scrofula in which it appears to be combined with syphilis, or to be excited by the too free and injudicious use of mercury.

Various alkaline and earthy substances have been, and still are supposed by many practitioners to possess great efficacy in the cure of scrofulous affections. They have been prescribed with very different intentions in the different periods of medical theory. At one period an acid humour was supposed to be the cause of scrofula, and a simple and ready cure was found in alkaline remedies. But though in the use of these substances theory and practice coincided, the results of trials, it must be confessed, were not always such as to induce practitioners to persevere in the use of alkalies. At another period it was discovered that scrofula was produced by inspissated lymph, and as alkalies are well known to unite with animal substances, and to form with them compounds soluble in water, it was imagined that the inspissated lymph would be converted into a soap by the use of alkalies, and scrofulous swellings removed by a kind of chemical solution. Alkalies were accordingly administered, but the inspissated lymph becoming perverse, often refused to combine.

The original seat of scrofula has been lately transferred, by medical pathologists, from the parts of the body in which it appears to the stomach and intestinal canal. I feel no inclination to call in question the soundness of this theory, because, whether true or not, it leads, in most instances, not only to safe but to useful practice. Acescency in the primæ viæ, particularly in young subjects, is a very common attendant upon scrofula, and wherever it occurs there are no remedies by which it can be more immediately corrected than alkalies. Given either alone or in conjunction with bitters and tonics, they may improve the general state of the health, and perhaps in this way cure scrofula. This is probably the sum total of their antiscrofulous virtues. Like the other remedies which I have enumerated, they seem to possess no distinct claim to the appellation of specifics for scrofula.

That all the internal remedies which I have enumerated should have been found to possess the virtues ascribed to

them by their respective admirers, will not easily be credited. Such a belief would argue a greater portion of credulity than usually falls now-a-days to the lot of those who are in the least degree tinctured with the knowledge of medicine. Neither is it necessary that we should reject altogether the use of these remedies. For purgative, tonic and alkaline remedies have all been tried, and have all been found in particular instances of the greatest benefit in the treatment of scrofulous affections. It is true enough, as Dr. Turner very justly remarks upon this subject, "that time, and some lucky change of temperament sometimes brought about thereby, has wrought wonderful alterations in this, as well as in other diseases, when, happy is the last medicine administered, and happy the last practitioner employed at such a critical turn or juncture! It was certainly this reflection," he adds, "that gave rise to that sarcasm upon physic, 'Natura curat acutos, tempusque chronicos,' which, under a limited sense, may be allowed without invective upon that art, which, if at the same time wholly neglected, it is most certain that nature will be found as little able to help herself, as time to work a cure abstracted from the art."

In the local treatment of scrofulous as of ordinary inflammation, the first object which the surgeon proposes to himself, is to procure, if possible, a resolution of that state. This is sometimes, though but seldom obtained, the inflammation usually terminating in an extravasation of fluids, and in the production of a greater or less degree of suppuration. In the few remarks which I have to offer upon this subject, I wish to direct your attention chiefly to the local treatment of scrofulous swellings in the subcutaneous cellular texture, and in the lymphatic absorbent glands. The peculiarities required in the local treatment of particular scrofulous diseases, will fall to be considered with more propriety in the descriptions afterwards to be given of the diseased states of the organs in which these diseases occur.

In endeavouring to procure the resolution of scrofulous swellings, we must attend to the character of the inflammation by which they are produced, or may be accompanied. This, though usually chronic, may in particular instances possess more or less of an acute character, and in this case will require the same antiphlogistic regimen to be followed, for a time at least, which is proper in simple inflammation. But if, as usually happens, the inflammation from the first

appears to be of an indolent or chronic character, some difference may be required in the kind and manner of employing external applications. Instead of the cold solution of acetite of lead, we may use a solution tepid or warm, to which an additional quantity of vinegar has been added. In cases where this solution does not appear to be sufficiently stimulating, the acetite or muriate of ammonia is added to the water in place of the lead, and this solution is applied cold, tepid, or warm, according to the degree of heat which exists in the part to which it is applied, and also according to the relief which these differences of temperature respectively seem to produce. Sea water and solutions of muriate of soda have been used for the same purpose. A very popular application for the discussion of an indolent scrofulous swelling, is the brine of salt beef. This has been supposed to possess specific virtues, though it seems very questionable whether it possesses any which do not arise from the muriate of soda which it contains. In many instances warm applications are found to answer better than cold; and these may be in the form of vapour, fomentations, or poultice. In the intervals of these applications, the part ought to be kept warm with soft flannel. Indeed, warmth by clothing is often one of the best means of procuring the resolution of scrofulous swellings which we can employ, and one, when the patient is obliged to subject himself to the vicissitudes of the weather, without which all other means of procuring resolution will very frequently fail. A cataplasm of fresh cow dung is a very common and popular application among the poor of this country. I have not seen, however, any more remarkable effects produced in the resolution of scrofulous swellings by its application than from common poultices, into the composition of which a little of the muriates of soda or ammonia had been introduced. But it would be difficult to persuade those to believe this, who are prejudiced in favour of a composition which it certainly is not in our power to imitate by art.

Friction is often recommended as a remedy for the discussion of scrofulous swellings. If managed so as to press chiefly or only upon the skin, perhaps the friction may prove serviceable ; but in a great proportion of the cases in which I have seen it employed, it occasioned an increase of heat, pain, and swelling in the subjacent parts, and not unfrequently seemed to induce suppuration. Friction, when

used as a remedy for the discussion of scrofulous inflammations, seems to answer best in those which are deep seated, as in the scrofulous affections of the joints. It may be applied with the hand alone, with a piece of flannel, or with the flesh brush. When the hand is employed, it is necessary to use some substances to lubricate the part that is rubbed. Warm stimulating oils are often used for this purpose with excellent effect. Friction with common flour is now the fashionable remedy in this country for the cure of chronic inflammations, or, as they are usually termed, white swellings of the joints. This mode of applying friction has undoubtedly, in many instances, produced the most beneficial effects, though I cannot help thinking that it may be doubted whether it will be found ultimately more useful in practice then caustics, repeated blisters, and the judicious use of the common class of rubefacients.

Local sea-bathing, both cold and warm, has often appeared to be of use in procuring the resolution of scrofulous swellings. The temperature of the bath must always be varied according to circumstances, according to the season of the year, the strength and habits of the patient, and, the particular effects which the bath seems to produce. It is at all times difficult to distinguish between the effects immediately arising from the application of salt water to the body, and those which arise from the increased warmth of temperature in the bathing seasons of the year, from the exercise which patients going to sea-bathing generally take in the open air, from the change of situation and amusements, and, among the poorer classes, from the more nourishing diet and exemption from labour, in which they are usually permitted to indulge during their residence at sea-bathing quarters. It is not improbable, that those living on the sea coast, who become affected with scrofula, would, for similar reasons, derive equal benefit by going from the sea coast to reside for a time in the interior of the country.

When scrofulous swellings are long of being resolved, you will often have occasion, in the course of your attendance, to vary the applications which you employ. Camphorated oil, volatile liniment, solutions of the acetite or of the muriate of ammonia, warm plasters, soap, and mercurial plasters, and electricity, are among the means which are regarded as the most beneficial. In no complaint is it more

necessary for the surgeon, in case of the failure of any of his remedies, to have a large store of innocent prescriptions in reserve. It is by this means only that he can hope to preserve credit with his patient, till time shall bring about the beneficial changes which it often does in this disease, sometimes with, and at other times altogether without the use of medicine, or the assistance of art.

There are several substances which have at different times procured a temporary reputation, on account of their supposed efficacy in promoting the resolution of scrofulous swellings; but I know of none of these in which practitioners of any experience now repose the least degree of confidence. Most of these remedies have been the leaves of plants made into cataplasms. Their effects seem to be nearly the same with those arising from fomentation with warm water, or the application of common poultices. The leaves of hemlock, fox-glove, and sorrel in particular, have had every recommendation from their employers which could in any way tend to procure credit with the public; but these are external applications which are now seldom had recourse to, unless by those who are much at a loss what external remedies to employ.

To this account of the means of procuring resolution I shall only add, that the other forms of specific inflammation, the syphilitic for instance, may, and often do, like those of scrofula, occur in so acute or active a state, as to require the use of the means, both constitutional and local, which are adapted for the cure of ordinary inflammation; but, in addition to these means, some specific remedy and particular modes of management are almost always required.

ADHESION.

Among the various powers inherent in living animals, there is none more interesting to the surgeon, nor more remarkable in the eyes of a philosophical observer, than that by which wounds are healed, or by which the different parts of animal bodies that have been recently divided, either by accident or design, are made to re-unite with each other. This is a power, the effects of which in the human body are so obvious and important, that it could not fail at a very early period to attract, in some degree, the attention of every observer of nature; and accordingly we find, from the records of medicine, that the various circumstances which promote, retard, or prevent the healing of wounds, have at all times been more or less known to the practitioners of the healing art. A very slight degree of observation, however, must soon have been sufficient to convince them that the phenomena which the healing of wounds exhibits, are neither simple in their nature, nor uniform in the order of their appearance, but variable according to the kind of wound that is inflicted, and the mode of treatment which, in the different external and internal conditions of the body, is employed for its cure.

In slight wounds, inflicted by the sharper kinds of instruments, even the most inattentive medical practitioners must have seen that a re-union is often speedily effected merely by keeping the edges of the wound in contact with each other; whereas in wounds, in which the divided surfaces are much torn or bruised, or where, from retraction or loss of substance, they cannot be brought into contact, the healing is always accomplished in a much slower, more uncertain, and more complicated manner. These diversities in

the process of re-union, are taken notice of by the earliest writers upon physic and surgery; and distinguished from one another by different appellations or terms of art. Re-union, by the *first intention*, was the term which Galen employed to express that mode of healing wounds, in which the re-union is speedily produced merely by keeping their edges in contact:—an operation of nature which we now more commonly denominate healing by the process of adhesion. And re-union by the *second intention* was, with that author, a term employed to indicate the series of phenomena which occur in that slower mode of healing wounds in which their edges coalesce more slowly; phenomena to which modern surgeons now usually give the name of healing by the process of granulation.

But though the more obvious effects of the process of re-union, whether by the first or second intention, and the advantages to be derived from it in the practice of the healing art, have been known to the medical practitioners of all ages, it was undoubtedly reserved for some of those of our own times, to investigate minutely the various and complicated phenomena of this process, and to point out more clearly than had been done by their predecessors those very simple means in the œconomy of animal bodies, by which nature accomplishes so salutary a purpose as the healing of wounds. It is to the labours of Mr. Hunter, more perhaps than to those of any other individual, that we are indebted for much of the knowledge which we at present possess respecting the processes of adhesion and of granulation. Previously to his time, medical inquirers seem but too frequently to have satisfied themselves with general expressions for these processes, and with a blind admiration of their effects, without giving themselves the trouble to examine carefully the order and relations of the very curious and interesting phenomena which occur in adhesion and granulation.

The phenomena which the process of adhesion, or of re-union by the first intention exhibits, may be best perceived in the re-union of those parts of animal bodies which have been forcibly and suddenly divided, without any communication having at the same time been formed between these parts and the external air. We have examples of this mode of re-union in bones which have been fractured, in tendons which have been ruptured, and even sometimes in muscles which have been wholly or partially torn asunder

without any division having been produced in the external integuments or skin which covers them.* In the sudden and violent division of these textures, a greater or less quantity of blood is always effused into the line of separation between the divided parts, and a quantity of that fluid is, at the same time, poured out also into the cellular membrane contiguous to, or immediately surrounding the solution of continuity. When the blood which is effused is not very considerable in quantity, and when the parts from which it has been effused have not been much hurt by the injury, it is observed to be gradually absorbed ; and in proportion as the effused blood is absorbed, the parts which had been divided seem to approach nearer to one another. If the divided surfaces be examined in a few hours after this division or solution of continuity has been produced, they will be found to be covered with a substance, which, in its appearance and other properties, resembles very exactly the coagulable lymph, or, as it is now termed, the fibrin of the blood.

In some experiments which I made upon brute animals, with a view to ascertain at what period this lymph is first effused, I found a distinct layer of it covering the wounds I had made, within less than four hours after they had been inflicted ; but perhaps a longer period may be required for the formation of this substance in the human subject, and this period may vary in different persons, in different textures of the same person, and in the different states of health and disease. But whatever may be the period at which it is first formed, it is now well ascertained, that, in healthy subjects, when fractured, torn, or ruptured surfaces, to which the external air has not been admitted, are properly covered with this layer of coagulable lymph, and come into contact, they speedily coalesce, and that, by this lymph becoming a living intermedium, the continuity of the divided part is at length restored.

Appearances precisely similar to those which I have described as occurring in divisions without communication with the external air, take place in simple incised wounds, the edges of which have been brought together before, or soon after the bleeding from the divided vessels has ceased. If a wound of this kind be torn open soon after its re-union,

* See Hunter, p. 191, 2.

the surfaces which had been united are seen covered with a substance resembling an animal jelly. This is the coagulable lymph, or fibrin of the blood, and the substance described by many of the older surgical writers, under the names of the nutritious juice, the natural balsam, the radical, or alimentary moisture, with which, according to them, the different parts of the body are nourished, and the continuity of divided parts restored. No perceptible differences have yet been found in the properties of this substance, whether effused from the vessels of the skin, cellular membrane, muscle, bone, or tendon ; and in all these textures, it is to be remembered, that it is this coagulable organizable lymph which serves as the connecting medium, as the bond of re-union between parts which have been intentionally or accidentally divided. It has been supposed that this coagulable lymph is poured out from the smaller vessels, divided by the solution of continuity ; but it seems a more probable opinion that it is chiefly, if not wholly, formed by the secreting action of the capillary vessels of divided surfaces ; for even previously to, and during the exudation of this coagulable lymph in wounds and ulcers, the capillary vessels in the divided surfaces become remarkably dilated, and seem to pass into that state which Mr. Hunter has so well described, as occurring in adhesive inflammation. If the effusion of coagulable lymph therefore ever does take place from the vessels actually divided, it would seem to depend on a change in the action of these vessels, by which they are in some measure converted from circulating into secreting organs.

The coagulable lymph is, soon after its exudation, penetrated with blood-vessels. These vessels, which proceed from the divided surfaces, appear to join in the process of re-union by open extremities, or, in other words, to inosculate with one another ; and the blood now circulates freely through the newly formed channels of communication, which are established between the vessels penetrating the lymph effused upon the surfaces formerly divided. This is the state or stage of re-union which Mr. Hunter has denominated the adhesive inflammation. The vessels which are projected into coagulable lymph during the state of adhesive inflammation, often acquire, in the course of a few hours, a size rendering them capable of being injected. The following case, taken from Mr. Home's Treatise on Ulcers,

shows that this effect can be produced within twenty-four hours in the human body, and probably in a much shorter period of time.

"The operation for strangulated hernia was performed upon a man, in other respects in perfect health, at seven o'clock in the morning; after the operation, the symptoms did not abate so much as might have been expected, and during the afternoon he complained of pain in the lower part of his belly, &c. and died about twelve o'clock next day, surviving the operation about twenty-nine hours. The body was opened, and the portion of gut which had been strangulated was found considerably inflamed, the surface having lost its natural polish, and having several small portions of exudated coagulable lymph adhering to it. The vessels of the gut were minutely injected, the arteries with a red coloured injection, and the veins with a yellow one. Upon examination afterwards, all these adhering portions of coagulable lymph were found to be injected, having a considerable artery going to each of them, and a returning vein which was longer than the artery. It is evident therefore, that the coagulating lymph was laid upon the external surface of the gut after the operation; and we cannot suppose that any such process as the forming new vessels could have been going on during the last five hours of his life, when the pulse in the wrist was scarcely to be felt, and the powers of life were so much weakened in every respect. We must therefore conclude, that the whole operation of throwing out coagulating lymph, and supplying it with blood-vessels after it had become solid, was effected in less than twenty-four hours."

The effusion of coagulating lymph, and its subsequent penetration by blood-vessels, are known to be conditions essentially necessary to the re-union of wounds by adhesion; but we have still to learn the precise manner in which the blood-vessels shoot into this substance. Is it the vessels which have been divided which penetrate this lymph? The extremities of the larger branches are closed up by the coagulable lymph that is effused, and removed by means of it, as well as by their natural elasticity, to a distance from each other. These two circumstances form, in my opinion, insurmountable bars to their immediate inosculation. If it be the closed vessels that are prolonged into the lymph, each small artery, it is obvious, must have its corresponding vein;

and though the vessels from the opposite divided surfaces may by prolongation pass each other in a wound, it is not easy to conceive the manner in which they will join or inosculate, nor how the artery becomes afterwards connected with the vein. But the inosculation, or direct union of the small blood-vessels from the opposite surfaces of wounds, however difficult to conceive or explain, is a truth undeniably established by a variety of observations.

M. Duhamel made an experiment with regard to this point, which shows in the clearest manner that in the reunion of parts which have been divided, the blood-vessels from the opposite surfaces inosculate directly, and do not merely pass one another. He broke the legs of six chickens, and after the bones had re-united, he cut through about one-third of the soft parts covering the callus or new bone. When the wound had healed up, he divided another third part, and in the same manner the remaining third part, sparing neither blood-vessel, tendon, nor nerve. Only one of the six chickens survived these cruel operations; but upon injecting the artery at the upper part of the thigh, the injection was found to have penetrated to the lowest part of the leg. "I cannot say (Duhamel remarks) whether the large vessels filled by the injection were dilated capillary vessels, or the large vessel of the leg itself, which had been re-united; but the experiment proves irrefragably the inosculation of the blood-vessels, a point which had been contested by several good anatomists." Later observations than those of Duhamel have shown that it is by the small vessels, and not by the larger trunks, that the inosculations are formed, by which the divided parts in a limb are supplied with blood.

One would imagine it to be a very easy matter to ascertain by experiment the manner in which inosculation takes place; and yet Mr. Hunter remarks, that he never could get an opportunity of observing inosculation in all his experiments and observations on inflammation, except in the coats of the eye. In many inflammations of that organ, we find, he says, "an artery, or arteries, passing from the tunica conjunctiva to the cornea, and ramifying upon that part; these have been often cut across to prevent an influx of blood; the two ends are seen to shrink, but in a little time they are again perceived to unite, and the circulation to be carried on as before. In this there can be no deception, and

to perform therefore such an operation effectually, a part of the vessel should be removed."* Notwithstanding the certainty with which Mr. Hunter speaks in this paragraph, I am inclined to doubt whether it be indeed the extremities of the arteries which have been divided, and which have shrunk, that are perceived to reunite. An attentive examination of the phenomena which Mr. Hunter mentions, will, I am convinced, show that it is not the divided extremities of the arteries that again unite, but the folds of small branches that are prolonged into the intermediate space, which become the channels of communication between the larger trunks that had been divided, but the extremities of which had been previously closed. Such, at least, are the appearances that have uniformly presented themselves in the experiments and observations which I have had an opportunity of making with regard to the recommunication of divided blood-vessels.

Mr. Hunter appears to me to have fallen also into another slight mistake, by supposing that blood may, in some instances, serve as a medium of re-union, or vital bond of connection between parts which have been divided, and that blood-vessels may begin to form and to inosculate with each other in this effused or extravasated blood. It was known in the time of Celsus, and probably long before his day, that the interposition of a layer of blood between the edges of a wound would prevent its re-union; and, although it sometimes happens, as Mr. Hunter states, that a thin layer of blood remains which does not ultimately prevent adhesion, yet it will be found, I am inclined to think, that the re-union in these cases does not take place till this layer of blood has been absorbed, and that the parietes of such wounds as contain blood, are uniformly covered with a layer of coagulable lymph. Such, at least, I know to have been the case in numerous instances in which I had an opportunity of observing the progress of adhesion, in wounds which I had inflicted for that purpose upon brute animals.

Adhesion by blood is not necessary to re-union by the first intention. It may, and does frequently occur in the commencement of that process, but it is not an essential part of it. The blood which is effused between surfaces that have been divided, usually coagulates, and by its coagulation

* P. 193.

forms an apparent bond of union between the divided surfaces. But this union is only of a temporary duration. The coagulable lymph, it is true, thrown out during the state of adhesive inflammation, may not at first detach this blood from the divided surfaces; on the contrary the lymph may unite with the blood, and it often becomes extremely difficult in wounds to distinguish the coagulable lymph capable of being penetrated with blood-vessels from the blood with which it is connected, but which must be separated as a foreign body, or removed by absorption, before the real process of adhesion can take place.

It was this temporary adhesion of the lips of a wound by blood, that Mr. Hunter denominated union by the first intention, in order to distinguish it from union by adhesion, which should with him, had he made use of the terms of Galen, have been called union by the second intention, while that which Mr. Hunter calls union by granulation would, in the language of Galen, have been union by the third intention.*

The inner surfaces of the cavities into which blood is poured, become affected during their enlargement with adhesive inflammation, and are, in consequence of this, covered with a layer of coagulable lymph. It is by means of this exudation of coagulable lymph, that the parietes of cavities which contained blood have sometimes been observed, after the evacuation of large collections of that fluid, to adhere without the occurence of suppuration. This happened in a case under Dr. Wardrop's care some time ago, in the Royal infirmary of this place, after the evacuation of the blood from a very large cavity, formed on the fore and inside of the thigh, by blood poured into it, from a rupture of the vena saphena which had been produced by a cart passing over the limb. Hevin mentions, in his Cours de Pathologie, that he had succeeded in producing re-union of the parietes of a cavity of this sort without suppuration, in an old man in whom an enormous bloody tumour was occasioned by the fall of a tree upon the loins, and which occupied for fifteen months the whole of the lumbar region, and two-thirds of the buttocks.

The question, whether blood in any state be capable of

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* Mr. Hunter, p. 371, it deserves to be remarked, calls the formation of granulations, the *third method* of restoring parts to health.

serving as a medium into which blood-vessels can shoot, has probably not yet received the investigation which it deserves. Coagulable lymph modified by the action of the secreting vessels, or in other words, as the product of the adhesive inflammation, seems to be the common medium of re-union; but we have still to learn, whether, and in what circumstances, the coagulable lymph contained in the blood which is simply poured out from divided vessels, be capable of serving as a medium for blood-vessels to shoot in, or whether some change effected by the action of the vessels pouring out blood be not necessary to qualify its coagulable lymph to serve as the medium of re-union.

Mr. Hunter, though he seems in general inclined to support the opinion, that common blood extravasated from a divided or ruptured vessel, is capable of becoming a living intermedium between divided surfaces, allows, p. 311, that in inflamed arms after bleeding, and in inflammations in consequence of other causes, the coagulable lymph thrown out by the vasa vasorum in its separation from the blood, "must have undergone some change arising from the action of the vessels; for, if this lymph was no more than the coagulating lymph with its common properties, or the properties common to that which is circulating in the same vein which receives it, it would in such cases only continue to throw in more coagulating lymph, in addition to what was circulating, and therefore, probably, it would be carried along with the blood to the heart, as a part of the common mass. From this we should infer that this coagulating matter is not simply coagulating lymph, such as it is when circulating, but somewhat different, from having undergone a change in its passage through the inflamed vessels, partaking of the disposition of those solids which are inflamed through which it passed. This process cannot therefore be supposed to be merely extravasation; for I conceive that an œdema would be a consequence of simple extravasation. But this may be taken up in another point of view, and upon the same principle. The inflamed vessel may give a disposition to the blood, as it is moving slowly along, to coagulate on its surface; and this is probably the more just idea of the two; as we find that the vessels, both veins and arteries, can give this disposition, and to a very great extent; we find in the beginning of mortification, the blood coagulating in the vessels, so as to fill them up entirely, and

this preceding the mortification seems to be for the purpose of securing the vessel before it is to give way; we, therefore, cannot doubt of a coagulating principle being given to the blood from the vessels; and as a farther proof of this we may observe, that the extravasated coagulating lymph, which produces either adhesions or forms tumours (which is often the case,) is always of the nature of the diseased solids that produced it. If the case is venereal, the new substance is of the same nature; if cancerous, it is cancerous; for I find that it has when absorbed the power of contaminating, similar to matter or pus produced by the ulcers or sores of such diseases; the absorbent glands being often affected by the absorption of the coagulating matter of a scirrhous breast."

If I understand Mr. Hunter properly, in the paragraph which I have quoted from his treatise, he seems to think, that the coagulable lymph which is to be found in the inner surfaces of inflamed arteries and veins after death, may have been deposited upon these surfaces by the blood which circulated through them, and this by a kind of attraction between the lymph and these surfaces, and that of course it has not been formed by the action of the exhalent arteries which open upon the inner surfaces of those inflamed veins and arteries. Now I am very unwilling to admit this opinion, because it seems to me to lead to very unsettled notions with regard to the process of re-union, and the means by which it is effected. For, if this view of Mr. Hunter's were just, then we ought to find a vascular union taking place, first, between the inner surfaces of these vessels and the blood which coagulates in them, and, secondly, a vascular union between the inner surfaces of these vessels, and the polypous concretions of coagulable lymph, which occur in aneurisms and in varices; but in neither of these two instances do we ever see any thing like vascular union take place. The coagulated blood and the polypous concretion are bodies foreign to the circulating system, which may be slowly taken up by the absorbents, or ejected altogether from the body by the process of ulceration, but in no instance do they ever form a vital or vascular union with the vessels in which they are lodged.

The lymph which is thrown out during adhesive inflammation, I am disposed to regard as in every instance formed by a process analogous to secretion or exhalation. The

qualities in which it differs from ordinary coagulable lymph may be of such a kind as not to be discoverable by chemical analysis, but they are not on that account the less real. The ordinary coagulable lymph of the blood, and even much of that which in inflammations of the pleura and peritoneum, is thrown out along with serum in the inflamed states of these membranes, seems to be incapable of being penetrated with blood vessel, or, in other words, unsusceptible of organization and of life. To distinguish therefore the lymph which is capable of serving the purposes of re-union, and for which it is thrown out by blood-vessels in the state of adhesive inflammation, I should be inclined to give to it the appropriate appellation of organizable coagulable lymph, or simply organizable lymph. The coagulable lymph thrown out again by serous membranes or other surfaces in a state of inflammation, which is not capable of forming a vital union between the surfaces it brings into contact, would, according to this nomenclature, be called inorganizable lymph.

The fact which Mr. Hunter mentions, of blood coagulating in the vessels of mortifying limbs, has been often observed, but has not hitherto, so far as I know, been satisfactorily explained. To me it seems to depend chiefly on the closure of the orifices of the smaller vessels going off from the larger trunk by the coagulable lymph thrown out during the state of the adhesive inflammation, and to the stoppage which is in that way put to its circulation. But this is a point which I shall afterwards have occasion more fully to consider.

When blood which is effused into the cavity of a wound coagulates, and adheres to the surface about to throw out organizable lymph, does this blood retain its adhesion to the divided surfaces in those cases in which the external integuments have been healed over it, till the whole of it be absorbed? I am inclined to believe that it does not; that, on the contrary, it separates, as in cases of simple fracture, from the sides of the wound to which it adhered; that, after having separated from the sides of the cavity in which it is lodged, part of the serum sometimes separates from the crassamentum; that when absorbents are once formed in the surfaces covered with coagulable lymph, this serum is frequently absorbed; and that, after this absorption of the serum, the coagulum and surfaces of the wound may come into contact, but that an adhesion is never produced between them.

Is the coagulum ever absorbed while the serum remains unabsorbed?—or are there cases in which the serum is ever increased by the secretion of a similar fluid from the surface of the cavity originally containing blood? Something like this would seem to take place in apoplexy. Much light might probably be thrown on this interesting point of pathology by a careful examination and full induction of the facts at present known with regard to the different states of the blood extravasated in that disease, and the various changes which it undergoes during the continuance of life.

The process of adhesion, or of re-union by the first intention, is, through every stage of its progress, accompanied by a greater or less degree of that state which is denominated inflammation. But the state of inflammation is characterised by an unusual degree of redness, pain, heat, and swelling in the part affected, and accompanied, according to the seat, nature, and extent of the inflammation, by a greater or less degree of fever. Inflammation, therefore, in the sense in which it is now usually employed, is merely a general term expressive of the simultaneous occurrence of the symptoms just enumerated, and comprehending under it a great variety of morbid appearances, which, though they may have some things in common, differ from one another by such distinct marks, or characters, as to enable us to distinguish them into several kinds or species of inflammatory diseases. Adhesion, or a disposition to that state, often occurs in inflamed parts from the first commencement of inflammation; it accompanies inflammation in every stage of its progress, and is also one of the modes in which inflammation frequently terminates. So often indeed are these two states or processes united, that Mr. Hunter has been induced to mark their frequent conjunction and peculiar effects by the appropriate term of *adhesive inflammation*. The phenomena of adhesive inflammation, the textures which are most susceptible of it, the constitutional symptoms by which it is attended, and the important purposes which it serves in the animal œconomy, are all so fully and minutely described in his Treatise on Inflammation, as to render any farther elucidation of these points extremely difficult, if not unnecessary. Various objections have been made to Mr. Hunter's use of the term adhesive inflammation, but these objections seem to me to have no very solid foundation. It has been said that adhesion pre-

vents inflammation, that adhesion is a healthy, and inflammation an unhealthy state, and that it is absurd to give the same name to phenomena so very different. "The adhesive inflammation, as it is called, is not attended with fever, pain, swelling, or redness, unless in the most trivial degree; indeed that gentle swelling that indicates the fulness and strong, but healthy action of the vessels, it must have; but the increased action of those vessels in re-uniting the lips of a wound, stands on the same footing with the healthy action of vessels in forming or in supporting any part of the system."* "From the very first moment of adhesion, the vessels begin a healthy action, unaccompanied with inflammation or pain, and the part is once more entire and sound. If the vessels become thus entire from the very moment of their re-union, if neither pain nor inflammation come on, unless the process fail and the vessels begin to part, how can this be called a disease? Or by what sophistry can it be comprehended under the definition of an inflamed part? To speak thus, seems to give an incorrect and unfavourable view; it is to describe the cure by the very name of the only disease which can interrupt the cure." Notwithstanding the very forcibly manner in which these objections have been stated, I am inclined to believe that if by the term inflammation we mean to designate that state of any part of our body in which its blood-vessels are enlarged in diameter, in which there is an increase of temperature, and in which the part is painful and swollen, we must admit this state to exist in adhesion, for the four local symptoms I have just now mentioned, and which are those by which inflammation is characterised, are the very phenomena which always accompany the process of adhesion. Who that has ever perceived the swelling, heat, pain, and redness which succeed to the operation by injection for hydrocele, can doubt for a moment whether the production of adhesion between the sides of the tunica vaginalis scroti and testis be not connected with, or rather dependent upon a state of inflammation? There is even reason to believe that in some textures, as in the mucous membranes for example, suppuration is produced by a degree of inflammation not sufficiently strong to produce adhesion. But if the existence of this

* Mr. John Bell's Discourses on Wounds, p. 23, 4.

degree of inflammation in mucous membranes be accompanied by the secretion of pus, it cannot surely have been so absurd in Mr. Hunter to denominate the more violent affection in which these membranes throw out coagulable lymph by the term adhesive inflammation. Besides, the process of adhesion is a state in which the local and constitutional symptoms of inflammation not only occur, but in which they often produce alarming or even fatal effects. To those who are in any degree acquainted with practical medicine, it will be unnecessary to adduce, as examples of this undeniable fact, the various morbid symptoms dependent upon the inflamed states of the membranes which line the cavities of the thorax and abdomen; for in the dissections of those who die from pleuritic or peritoneal inflammation, it often happens that no other morbid appearance can be perceived, except that state which Mr. Hunter has denominated the adhesive inflammation.

A learned and judicious author observes, "that it does not appear, on the strictest examination, that the essential characters of that inflammation which is followed by an adhesion of contiguous surfaces, are at all diverse from that which terminates in a very different manner. Hence it appears, (he adds,) very improper to make an accidental mode of termination the foundation for establishing a distinct species of the disease."* This, it is obvious, is an objection of a kind very different from the former. Mr. Pearson admits the existence of inflammation in the adhesion of contiguous surfaces, but contends that it is improper to make adhesion, which is an accidental mode of termination, the foundation for establishing a distinct species of the disease. But the objection, as stated in this manner, obviously resolves itself into a mere question of arrangement. Mr. Hunter has divided inflammation from some of the more remarkable general phenomena, or effects of that state, into adhesive, suppurative, and ulcerative, and this division is manifestly taken partly from the appearances with which its progress in different textures is attended, and partly from the manner in which inflammation usually terminates. Now, whether we admit adhesion, suppuration, and ulceration, as distinct species of inflammation, or consider them as concomitant circumstances attending it, or as

* Pearson's Principles of Surgery, paragraph 44.

modes in which inflammation terminates, still the propriety of Mr. Hunter's division will remain unaffected. The processes of adhesion, suppuration, and ulceration, are processes which accompany inflammation in every stage of its progress, and they are distinguished from each other by phenomena sufficiently distinct to require a separate aud particular consideration. Adhesion indeed occurs in some degree even in those instances in which inflammation terminates by resolution, and it occurs also, we shall find, in the modes of termination, by suppuration and ulceration, and appears to set bounds to the progress of these processes. But the appearances which it exhibits, and the effects which it produces, are too uniform, too distinct, and too important to admit of being confounded with the phenomena of suppuration, or of ulceration. It was by collecting and by combining the phenomena peculiar to each of these processes, by observing them with care, and describing them with the most minute and scrupulous accuracy, that Mr. Hunter has so eminently distinguished himself from every other chirurgical pathologist. The more the propriety of his division of inflammation into adhesive, suppurative, and ulcerative is investigated, the more clearly, I am convinced, will it appear, that his distinctions are founded in sound observation, and strictly conformable to the most rigid rules of logical definition.

Our knowledge of the process of adhesion or of re-union by the first intention, has been considerably extended by the attempts which have at different times been made to repair and improve those parts of the human body that had been cut off, or otherwise mutilated. Celsus is the first author who mentions the practice of repairing mutilated parts. In the ninth chapter of his seventh book he treats professedly of the mutilations of the ears, lips, and nose. But the only repair of mutilations with which Celsus seems to have been acquainted, is that which consists merely in paring the callous edges of mutilated parts, in raising these edges by dissection from the parts below them, and in drawing them nearer, and retaining them together with sutures and adhesive plasters. Galen allows that the deformities of mutilated parts may be corrected by this mode of repairing noses, lips, and ears, but he justly remarks, that there is no real addition of substance made to the parts which are so repaired. He, perhaps less justly, regards the re-union of

parts entirely separated from the rest of the organic system as utterly impracticable. It does not appear that Ætius makes any mention of the repair of mutilations; but Paulus of Ægina delivers opinions respecting this point nearly the same with those of Celsus and Galen. The repair of mutilated parts, as described by these authors, was confined entirely to attempts to correct the deformities, and to diminish the size of the cicatrices in the parts where wounds had been inflicted.

It was not till about the middle of the sixteenth century that a new mode of repairing mutilated parts began to be first practised in Italy. By this new mode of repair, a portion of the skin of the arm was added to the mutilated parts, in order to supply the place of that which had been lost. Alexander Benedictus, an Italian physician, who published a work upon anatomy about the year 1527, mentions particularly, that some ingenious men had discovered a way of correcting the deformities occasioned by the mutilations of the nose, which consisted in raising a flap of skin from the arm, stitching it to the mutilated part, and, after dividing this flap from the arm, modelling it as much as possible into the shape of the nose. These new noses, Benedictus remarks, bear ill the cold of winter, a fact afterwards confirmed by later observations; and he very prudently advises that they shall not be rashly nor severely pulled, lest they yield and come away.

Gourmelin, professor of surgery to the medical faculty in the university of Paris, and the celebrated oppugnor of Ambrose Paré's proposal of tying arteries in amputation, in his Synopsis Chirurgicum, published in the year 1566, reprints a letter from a person of the name of Calentius, to one of the name of Orpianus, who appears, from that letter, to have suffered a mutilation of his nose. Calentius invites his friend to come and have his nose restored by one Brunus, a Sicilian, by whom he asserts that he had seen that operation actually performed.

Vesalius, in his Chirurgia Magna, printed at Venice in 1569, gives a still more minute account than had been done by Benedictus or by Gourmelin, of the mode of repairing noses by a flap or portion of flesh taken from the arm. That great anatomist erred, however, in conceiving that in this repair it was necessary to raise a portion of the biceps muscle, an error from which Taliacotius afterwards inferred, and

perhaps with justice, that this was an operation which Vesalius had never himself performed.

Ambrose Paré, in the Latin edition of his works published at Paris in 1582, falls into the same error with Vesalius in supposing it necessary, in the repair of the nose, to raise a portion of the biceps muscle; but, so far from doubting of the possibility of this mode of repair, he mentions expressly, by name, the younger son of a well known family in France, who had had his nose repaired after the manner already mentioned by a surgeon in Italy.

But the best, and by far the most interesting account that is any where to be found of this mode of repairing mutilated parts, is that which is contained in the elaborate, and not inelegant, though certainly prolix work, of the celebrated Gaspar Taliacotius, entitled, De Curtorum Chirurgia per Insitionem, printed at Venice in the year 1597. Taliacotius was a man of great learning, and of the most undoubted veracity; and, though a degree of ridicule has been thrown upon the doctrines which he taught, and the practices which he followed, there is nothing surely incredible either in the nature of the facts which he relates, or in his mode of relating them. He describes most minutely and circumstantially, his manner of restoring, by engraftment, noses, lips, and ears which had been cut off, but he does not by any means lay claim to the first invention of this practice, which has been erroneously supposed to have originated with him, and which has not unfrequently, since his time, been ignominiously styled, the Taliacotian Art. The work of Taliacotius, which consists in all of about 300 pages in folio, is divided into two parts. The first, which is chiefly theoretical, contains no fewer than twenty-five separate chapters. With much of the absurd and grotesque learning of his time, Taliacotius mixes many solid, original, and practical observations. He candidly acknowledges, that it was the practice of engrafting trees that first suggested to naturalists and to medical practitioners the idea of repairing, by engraftment, mutilated lips, ears, and noses, and that the founders of this art had been led, like him, by conjecture, to the performance of that artificial operation, in performing which, as he himself says, they happily attained that which they had conceived to be possible. He discusses at great length the question, whether the flap of skin which is to be moulded into the new organ ought to

be taken from the arm of the mutilated person, or from that of another person, and concludes with recommending, for many reasons, which it would be tedious to enumerate, that the flap be raised from the arm of the person on whom the operation is to be performed. Many of his pathological ideas are uncommonly correct, particularly those in the chapter in which he proposes it as a question, "In what manner and by what means are the new noses nourished? Do they live and feel?" Their nourishment, he remarks, must depend either upon the formation of a new set of vessels in the engrafted nose, or on the inosculation of the vessels previously existing in it with those of the part upon which it is placed.* The latter he regards as the more probable opinion. The innate heat, vitality, or living principle, is the chief agent, he affirms, in all the operations which take place in the living body, but the blood circulates freely in parts which have been engrafted, as he had often found to his cost by incision; and wherever this fluid goes, we may rest assured, he affirms, that it will communicate its vital principle to the parts through which it circulates.

In the second part of his work, which consists of twenty chapters, Taliacotius treats, with a most tedious minuteness, of the preparation of the flap of skin upon the arm, the manner in which it was to be marked out, and a slip of cloth inserted under it for some days; of the division of the upper extremity of this flap from the arm; of paring the mutilated part, and sewing, with mathematical precision, the flap so raised to the nose; of the apparatus necessary for retaining it in this position; of the division, after a union has taken place between the nose and the flap, of the lower end of the flap from the arm; of the modelling or configuration of the septum; of the plasters and bandages to be applied in this stage of the process, and of the means to be used for some time to defend the nose from accidental injury. He then treats in separate chapters of the repair of the upper and lower lips, and of the formation of new ears: the instruments to be employed, and the progress of the artist in the different stages of his work, are illustrated and rendered visible to our senses in no fewer than twenty-two plates.

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* Page 59, 60.

In the repair of the upper lip, the lip was joined, like the nose, to the upper extremity of the flap; but in that of the lower lip it became necessary to divide the lower end of the flap first from the arm, and connect it with the lip, so that the skin of the engrafted part might always be outermost.

Never was any surgeon more zealous in his profession, nor perhaps more successful in any operation, than Taliacotius appears to have been in that of repairing noses,—an art which, from the numerous improvements he had introduced into it, he seems, in some parts of his writings, to consider as almost exclusively his own. In reading the works of this author, one is often at a loss whether to admire most the patient suffering of those upon whom he operated, or the indefatigable and persevering industry by which his cures were accomplished. It has been said that the reality of his cures was denied, and his art derided by his contemporaries; but of this, after some research, I can find no proof, though I have met with several proofs to the contrary. Fabricius Hildanus mentions the case of a young girl who had had her nose cut off, and repaired in the Taliacotian manner by a surgeon of Lausanne, of the name of Griffon. Hildanus says he had often seen and examined this nose, and that, after sixteen or seventeen years, it had remained as sound as ever. Fienus, in his Libri Chirurgici Duodecem, &c., published at Frankfort in 1649, treats very fully, in his twelfth book, of the manner of repairing noses by a flap of skin taken from the arm; and, after enumerating the different authors who have mentioned this mode of practice in their writings, says expressly,—"I can testify that Gaspar Taliacotius, professor of surgery in the academy at Bologna, has restored many noses by this art, some of which I have seen restored, and others in the way of being so." The Taliacotian art does not, however, appear to have long outlived its author in Italy; nor need this seem wonderful, if we consider the extreme difficulty of executing it, and the very small advantages which it actually procured.

Curtin is almost the only one of Taliacotius's immediate disciples who seems to have followed up carefully the practice of his master. In his Miscel. Medicinal. Decades Denæ, printed at Maisance, he affirms, with great exultation, "that, by the assistance of God, he had made such proficiency in this art as to repair not a few noses both in Sicily and other places."

The occasions for imitating the mode of practice, so fully described by Taliacotius, happily now occur very seldom in Europe; but in India, where the punishments are in some places of the same nature with those that were inflicted in Europe in the time of Taliacotius, the art of restoring noses is still held in considerable repute.

You will find an interesting and well-authenticated account of the manner of repairing noses, as practised in India, contained in the Gentleman's Magazine for the month of October, 1794. By this account it appears, that the Indian method of restoring noses differs from the Taliacotian chiefly in taking the flap of skin, of which the new nose is to be formed, from the forehead in place of the arm.

Boyer mentions, that the late M. Chopart had employed, in a manner, it would seem, similar to that practised in India, a portion of the integuments of the neck, to fill up a void space left by the operation for cancerous lip. The union took place, and a tolerably well formed lip was procured.

From the numerous analogies which exist between vegetable and animal bodies, and from the results of some experiments which have occasionally been made relative to the transplanting or engrafting parts of living animals into each other, in imitation of practices that have been long followed with vegetables, it has become a question in the progress of surgery, whether parts which have been completely separated from the rest of the animal system, and in which the circulation has ceased altogether, can be again re-united. This re-union was long conceived to be in every instance impossible; but the success which in some cases has attended the transplantation of the teeth, has clearly shown, that in one instance at least, even in the human body, this re-union is possible. Of the possibility of this mode of re-union in brute animals, numerous examples are to be found in authors. The experiments and observations which have been collected relative to this point, while they extend our knowledge of the process of re-union, serve also to evince that it often takes place, even in circumstances in which, previous to trial, we should have conceived it to be impossible.

Du Hamel, in his very ingenious and instructive essay on the subject of vegetable and animal engraftments, inserted in the Memoirs of the Royal Academy of Sciences for the year

1746, mentions that it was a very common practice in the poultry yards in France, to engraft the spurs of young cocks upon their combs, and that in this situation the spurs were observed to grow to a larger size, than when they were allowed to remain on the legs. In one instance the spur was known to grow to the length of nine inches. Du Hamel was led by curiosity to repeat these experiments upon a number of young cocks; several of the spurs fell off, but in those that remained, a strong and perfect union was found to have taken place by the fifteenth or twentieth day. Spurs, which in the month of June were not larger than an ordinary hempseed, had acquired nearly half an inch in length before the end of December in the same year, and by the end of three or four years, some of the spurs engrafted by Du Hamel in the comb had acquired about four inches in length. In dissecting the parts which had been united by this engrafting, Du Hamel found, first, that the base of the spur was surrounded by a kind of cartilaginous ring; secondly, that when this ring was removed, a kind of capsular ligament was perceived, which formed a sort of joint between the spur and the cranium of the cock; thirdly, that several ligamentous bands could be seen passing from the root of the spur to the fore part of the beak, to the superior part of the orbits, and to the different parts of the occipital bone; fourthly, that the interior bony part of the spur was covered by a membrane that resembled the periosteum, and in some parts it was seen as if filled with blood; and, fifthly, that the external horny part was thin at its base, and solid towards its point. From these experiments and dissections, Du Hamel has deduced the following conclusions: first, "We see then," says he, "that an organized part detached from the leg of a cock, when it was not bigger than a hempseed, and placed upon the head of the same animal, forms there an union sufficiently intimate to become several inches in length, while it preserves in this new situation its original organization in every respect, except in the mere circumstance of becoming larger. This, therefore, is a true engraftment performed upon an animal. Secondly, we see a bony nucleus covered first with a periosteum, and then with a horny substance; in a word, a horn similar to that of oxen, and which grows in the same manner, connected to the cartilaginous ring by the ligamentous bands, which have been already mentioned. Thirdly, this

horn, by its size, and by the continual motions of the head, being prevented from uniting firmly, or, in other words, from anchylosing with the cranium, forms a kind of joint furnished with several ligaments sufficiently strong to support it. But these organs are not to be found in the natural state, either under the comb of the cock, or in the neighbourhood of their spurs, at least I have never been able to perceive them there. Nature in this manner choosing to supply her own wants by the developement of new organs."

The experiments of Du Hamel have since been repeated, and similar results obtained, by Mr. Hunter. Several authors indeed have supposed that they were first made by Mr. Hunter, but he is far from wishing to assume that merit to himself. In relating these experiments, at page 224 of his work on inflammation, Mr. Hunter says, " the first was the common experiment of transplanting the spur of a young chicken from its leg to its comb, in which experiment I always found that the spur on the comb, when it took root, grew much faster, and became much larger, than that on the leg. This I attributed to the greater power of action in the comb than in the leg, although they are pretty nearly at equal distances from the source of circulation ; but probably position also favoured it, as there was no stagnation in the veins of the head. In the power of producing such effects in disease as well as in the growth of parts, I was then desirous to know the comparative degrees between the male and female. I wished also to know if the parts peculiar to the male could grow on the female, and if the parts of a female on the contrary could grow on a male.

" Although I had formerly transplanted the testicles of a cock into the abdomen of a hen, and they had sometimes taken root there, but not frequently, and then had never come to perfection, yet the experiment could not from this cause answer fully the intended purpose ; there is, I believe, a natural reason to believe it could not, and the experiment was therefore disregarded.

" I took the spur from the leg of a young cock, and placed it in the situation of a spur in the leg of a hen chicken ; it took root, the chicken grew to a hen, but at first no spur grew, while the spur that was left on the other leg of the cock grew as usual.

" This experiment I have repeated several times in the

same summer with the same effects, which led me to conceive that the spur of a cock would not grow upon a hen, and that they were therefore to be considered as distinct animals, having very distinct powers. In order to ascertain this, I took the spurs of hen chickens, and placed them on the legs of young cocks. I found that those which took root grew nearly as fast, and to as large a size, as the natural spur on the other leg, which appeared to be a contradiction to my other experiments. Upon another examination of my hens, however, I found that the spurs had grown considerably, although they had taken several years to do it; for I found that the same quantity of growth in the spur of the cock, while on the cock, during one year, was as much as that of the cock's spur on the hen in the course of three or four years, or as three or four to one; whereas the growth of the hen's spur on the cock was to that of the proper spur of the cock, as two to one. These experiments show that there is an inequality of powers in different parts of the same animal, and that the legs have much less than the comb; they also show that there is a material difference in the powers of the male and female. The spurs of a cock were found to possess powers beyond those of a hen; while, at the same time, the one animal, as a whole, has more powers than the other; yet, when I apply these principles to the powers of cure in local diseases, of the two sexes in the human race, I can hardly say that I have observed any difference."

Mr. Hunter made a whimsical enough variation upon this experiment, by inserting a human tooth, newly pulled, into the comb of a cock. From the specimens, marked 58, 9 and 60, among the preparations in spirits preserved in his museum, and which were the subjects of this experiment, it appears that a vascular union had taken place between the comb and the vessels of the tooth, for the membrane lining the cavity of the tooth is seen beautifully coloured by a red injection, which had been thrown into the vessels of the cock. Mr. A. Cooper, of Guy's Hospital, is in possession of a similar preparation.

Mr. Hunter, in the paragraphs which have been quoted, refers to some experiments which he had at one time made with regard to the possibility of an adhesion taking place between the testicles of cocks, and the inner peritoneal surface of the bellies of hens, into which these testicles were

introduced. The experiment he mentions often failed ; but four specimens are preserved in his museum, marked Nos. 54, 5, 6, and 7, in which a vascular union had actually taken place, and in which, though the size of the testicles does not appear to have received any addition after their attachment to the parietes of the abdomen of the hen, still their vitality had been completely preserved by the communication of blood-vessels which had been formed. Had the circulation been carried on in these testicles without the co-operation of the absorbent vessels, in that case we should have expected an increase of bulk, not a diminution, as actually happened.

M. Richerand, in his Nosographie Chirurgicale, contends that Mr. Hunter's experiment of introducing the testicles of the cock into the abdomen of the hen, and their adhering to the peritoneum, by no means prove the possibility of re-uniting a part which had been entirely separated from its connections with the animal system. They are, he says, foreign bodies, which irritate the peritoneum, and occasion an exudation of lymph, which produces a feeble union; but the foreign body at length wastes, becomes decomposed, and falls into a putrid solution, injurious to the animal upon which the experiment has been made. It does not appear that M. Richerand has ever repeated Mr. Hunter's experiments, for if he had, it is not likely that he would have been disposed to question the accuracy of Mr. Hunter's statements. Mr. Hunter indeed candidly acknowledges, that the union of the testicle very seldom took place in his experiments ; but in those instances in which it did, and the subjects of which have been preserved in his museum, the testicles, so far from acting as foreign bodies, or from falling into a state of putrid solution, coalesced by a vascular union, and continued, till the animal was killed, to receive their contingent of blood and of vitality from the general circulation.

But the experiment of engrafting the parts of one animal upon another, and by that means making them grow in new situations, has not, as has already been hinted, been entirely confined to brute animals; it has perhaps been oftener performed upon the human body than upon any other subject, in the well-known practice of transplanting teeth. The possibility of a re-union taking place between a tooth and the socket from which it had been recently forced

out, or pulled, was probably first discovered by accident: for in extracting teeth, the operator sometimes pulls one different from that intended, and, to conceal this accident, is induced to replace it, and to represent it as one which has been slightly loosened. That a tooth replaced in this manner not unfrequently re-adheres, has been long known to the practitioners of the healing art.

Celsus describes the mode of replacing and of fixing teeth which had been forced out by blows and other accidents; and his practice does not seem to differ, in any material point, from that of the best dentists of the present day. But in whatever way the possibility of re-uniting a tooth to its socket may have been first discovered, we know that the transplantation of teeth from one person's mouth to another's has often been practised, oftener than any other species of animal engraftment, and oftener perhaps than it is ever likely to be again, from the untoward symptoms which have not unfrequently been found to result from this practice.

M. Richerand regards the transplantation of the teeth as a fact not more conclusive than the adhesion of the testicles in the abdomen of hens. It, (that is, the tooth,) he says, does not truly take root, as the vulgar believe, but is merely retained mechanically by the union of the gums, which embrace its neck, and by the contraction of the alveolus, which moulds itself upon the root and part of the body introduced into it. This statement of M. Richerand's, with regard to transplanted teeth, is, I am inclined to believe, in some respects true, and in others imperfect and erroneous. That a vascular re-union may take place between the vessels of the tooth and those of the socket, seems to me to be proved, beyond all possibility of doubt, by the experiments of Mr. Hunter and of Mr. Cooper, in which the vessels of the membrane lining the cavity of the tooth, and probably the only vessels which a tooth has, were filled from the vessels of the comb into which the tooth had been inserted; though it may be, and perhaps ought to be, conceded to M. Richerand, that even in those cases in which a replaced or transplanted tooth becomes fixed, its firmness is in a great measure owing to the circumstances which he describes.

The anonymous author of the article Cranium, in Rees's Encyclopædia, in a very ingenious and able dissertation on the question, Whether the bony part of the teeth be vascu-

lar or not, affirms, that if a dead tooth, or, in other words, one that has been for a long time pulled, be inserted into the comb of a cock, it will adhere, as well as a living or recently pulled tooth; and, in proof of this, he mentions that he had seen an example of a dead tooth "adhering firmly" in the comb of a cock, where it had been placed by Mr. Moore, an ingenious dentist and lecturer in London. This is certainly a very curious and uncommon result, and one which differs totally in kind from the adhesion of the spurs in Du Hamel, and of the teeth in Mr. Hunter and Mr. Cooper's experiments. It is to be regretted, however, that this author omits to inform us whether by the terms "adhering firmly" we are to understand that the tooth in Mr. Moore's experiment is fixed merely by mechanical means, such as the contraction of the comb round the roots or neck of the tooth, or whether there be indeed a coalescence formed between the surface of the tooth and comb, into which it has been inserted, similar to that which exists between the human nails and the parts subjacent to them, or to that coalescence or adhesion which we observe between the soft and hard parts of a shell fish, and the other tribes of crustaceous animals; a coalescence which would seem to be the effect of a vital process, though we have no reason, it must be confessed, to believe that any thing like vascular union or communication of blood-vessels occurs in the surfaces which adhere so firmly to one another. That a tooth dead in every respect may be fixed even without any external mechanical means in the living socket, so as not only to remain there for months, or for years, but to become so firmly fixed as not to admit of being readily pulled out, and to serve very well for dividing and grinding the food, is a singular fact, that was first mentioned, so far as I can find, by M. Fauchard. The observation has been since confirmed by some cases which are related by M. Bourdet, at the 199th page of the second volume of his work on the Art of the Dentist.

In fixing a dry tooth, several notches are made on its root with a file, before it is introduced into the socket. Bourdet remarks, that though this operation often succeeds, it does so less frequently than the transplantation of fresh teeth. He succeeded in one only of three cases in which he attempted it. The tooth, in this case, became as firm as any of the teeth in the head. A lady of Bourdet's acquaintance had this operation performed by a cutler. After se-

veral years the transplanted tooth preserved its whiteness, and was one of the strongest teeth which this lady had. It was easy to perceive, on looking at it, that this was a tooth from the left side of the mouth which had been fixed into the right.

These cases of M. Bourdet's are abundantly curious, and show clearly that we should form a very erroneous opinion were we to conclude, from the mere circumstance of a replaced or transplanted tooth becoming fixed, that a vascular re-union must necessarily have taken place between the vessels of the tooth and those of the alveolus, every time that it becomes fixed in the socket into which it has been inserted; while, on the other hand, we should reason equally ill, I conceive, were we, from the fact of a dead tooth becoming fixed after insertion in the living socket, to deny that a vascular re-union takes place between the vessels of the pulp of a recently pulled tooth, when it adheres after being replaced in its former socket, or transplanted into a new one. The possibility of the vascular re-union of the vessels of the tooth with those of the living part into which it is inserted, has, it appears to me, been incontestibly established by the experiments of Mr. Hunter and Mr. Cooper upon brute animals, and has much oftener been evinced in the replaced and transplanted teeth of the human subject, by the occurrence of pain in the nerves of the membrane lining those teeth, when they were afterwards attacked with caries, or were filed or stuffed by the dentist. La Motte mentions one case where, on account of the exquisite pain occasioned by a replaced tooth, it became necessary to extract it several years after it had become fixed in the head; a piece of the jaw came away along with it. Fauchard relates several cases of replaced and transplanted teeth, in which he produced a great deal of pain by the introduction of the probe in stuffing them.

Besides those examples that are seen in the transplantation of the teeth, it must be confessed that instances of reunion among parts which had been entirely separated are very rare in the human body, so rare indeed that most practitioners still treat with disbelief and ridicule the few instances which have been put upon record. But the different facts which have been learned respecting the transplantation of the teeth, together with the experiments of Du Hamel and of Mr. Hunter, prove indisputably the possibi-

lity of parts being re-united which have been completely separated from the animal system to which they belonged, and in which the circulation of the blood must necessarily have ceased for a time. There is nothing, therefore, in the nature of the fact recorded that can justify us, I conceive, in doubting the veracity of those by whom similar instances of re-union between other parts of the body have been related.

That practitioners have generally failed in effecting this re-union is frankly acknowledged by those who have related cases so very extraordinary. I shall mention to you a few of those rare cases, and leave it to your own judgment to deduce from them the conclusions which the characters of the authors by whom they are related, and the nature of the facts themselves which they relate, may seem to you to warrant.

The first example of this kind which I find distinctly recorded is by Phioravant, in the 54th page of his second book of the Secrets of Surgery: "In that time, when I was in Africa," says Phioravant, "there happened a strange affair, and that was this:—A certain gentlemen, a Spaniard, that was called Il Signior Andreas Gutiero, of the age of twenty-nine years, upon a time walked in the field, and fell at words with a soldier, and began to draw; the soldier seeing that, struck him with the left hand, and cut off his nose, and there it fell down in the sand. I then happened to stand by, and took it up, and pissed thereon to wash away the sand, and dressed it with our balsamo artificiato, and bound it up, and so left it to remain eight or ten days, thinking that it would have come to matter; nevertheless when I did unbind it I found it fast conglutinated, and then I dressed it only once more, and he was perfectly whole, so that all Naples did wonder thereat, as is well known, for the said Signior Andreas doth live and can testify the same."

Blegny, in his Zodiacus Medico Gallicus for the month of March, 1680, mentions a case in which a nose that had been cut off with a sabre was replaced by a military surgeon of the name of Winsault, and in which a perfect re-union was obtained, he affirms, by the use of stiches and of agglutinating plasters.

A third case of the same kind is related by Garangeot, at the 55th page of the third volume of his Operations of Surgery. Garangeot's case is the following:—"In the

month of September, 1724, a soldier of the regiment of Conti coming out of L'Epée Royale from an inn in the corner of the street Deux-Ecus, was attacked by one of his comrades, and in the struggle had his nose bitten off, so as to remove almost all the cartilaginous part. His adversary perceiving that he had a bit of flesh in his mouth, spat it out into the gutter, and endeavoured to crush it by trampling upon it. The soldier, who, on his part, was not less spirited, took up the end of his nose, and threw it into the shop of M. Galin, a brother practitioner of mine, till he should run after his adversary. During this time M. Galin examined the nose that had been thrown into his shop, and, as it was covered with dirt, he washed it at the well. The soldier returning to be dressed, M. Galin washed his wound and face, which was covered with blood, with a little warm wine, and then put the extremity of the nose into this liquor, to heat it a little. Having in this manner cleansed the wound, M. Galin now put the nose into its natural situation, and retained it there by means of an agglutinating plaster and bandage. Next day the re-union appeared to be taking place, and on the fourth day I myself dressed him with M. Galin, and saw that the extremity of the nose was perfectly re-united and cicatrized."

These are the only cases which I have been able to find distinctly stated of the re-union of a nose which had been completely cut off. This event, from analogy we have reason to believe, is possible, and nothing short of a contrary testimony in the instances I have related, could justify us, I conceive, in denying the truth of the fact.

Bossu, surgeon at Arras, in the 33d volume of the Journal de Medicine, relates the history of a case in which the point of a finger that had been cut off was afterwards re-united. "The facts," says this author, "related by Garangeot appeared to me at first, as they have done to many others, so ridiculous, that I frankly confess I doubted of their possibility till experience had undeceived me. Anthony Mignot, a slater boy, dwelling in the village of Hamegecourt, near to La Fere, in shaping a wedge of wood with a hedge-bill, amputated obliquely the third phalanx of the thumb of the left hand a little above the nail, in such a manner as to lay open the articulation on the lateral and internal part. He came to me immediately after the accident, and while the wound was still bleeding. I took the

thumb which he had in his pocket, covered with dirt and crumbs of bread, washed it in warm wine, re-applied it, and supported it with proper dressings, and bandaging. I put his arm into a sling, and recommended him to dip the thumb from time to time in spirits of wine. Next day I found the arm slightly swelled, but this swelling disappeared at the end of six or seven days, when I removed the dressings : I then saw with pleasure that the re-union had begun to take place. A slight suppuration which had come on, induced me to enclose the thumb in a slip of linen cloth dipt in the balsamum arcæi, and to remove the dressings from time to time. About the thirtieth day the extremity of the thumb, now re-united, was deprived of the cuticle and nail, which came away like the finger of a glove, and exposed to view a circular and perfectly solid cicatrix. A new nail came gradually on, and the joint recovered its flexibility, but the extremity of the thumb possessed only a very imperfect sense of touch. The length and natural figure of the thumb, the motion of the joint, the circular cicatrix, and the nail very well shaped, prove undeniably," says this author, " that the portion which had been applied had become alive again."

I have been informed by different persons, of whose veracity I have no reason to doubt, of a considerable number of cases, similar to those which have been related by the authors I have quoted, in which the points of fingers and toes completely separated were afterwards re-united. Indeed it is not easy to conceive any motive which the reporters of such occurrences can have to deceive the public; and this is obviously one of those points in the practice of the healing art in which no room is left for the practitioner to deceive himself. On the other hand, it must be acknowledged that attempts to produce this species of re-union, whether made on the human body or upon brute animals, have almost always failed, even when they were made in circumstances which seem favourable to re-union. First Delafaye, and more recently Richerand, have tried to produce it, but without success, in numerous experiments upon the nose and ears of the dog.

But whatever may be the precise state of the fact with regard to the cases of complete separation which I have related, certain it is, that many cases are upon record, and many more have been observed, in which parts have re-united, which were divided all to a very small portion of

cutis—a portion so small, that it is not easy to conceive that any very effective circulation could be carried on through it, and in these cases it deserves to be remarked, that it was generally the nose, or the extremities of the fingers and toes, which re-united after having been separated and replaced. I have seen two examples of the re-union of the nose where it was almost entirely separated. In one of them it adhered only by the skin of one of the alæ, and in the other chiefly by the septum. Arcæus mentions a case in which the nose, with most of the upper jaw, was so separated as to hang down upon the chin, and yet a re-union was effected. A case is mentioned by Lombard, in which the nose, nearly cut off, and unreplaced for some hours in winter, was made to re-adhere by stitching and proper dressing. Another case of the same kind occurred to Loubet.

I have seen the little toe re-adhere after it had been separated at its root, so as to remain attached only by a small slip of skin. In this case an exfoliation of the bone of the first phalanx took place, and the re-union was tedious. A woman came to me several years ago, who had cut through the point of her little finger with a reaping hook; it hung loose by a very small slip of skin. I wished to have taken off the loose portion of the finger, but to this she would not consent. The divided portion was replaced, and after a long time it re-adhered.

It must not be imagined that the recital of such uncommon cases is without its use; for while they extend our knowledge of the powers inherent in living bodies, they inform us of the advantage often to be derived from allowing these powers proper opportunities of exerting themselves. Of re-union by adhesion, we are in no case to despair, so long as the least degree of circulation remains in both, or even in one of the parts divided. We must learn from experience in what circumstances re-union may be attempted with probability of success and in what it may be regarded as impossible.

The effects of adhesive inflammation in uniting together parts which are naturally discrete, and which in a sound state are intended to move more or less freely on each other, are often manifested in the progress of internal diseases. The more remarkable examples of this kind which occur in the human body, are those which, during the state of inflammation, so frequently take place within the cavities of

the chest and belly. These cavities are lined, and the viscera they contain, covered by the texture called serous membrane, the properties of which I have already described to you, and which is very subject to inflammation of the adhesive kind.

Inflammation of the pericardium, pleura, and peritoneum, may be acute or chronic in its progress. In acute inflammation it is often organizable lymph that is effused; but if the inflammation runs high, there is often an exudation of serum, and of serum tinged with blood. This occurrence has most frequently, though perhaps not always, a fatal termination, for the serum which is thrown out in this manner is sometimes absorbed, as we have reason to believe takes place, in the cure of hydrothorax and ascites, succeeding more or less quickly to inflammation. That a similar exudation takes place in the inflamed state of the tunica vaginalis scroti, is evinced by the fluctuation which often occurs after the operation by injection for hydrocele, and that even in cases where adhesion afterward actually takes place between the tunica vaginalis testis and the tunica vaginalis scroti.

Adhesions are often formed, between the parietes of the thoracic and abdominal cavities and the viscera which they contain, both in cases where a spontaneous resolution of inflammation takes place, and where the recovery of the patient is to be attributed to the powers of medicine. When the adhesions are slight, and confined to one or two points, the effused and connecting coagulable lymph is sometimes formed into membranous expansions from the motions to which the viscera contained within the chest and belly, are naturally subjected. I have seen these membranous adhesions an inch or more in length, between the surface of the lungs and pleura costalis, and still longer, though this is rare, between the viscera contained within the cavity of the abdomen. More frequently the inflamed surfaces in this cavity remain in contact during the whole course of after life.

In chronic cases of pleuritic and peritoneal inflammation, the lymph which is effused, is in a soft loose and pulpy state, floating often in a milky-like serum, adhering but little, if at all, to the parts with which it comes in contact, and obviously incapable of serving as a medium of adhesion between the opposite inflamed surfaces. The effusion or extravasation to which I allude, has a stronger resemblance

to milk coagulated by white wine than to any other substance to which I can well compare it. I have seen this kind of effusion repeatedly in inflammations of the chest, succeeding in old people to severe chirurgical operations, as after the amputation of a limb for example, but I am ignorant of the particular constitutions and the state of the body in which it occurs. In chronic inflammations of the serous membranes, instead of any evident exudation of organizable coagulable lymph or of serum, there sometimes takes place an exudation of pus ; but perhaps even in these cases, the exudation of a certain quantity of coagulable lymph, and the formation of a vascular apparatus in these membranes, precedes the formation of that fluid.

The surgeon takes advantage of the knowledge which he has of the disposition of serous membranes to adhere during inflammation, in the cure of hydrocele by injection with wine or some other stimulating liquid. It is probably also by a slight degree of adhesive inflammation that the communication between the cavity of the abdomen and the prolongation of the peritoneum into the scrotum, is shut up by nature after the descent of the testicle; and we have reason to believe that it is by the same means, that in hernia, the passage through which a portion of intestine or omentum has descended out of the cavity of the abdomen, is obliterated after their replacement, by the pressure of the pad of a hernial truss. In wounds of the thorax also, we often see nature employ the adhesive inflammation in shutting out the external air from the cavity of the chest, by uniting the surface of the lung to the inner orifice of the wound ; and in strangulated hernia terminating in mortification, we generally find, that the protruded and strangulated part is surrounded by adhesions of the omentum or of the intestines to the parietes of the abdomen, so as to cut off the communication of that cavity with the external air, and to prevent the contents of the intestine, when it gives way in the progress of the disease, from being poured into the cavity of the abdomen.

The effusion of coagulable lymph into the interstices of cellular texture, takes place in almost every case of internal abscess, and by its accreting together the cells of this texture forms the sac in which the matter of suppuration is lodged, and prevents it from being diffused into the cellular membrane surrounding the abscess. The existence of this

effusion is also proved by the hard incompressible swellings which often remain after every other symptom of inflammation has disappeared, as may be observed in the swellings which take place over the joints in rheumatic affections, and still more distinctly in those which accompany, or rather produce that affection termed chordee, which sometimes occurs in gonorrhœa. You will find many curious and interesting illustrations of the process of adhesion and the effects which it produces in the animal œconomy, in Mr. Hunter's chapter upon adhesive inflammation. I shall quote a few paragraphs from that chapter, in the hopes that you will be induced to peruse the whole.

"That the degree of inflammation which becomes the cause of adhesion gives but little pain, is proved by the dissections of dead bodies; for we seldom or never find a body in dissection which has not adhesions in some of the larger cavities; and yet it may reasonably be supposed, that many of these persons never had any acute symptoms, or violent pain in those parts; indeed, we find many strong adhesions upon the opening of dead bodies, in parts which the friends of these persons never heard mentioned, during life, as the subject of a single complaint."

"It seems to appear from observation, that some surfaces of the body do not so readily unite by the coagulating lymph as others, and therefore, on such surfaces there is commonly a much larger quantity of this matter thrown out than probably would have been if union had readily taken place; for we may suppose, that where once union has taken place, extravasation is at an end. Thus we see in (what we may suppose) inflammation of the heart, that the coagulating lymph is thrown out on the exterior surface in vast quantities, while at the same time the heart shall not adhere to the pericardium. This is not only seen in the human, but in other animals. In an ox, the heart was furred all over, and in some places the coagulating lymph was near an inch in thickness. The external surface of such hearts have an uncommon appearance; the outer surface of the coagulating lymph is extremely irregular, appearing very much like the external surface of a sponge, while the base, or attachment to the heart, is very solid and firm. However, in many instances we find the pericardium adhering to the heart, and generally in pretty close contact, which would make us suppose that the extent of motion of

those two parts on one another is not great. These adhesions affect the pulse much, which is a good reason why nature avoids them as much as possible. On the other hand, it seems deducible from observation, that neither the pia nor dura-mater are apt to throw out much coagulating lymph, for here it would produce compression; and, therefore, we seldom find adhesions between them; in consequence of such accidents as produce suppuration between these two membranes, we seldom or never find the surrounding parts adhering so as to confine the matter to the suppurating surface."

"It is unnecessary to instance every possible situation where adhesions could be produced; they can take place wherever there are two internal surfaces in contact, or that can be brought into contact. I cannot give a better instance of its utility in the animal œconomy than in the following experiment: I wished to know in wounds which penetrated into the chest, (many of which I have seen in the army) where suppuration had come on the whole cavity of the chest, as well as on the surface of the lungs, and where the lungs collapsed, how parts were reinstated, or in what form they healed; whether the lungs, etc. lost their suppurating disposition, and dilated, so as to fill the chest again. To ascertain this as far as one well could, I made the following experiment on a dog.

"October, 1779, I made an opening between the ribs into the chest of a dog, and touched the edges of the wound all round with caustic, to prevent it from healing by the first intention, and then allowed the dog to do as he pleased. The air at first passed in and out of his chest by the wound. He eat, etc. for some days, but his appetite gradually began to fall off. He breathed with difficulty, which increased; he lay principally on that side, which we find people do who have the lungs diseased in one side only or principally, and he died the eleventh day after the opening. On opening the body, I found the collapsed lungs passing directly across the chest, and attached to the inside of the wound all round, so that they excluded the cavity of the chest from all external communication. This circumstance of the lungs falling across the chest was owing to his having lain principally on that side, which I conceived to have been only accidental.

"The cavity of the chest all round was filled with air.

That part of the external lungs which did not adhere, that is to say, the upper surface of the diaphragm, and that part of the pleura which covered the ribs, were entirely free from inflammation or suppuration; this cavity, from these adhesions, being rendered a perfect cavity, shows that air, simply, has no power to excite inflammation when the cavity is otherwise perfect, which the adhesions had effected; this shows also that adhesions of two surfaces round the exposed part, exclude every part from the necessity of inflammation, as was explained when treating of inflammation."

Have inflamed surfaces or inflamed serous membranes the power of exciting inflammation in sound surfaces, or membranes with which they come into contact? I am inclined to believe that they have; but this is a point which would require to be investigated experimentally.

It is by availing himself of the disposition which parts in the state of adhesive inflammation have to unite with one another, that the surgeon is enabled to suppress hemorrhage, and to promote the re-union of the edges of wounds. This disposition is the real source of most of the cures which he performs, and the sole foundation of the operative part of his art. But for this innate power hemorrhage could not be suppressed, operation would be impracticable, and the condition of the wounded in every respect helpless. Indeed the suppression of hemorrhage, and the re-union of divided surfaces, are in every wound, and in every operation, the first and the ultimate objects of the surgeon's attention; and his success in practice, it may be presumed, will be proportional to his knowledge of the means by which these objects are best attained. This consideration will, I trust, sufficiently justify the minuteness of the details into which I am now to enter.

Hemorrhage in wounds may take place from veins or from arteries. The arterial hemorrhage is in general easily distinguished from the venous, by the blood being of a more florid red colour; by its coagulating more readily than venous blood; by its stream being increased at every pulsation of the arteries; and by its being capable of being stopped by means of pressure applied to the trunk of the artery any where between the wound and the heart.

The quantity of blood which flows from a wounded artery is found to vary, not only according to the size of the artery, and of the wound made in it, but also according to the

direction of the wound, whether longitudinal, oblique, or transverse; the more or less complete division of the artery; the depth and relative situation of the parts which cover it; and the pains which are taken to confine the blood by the external integuments. In illustration of this statement, I may remark, 1st. That if the femoral artery of a quadruped be punctured with a lancet in the longitudinal direction of its canal, the blood will at first rush through the puncture with great impetuosity; a part of it, however, in escaping, will insinuate itself into the cellular membrane, situated between the artery and the skin, and accumulating there, will produce a swelling, which gradually shuts up the canal of the puncture, and prevents any farther external loss of blood: a thrombus, or aneurism, is formed, which will continue to increase while the puncture in the artery remains open, but which will gradually disappear after that puncture has been closed.

2dly. If, instead of a longitudinal, a transverse wound be inflicted, so as to divide the anterior side only of the artery, together with the integuments which cover it, the blood will continue to flow in an uninterrupted stream till the exhausted animal expires. This is a species of wound which nature very seldom attempts to cure.

3dly. If the artery, instead of being partially, be completely divided in the transverse direction, its extremities will recede from each other, and in receding their diameters will contract. The stream of blood will lessen by degrees, till it at length ceases altogether, or comes only by jerks. The effect of this contraction, in putting a stop to hemorrhage, as well as the very slow and gradual manner in which it takes place, may be very well seen in the phenomena which present themselves in the division of small arteries during chirurgical operations. The stream of blood which flows from these arteries becomes gradually smaller, till at last it ceases to be thrown forward in jets, trickles merely over the surface of the wound, or stops altogether. This spontaneous contraction in the extremity of the artery may be overcome, it is true, by whatever produces an increased influx of blood into its canal; but when this increased influx ceases, the extremity will again close. This is the state in which divided arteries have been found, in all cases where hemorrhage from them has been suppressed by nature.

4th. If, lastly, an artery, instead of being divided with a

cutting instrument, be forcibly torn asunder, a very inconsiderable quantity of blood will in general be lost. The inner surface of the ruptured artery will be found torn, in various places contracted, and containing coagula of blood. This is a state of arteries which has been first accurately ascertained by Dr. Jones, in his Experimental Investigations.

When in wounds of arteries much blood is lost, the animal becomes languid and faint, the heart ceases to beat with its accustomed force, and the blood ceases to flow, or flows only in small quantity from the wound. The blood which comes into contact with the external air coagulates; and this process of coagulation extends to the blood contained in the interstices of the cellular membrane surrounding the artery, and, in some cases, also into the open extremity of the artery itself: a clot or plug of blood is formed, both without and within the divided artery, which opposes a new barrier to the escape of fresh blood. But in wounds of the larger arteries, and in a more active state of the circulating organs, this clot may be driven off by the impulse of a fresh influx.

The extremities of a divided artery are occasionally compressed by the cellular membrane immediately surrounding them becoming injected with blood, but I doubt whether this ever occurs in such a degree, as to put even a temporary stop to arterial hemorrhage. The radial and ulnar arteries in particular, have often been observed to bleed freely, though the cellular membrane surrounding them was distended with blood.

During the time that the events which I have described are going on in wounded arteries, there are other changes taking place, which though of a less obvious nature, are more essentially necessary to the final closure of the arterial canal. In a few hours after the infliction of the wound, the process of adhesive inflammation supervenes, and a layer of coagulable lymph is thrown out, which covers the surface of the wound, and extends into the extremities of the divided arteries. In the progress of this inflammation, the internal parietes of the extremities of the arteries adhere, and the process which nature employs in the suppression of hemorrhage may now be said to be completed.

If, instead of wounding the main artery of a limb, you lay it bare by dissection, and tie it with a ligature, various

changes will be induced in the canal of the artery itself, as well as in the limb to which it belongs. The course of the blood in the portion of the artery to which the ligature is applied, will of necessity be suspended, and the pulsations stopt for some way below the ligature; but the distance in the canal to which this stoppage of the pulsation extends, varies in different cases. The limb often feels benumbed immediately after the application of a ligature to its main artery, though no portion of a nerve is included in it. The temperature of the limb is in general reduced several degrees. This, I know, has been doubted, and cases have been adduced in which an increase, rather than a diminution of temperature seemed to follow the stoppage of the circulation through the main arterial trunk. But there are several sources of fallacy in making this experiment, against which it is necessary to be on our guard. It is necessary that the limbs to be compared shall have precisely the same quantity of clothing; that they shall remain equally at rest; and that the anastomosing branches of the limb, in which the artery is tied, shall not previously have acquired any preternatural increase of size.

That the circulation of the blood through a limb is not altogether stopt by the application of a ligature to its main arterial trunk, may be made apparent by passing a bandage round the upper part of the limb, so as to press upon the subcutaneous veins. By swelling out under this pressure, these veins show that the limb is receiving a supply of blood through the collateral and anastomosing arterial branches. In a few days after a ligature has been applied to the origin of its main artery, the temperature of the limb becomes equal to, or higher than that of the corresponding limb; and at this period the pulsation, in consequence of the dilatation of the collateral anastomosing arterial branches, usually returns in the arteries situated at a distance from the place to which the ligature is applied. The part of the artery included in the ligature being deprived of its vitality, separates from the living parts, and the ligature is discharged. If at this period we open the extremities of arteries which have been closed, either by the spontaneous process of nature, or by the application of a ligature, we shall find these extremities contracted, and, in some instances, filled with small clots or plugs of coagulated blood; but most generally, instead of blood, we shall find clots or plugs of coagulable lymph, ex-

tending from the closure of the artery into its open canal. These clots, which are usually of a conical shape, and have their basis attached to the contracted extremities of the arteries, are capable of being injected with size and vermilion. Not so the coagula of blood : they are foreign bodies which require to be removed by the process of absorption. If examined at a later period, we not unfrequently find the canal of the artery, to which a ligature has been applied, rendered impervious, and completely obliterated from the point to which the ligature was fixed, up to the first obvious anastomosing branch. This is a fact that was first noticed by Petit, and afterwards by Mr. White, of Manchester. The presence of an anastomosing branch close to the place of the ligature, by the circulation which it keeps up, often prevents the formation of the coagula of blood and of lymph, by which the extremities of tied arteries are closed.

In wounds in which an arterial hemorrhage occurs, which does not speedily cease of itself, and particularly in wounds where we perceive that the blood flows with considerable force, recourse must be had to artificial means in order to restrain it. These means may all perhaps be reduced to compression, ligature, astringents, and cauteries.

Compression may be made upon wounded arteries by pads, or compresses which are retained by means of bandages or instruments. Galen mentions a wound of the brachial artery inflicted by a young practitioner in the operation of blood-letting, which was healed by compression in four days. The compression appears to have been made by an agglutinating plaster, a piece of sponge, and a roller bandage that was carried several times round the elbow-joint. In all the other cases of wounded arteries which had come under his observation, an aneurism, of a greater or smaller size, had uniformly been produced. As a proof that the blood came from an artery, and not from a vein, Galen remarks that it came with a jerk; and this is, I believe, the first instance on record in which this mark of arterial hemorrhage is mentioned.

A considerable improvement in the mode of applying the roller-bandage in wounds of arteries, was made by Genga, an Italian physician and surgeon, of which he has given an account in his Anatomia Chirurgica, printed in 1687. This practitioner was called to a young man who had just had the brachial artery opened in the operation of blood-letting. Pressure being made by an assistant upon the course of the

wounded artery, Genga began by applying a small roller to each of the fingers, and afterwards a longer and broader one to the hand and forearm, rolling this with a moderate degree of tightness till he came near to the elbow-joint. Compresses were now applied to the wound, and, after making two or three turns with the bandage over the compress, he carried it some way above the elbow. A firm compress was then laid upon the course of the blood-vessels above the wound, and made to press upon them by a second bandage, applied over the first. The pulsations of a small aneurism which had formed, were still visible at the end of the fourteenth day; but, by continuing the use of the bandages, the cure was completed by the twenty-second. Genga says that he was led to adopt this mode of bandaging from having perceived in several similar cases, swelling gangrene and sphacelus of the hand and forearm occur from the application of bandages, which acted like so many tight ligatures placed around the elbow-joint. The propriety of commencing the application of the bandage from the points of the fingers and toes, is not, Genga justly remarks, confined solely to cases of wounded arteries. It is equally proper, I am convinced, and will ever be found useful in all cases of fracture, dislocation, or ulcer of the extremities in which the use of bandages is required. This practice of Genga's was afterwards adopted by his countryman, Guattani, and applied by him with very considerable success to the cure of the larger aneurisms of the inferior as well as of the superior extremities. It was much used in wounds of arteries by Theden, who was a long time head surgeon to the Prussian army. From the accounts which have been published of its success, and from what I have myself seen, I am satisfied that it is a mode of bandaging that may be highly useful in many cases of wounded arteries; and that, when judiciously employed, it may prevent the occurrence of aneurisms, or even cure them after they have occurred.

A great variety of instruments for compressing wounded arteries and aneurisms have been at different times invented. The first instrument of this kind of which I find any account, is figured by Scultetus, in his eighteenth plate. It seems to have been invented about the beginning of the seventeenth century, by a dexterous arteriotomist, who was accustomed to draw blood from the radial artery, in order to cure severe pains of the head. It consisted of two circu-

lar pieces of iron, in which the forearm was placed, connected together with bars about a foot in length. In the lower part of one of these bars, a screw-pad was fixed, by turning round which, any degree of compression required could be made upon the artery over which it was placed. Scultetus suggests that every surgeon should be in possession of a similar instrument; and it seems difficult to look at the representation given of it without being led to imagine that it may have suggested to the mind of Petit the first idea of the screw tourniquet.

Many years after this, a compressing instrument for the cure of wounded arteries and aneurisms, was invented and used in his own case, by M. Bourdelot, physician to the Queen of Sweden, who had had his brachial artery pricked in blood-letting. The compressing instrument was worn by Bourdelot upwards of twelve months, and a radical cure obtained; of which he published an account in the Zodiacus Medico Gallus for the year 1681. Since that time, various other instruments have been proposed for the same purpose, but, however much diversified in form, they all seem to act upon the same principle. By their means, pressure is made with a screw-pad over the extremity of the wounded artery, or over the sac of the aneurism, while the counter-pressure necessary to support this is diffused over an extensive surface on the opposite side of the limb. The screw-pad which presses upon the artery, and the compresses by which the counter-pressure is made, are connected together by semicircular pieces of iron, which stand off from the sides of the limb, so as to make no pressure there, but to allow the circulation of the blood and of the lymphatic fluid to go on freely through the collateral and anastomosing branches. It cannot be denied that cures have occasionally been effected by means of these instruments; but the objections to their use are numerous, and appear to be but too well founded. They are easily displaced; they occasion pain, which is long continued: they produce sometimes in the parts on which pressure is made, and at other times in those below them, a swelling and tendency to gangrene. Even in the cases in which they are successfully applied, they are long in effecting a cure, and the cure which is at last obtained, is one which might, in some instances, have been produced by surer, safer, and simpler means. Of the three methods of compressing wounded arteries and aneu-

risms, I regard that employed by Genga as by far the best, and can easily conceive many cases in which it is deserving of a trial.

In the greater number of cases in which compression produces a cure of wounded artery or of aneurism, there is reason to believe that the canal of the artery is shut up, by the adhesion of its sides at the place where the pressure is applied. Two cases, however are recorded, one by Petit, and the other by Scarpa, in which compression effected a cure of aneurism at the flexure of the elbow joint, with the entire preservation of the arterial canal.

But compression serves as a temporary means of suspending hemorrhage, in many cases of the division and wounds of arteries in which we expect nothing from it in the way of cure. We have daily examples of this in the performance of those chirurgical operations which require the use of cutting instruments. The trunk or orifice of a vessel from which blood issues in operation, may, in some instances, be pressed with the fingers simply, so as effectually for a time to restrain the hemorrhage. But, in most operations of any importance, the fingers are either insufficient for that purpose, or cannot, from the situation and number of arteries to be divided, be safely or usefully applied. Hemorrhage, therefore, is now usually suspended during operation, particularly upon the extremities, by the use of the instrument so well known by the name of the tourniquet. This instrument consists of a firm belt, strap, or ligature, which is put round the limb, and made to press upon the arteries by tightening it with a pin or a screw. The tourniquet is one of the simplest, most obvious, and useful of human inventions, and yet it does not appear to have been made, nor this mode of suppressing hemorrhage in operation employed, before the siege of Besançon, in 1674. At this siege M. Morrell employed a pin in tightening the ligature that was put round the limb in amputation, in the same way that carters tighten the ropes with which they fasten goods of different sorts upon their waggons. This instrument is the *turn-stick* of the older English surgeons. The mode of suppressing hemorrhage by it is described by Mr. Young of Plymouth, in his Currus Triumphalis e Terebintho, written in 1678, four years after the siege of Besançon, "I hope," says Mr. Young, "it will not be altogether impertinent if I here take occasion to recommend to the

young practitioner one way of ligature very useful in amputations, especially above the knee, that is to say, a wadd of hard linen cloth, or the like, inside the thigh, a little below the inguen; then passing a towel round the member, knit the ends of it together, and with a batoon, a bedstaff, or the like, twist it till it compress the wadd or boulster so very strait on the crural vessels, that (the circulation being stopped in them) their bleeding, when divided by the excision, shall be scarce large enough to let him see where to apply his restrictives, nor shall the pain of that operation be comparable to what it would be were not the member numbed by the compress."*

Previously to this period, surgeons simply tied a ligature round the limb, or grasped the parts above the incision very firmly with the hands. The turn-stick is still a very useful instrument, which may at any time be formed of a belt, neck-cloth, handkerchief, strap, or cord, and any hard body whatever, which, by being turned round, may twist these ligatures. It is still used in some public hospitals, but its place in operation is now generally supplied by the screw tourniquet. The proposal of tightening the belt of the tourniquet by means of a screw was made by Petit the surgeon, in 1718, and may justly be regarded as the greatest improvement which has ever been effected in the construction of that instrument. The degree of pressure necessary to restrain hemorrhage can be regulated by the screw with much more exactness than by the turn-stick; and, besides, it does not require the unceasing aid of an assistant to keep the belt of the tourniquet sufficiently tense. The belt or strap should be of a firm cloth, the warp of which does not yield readily to the tongues of the buckles which are fixed into it; and the screw should always remain, however firmly it may be screwed, at the point to which it has been turned by the surgeon. A tourniquet, the screw of which may be turned or moved by pulling strongly at both ends of its strap is insufficient, and may occasion much inconvenience, if not danger, during operation. This trial, therefore, ought always to be made before the tourniquet is applied, that the surgeon may know how far he can safely trust to it.

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* Young, p. 30.

After important operations on the extremities, particularly after amputation, it is often necessary to have a tourniquet placed on the limb, ready to be screwed or tightened in the event of any hemorrhage taking place; but the common screw tourniquet is inconvenient from its weight, and on that account one of a lighter make has been proposed. The forms that have been given to this lighter tourniquet are innumerable, but they are in general of little importance; and the old turn-stick may, I conceive, with great propriety, be substituted in place of them all, being a much simpler and better instrument for the purpose than any of the light tourniquets which have yet been invented.

Pressure by the tourniquet can be applied only for a short time. It puts a complete stop to all circulation in the limb below the part to which it is applied, and seldom fails, when long continued, to occasion irremediable mischief. It should never, therefore, be kept applied longer than is necessary to enable the surgeon to search for and apply ligatures to the divided vessels, and when these are tied it ought instantly to be loosened or removed.

With whom the proposal to apply ligatures to divided or wounded blood-vessels first originated, is a point which cannot now be ascertained. Celsus directs that two ligatures be applied to a wounded vein, and that the vessel be divided between them; but he does not appear to have been acquainted with the use of the ligature in suppressing hemorrhage from arteries. Galen recommends the application of the ligature as a means of suppressing hemorrhage from arteries as well as from veins. But he says nothing of its use in aneurism. Ætius, who lived about the middle of the fourth century, is the author by whom this improvement in operative surgery is first mentioned. "We mark out," says he, "the course of the artery as it descends from the axilla, and then beginning about three inches below that cavity, making a longitudinal incision downwards over the course of the artery. After laying the artery bare, we raise it with a blunt hook, pass two ligatures round it, and then divide it between the ligatures. The wound is then to be filled with frankincense, and proper dressings and bandages applied. We then lay open with safety the swelling in the flexure of the elbow joint, no longer dreading a flow of blood. After taking out the clots of coagulated blood, we seek for the

wound from which it came, tie the artery with two ligatures, and divide between them, filling this wound also with frankincense, in order to promote the process of suppuration."

Paulus of Ægina, who is supposed to have lived in the seventh century, remarks, "that aneurisms which occur in the arm-pits, groins, or neck, are dangerous to meddle with from the size of the arteries, but that those which occur in the extremities admit of being cured by operation." He directs a longitudinal incision to be made over the course of the artery going to the aneurismal tumour, the lips of the wound to be kept open by hooks, and a needle, containing two ligatures, to be passed under the artery after it has been properly laid bare, the artery to be divided between these ligatures, and the wound healed up by suppuration. By way of greater security, and to prevent the slipping of the ligatures which are first applied, Paulus directs that an additional ligature be applied by another needle to each extremity of the artery. This seems to be the first hint of the application of a ligature of security which has been so much employed in modern times, particularly by some of the French surgeons.

The directions given by Ætius and Paulus for the application of the ligature in the cure of aneurism, are copied by the Arabians, and by almost all the older systematic authors. But whether the operation so minutely and accurately described was frequently or at all practised, does not appear from the records of physic and surgery. Guillemeau is the first author who mentions having performed the operation by ligature for an aneurism situated at the flexure of the elbow joint; and he seems to have been guided in the performance of that operation by the directions of Ætius and Paulus, for he laid bare the artery above the aneurismal tumour, tied it, and then opened the aneurismal sac, turned out the clots of blood with which it was filled, dressed the wound, and healed it by suppuration. His account of this operation was published at Paris in 1594.

Sylvaticus, in a treatise published at Venice in 1604, the first distinct treatise, it deserves to be remarked, which was published on the subject of aneurism, recommends in aneurisms of the extremities the application of the ligature in the manner which had been recommended by the ancients, and says that he had seen wounded arteries healed up in various parts of the body. The method of cure by ligature, however, does not seem to have been universally prac-

tised about this time; for Fabricius Hildanus mentions a case of aneurism at the flexure of the elbow joint, which he cured by the application of compresses and bandaging. I do not find any cases of aneurism of the arm recorded, in which the cure had been attempted by the application of the ligature, from this time to that of Wiseman, who, in his Surgery, published in 1676, mentions two cases of aneurism at the flexure of the elbow joint, in which, after having had pressure made upon the artery above the tumour, he cut directly into the sac of the aneurism, without having previously applied any ligatures, as the ancients directed, to the artery above it. "That done," says he, "I threw out the grumous blood with my fingers, and cleansed the wound with a sponge. Then desiring Mr. Hollier to slacken his hand, upon which the artery discovered itself by the blood spurting out, I passed my needle under the upper part of the artery, and tied that, and cut off the end of the ligature. Near the wound made in the artery by letting blood, there was a cartilaginous body formed, which hindered my coming to the artery; I cut it away, then passed my needle, and made a second ligature."

In the second case operated on by Wiseman, a hemorrhage took place on the third day after the operation, in all probability from the inferior part of the artery, to which it does not appear that Wiseman in either of his operations had applied a ligature. This hemorrhage was easily repressed by a bandage, which Wiseman appears to have applied in the manner afterwards proposed by Genga.

Saviard, who seems to have practised in the Hotel Dieu from 1690 to the beginning of the eighteenth century, mentions three cases of operations performed by him for aneurism at the flexure of the elbow joint, occasioned in the operation of blood-letting. In the first case he applied a ligature, it would appear, to the upper part only of the artery, a hemorrhage took plaee from the lower part twelve days after the operation, and seems to have suggested to Saviard the necessity of a double ligature in those cases in which an opening is made directly into the sac of the aneurism. His reflection upon this case is in the following words:—"This accident ought to be a caution to young surgeons, not to neglect tying the artery both above and below the aperture in the operation of the aneurism, in order to be prepared against an accident that may cost the patient his life, after enduring a painful operation."

The operation performed by M. Saviard in the other two cases, is almost in every respect the same with that which is performed for aneurism at the flexure of the elbow joint by the surgeons of the present day, and has served as an example of the judicious and safe mode of operating since his time. The only variation which has been made on the operation for aneurism at the flexure of the elbow joint since the time of Saviard, is that which you will find described in the sequel to the new method of curing fistula lachrymalis, by M. Anel, printed at Turin, in 1714. This method of M. Anel is mentioned by Heister, in his Institutions of Surgery. But it seems to have been totally overlooked by the greater part of those who have written upon the subject of aneurism, and derives much of the interest which it at present possesses from the circumstance of its having been reinvented by Mr. Hunter, and applied by him to aneurisms situated in the lower extremity, a situation in which it is infinitely more useful than it can ever be in aneurisms of the upper extremity.

Anel's method consists in laying bare the artery above the aneurism, in applying a ligature to it so as to stop the flow of blood, in leaving the aneurismal sac unopened, and in applying to the aneurismal tumour a very moderate degree of pressure. He performed this singular operation at Rome, in the year 1710, and with complete success. It does not appear from his own relation, what the circumstances were which determined him to leave the aneurismal sac unopened, but this he did at a period when the functions of the absorbent system were but little, if at all, known, and when of course he could not be said to trust to them for the completion of the cure. The tumour, however, disappeared in this case so completely, that Anel says, it would have been difficult from the examination of the arm to have pointed out the place where the aneurism existed. We have no reason to believe that Anel repeated this operation, otherwise he certainly would have mentioned it.

The ancients have not left us any directions with regard to the application of ligatures to the arteries of the lower extremities, similar to those which they have given respecting the arteries of the upper extremeties in the operation for aneurism situated at the flexure of the elbow joint, and from their silence, there is great reason to believe that they never practised that ligature. Galen declares, that it was

impossible to save any one in whom the great artery of the thigh was wounded.

The honour of having proposed and executed the ligature of the femoral artery seems to have been shared by two Italian surgeons, Joannes Trullus and Marcus Aurelius Severinus. The account which is given of this operation by Severinus is to be found in his work, entitled De Efficaci Medicina, published at Frankfort in 1646. The patient, a young man of 17 years of age, was wounded by a ball in the right thigh about eight inches below the groin, which passed through the thigh, and at the same time appears to have opened the femoral artery. The wound was dressed by a barber, and the hemorrhage restrained, but in the course of the next day a pulsating tumour was observed; a hemorrhage occasionally took place to the amount of three or four ounces, and again stopped spontaneously. The aneurism increasing, with much fever and pain, a consultation of surgeons was held, all of whom were for leaving the case to time and nature, except Joannes Trullus, who was of opinion that the wound should be dilated, with the design of seeking for the wounded artery. This advice, however, was overruled, till a fresh hemorrhage occuring, Severinus was called into consultation. The situation of the patient was found to be such, that nothing but the dilatation of the wound, and the ligature or cauterizing of the artery, so as to suppress the hemorrhage, seemed to afford any chance of saving the patient's life. The consent of the patient and his friends having been obtained, Trullus and Severinus proceeded to the operation. They placed a hard pad upon the artery, the pulsations of which were felt by the finger a little below the groin, and bound down the pad by a strong ligature as was practised at that time in amputation. Trullus afterwards divided the skin, and immediately a great quantity of grumous blood, amounting to six pounds in weight, was removed by Severinus, together with the fresh blood, which now began to flow from the artery, and which directed them to the place where the artery was wounded. The hemorrhage was restrained by Trullus pressing upon the artery in the groin, while Severinus separated it from the contiguous vein, and tied it above and below the wound. Trullus divided the artery the day after the operation, and from that time the cure went on as in a simple wound. Upon this case, Severinus makes the following reflections:—

"There are," says he, "indeed many things worthy of admiration in this case, of which I shall mention three. The first is, that, after an interval of forty days, the extravasated blood should have been preserved free from putrefaction. The second, that this blood should have separated the muscles from one another, so that when the clots were removed the artery presented itself to us as if the muscles had been separated by dissection; a circumstance which afforded great facility in operating, and which inclines me to think, that in similar cases the operation should be deferred for some time, unless the hemorrhage obliges us to have recourse to it. The third and last circumstance is, that nature nourished the limb after the artery was tied in the same way as if it had been supplied by a sound artery, so that the limb remained neither less in size, nor weaker in power, than the other."

It is curious enough, that the cure of femoral aneurism, recorded by Severinus, should have been regarded by some as marvellous, and by others, as referable only to a particular conformation of the subject he operated upon, in whom it was supposed that the femoral artery was divided into two, as the brachial is sometimes observed to be divided very high up and even in the axilla into radial and ulnar arteries.

A man was brought to the Hotel Dieu, in the month of November 1688, on account of a wound which he had received with a sword in the internal and superior part of the thigh, and which had been succeeded by a considerable aneurism. A consultation of surgeons was held, who were of opinion that the aneurism was caused by the aperture of the trunk of the crural artery, or of the beginning of one of the principal branches proceeding from it at the place of its division. It being conceived that the operation for aneurism was the only means of cure which could be attempted with any hopes of success, the tourniquet was applied. When M. Bottentuit, the operator, judged that this instrument was twisted sufficiently tight, he opened the aneurismal sac in its full extent, and extracted all the blood that was extravasated. The wide vacuity produced by this extraction afforded room when the tourniquet was loosened, to perceive the place where the artery was opened, which was found to be very considerable by the flux of blood, yet it was soon stopt by twisting the tourniquet. "The hemorrhage being thus stopped, we passed," says Saviard, "a crooked needle

under the artery, threaded with a double waxed thread, part whereof we passed above the aperture in the vessel, and the other below, which were afterwards tied with a double knot called the surgeon's knot. No small compresses were placed upon the artery above the knot, as is practised by some, because it was judged proper to tie so considerable an artery very tight, which we could not have been sure of doing by the interposition of a compress, which, being imbibed with moisture, diminishes in thickness, and makes room for the ligature to loosen." The relaxation of the tourniquet making it appear that the blood was stopped by the ligature of the artery, the wound was dressed, and the patient put to bed, with the limb placed in an elevated situation upon a pillow. The ligature fell off of its own accord in fifteen days, and the patient, who was perfectly cured in six weeks, made afterwards several campaigns in the army with all possible vigour.

A period of nearly fifty years elapsed between the first and second, and of seventy years between the second and third application of the ligature to the femoral artery for the cure of aneurism. During these intervals, the disease must have frequently occured, but the results which Severinus and Saviard had obtained in their operations, seem to have been either unknown or completely forgotten. The attention of the public, however, was at last roused to the possibility of a limb being saved that was affected with femoral aneurism, by the publication of an operation performed in the Manchester Infirmary on the 28th of February, 1757. This case, which is inserted in the third volume of the Medical Observations and Inquiries, is entitled, An Aneurism in the Thigh perfectly cured by the Operation, and the Use of the Limb preserved. The aneurism, in this case had been produced by the patient dropping a pair of scissors, and suddenly clapping his knees together to prevent the scissors from falling to the ground. In doing this, he forced the point into his thigh, and wounded the artery. This is an accident which has repeatedly been observed to take place from the instinctive effort which is made to stop a knife, which has been accidentally dropt, from falling to the ground. Mr. Burchall the operator in this case, applied a tourniquet to the crural artery, made an incision the whole length of the tumour, and removed the grumous clots of blood. On the tourniquet being slackened, the blood im-

mediately gushed out of the punctured vessel with great impetuosity, and plainly discovered from whence it came. "I instantly directed," says Mr. Burchall, "the tourniquet to be made tight, then soaked up the remaining part of the blood from the denuded artery with a sponge dipped in warm water, which laid in view the puncture, about as large in diameter as would admit of a crow's quill. I then passed a needle threaded about half an inch above, and again below the orifice of the wounded artery, and secured both parts of the vessel by ligature, without dividing the artery. I filled the wound with lint, and covered it with large pledgits spread with yellow basilicon, and a gentle easy bandage over all. March 6th.—A slight hemorrhage ensued, which obliged me to take off the dressings. I perceived that the upper ligature was too slack, I therefore passed the threaded needle, as before, a little higher than the first, and included a small bit of plaster, rolled up as a compress, within the ligature, for fear of cutting the artery; and, by way of farther security, did the same below, and dressed all up as before. Not the least hemorrhage appeared afterwards; the wound digested very well; the injured part of the artery sloughed off with the ligature in a short time; the external wound was healed up in six weeks, and the patient discharged, perfectly cured, on the 17th of April following." This patient was shown about nine years afterwards, by Dr. Hunter, to a medical society in London, as a singular example of a person who had had the femoral artery tied without the loss of a limb. From this period, but not sooner, surgeons began to regard the ligature of the femoral artery as a means which might, with some prospect of safety, be employed for the cure of femoral aneurism; and a few cases of this operation were recorded in the public journals, in different countries of Europe. I do not, however, believe that above ten instances are recorded in which the femoral artery had been tied, before Mr. Hunter proposed, in 1785, the ligature of this artery, in the middle of the thigh, for the cure of popliteal aneurism. This is an operation which has since, in a very particular manner, attracted the attention of surgeons in every part of the world. Several French surgeons have contended that it was an operation first devised by Desault. More lately this merit has been claimed for Anel. That

Anel performed the operation of which I formerly gave you an account, and that it resembled Mr. Hunter's operation for popliteal aneurism, in the aneurismal sac being left unopened, there can be no manner of doubt, but this is the only circumstance in which Anel and Mr. Hunter's operations agree. Anel's was an alteration on an operation which had almost always had a favourable termination. Mr. Hunter's operation was a simple and safe substitute for a variety of operations, all of which had been dangerous or fatal in their execution or results. Anel's operation has not been repeated. Mr. Hunter's has been oftener performed since it was first proposed, than the operation for any other species of aneurism. How it is likely to be judged of by posterity, we may form a tolerable guess by the opinion concerning it already pronounced by Scarpa, in his learned and scientific Treatise on Aneurisms. "Mr. John Hunter," this author observes, "was undoubtedly the first who proposed and performed, (in St. George's Hospital, London, 1785,) the ligature of the superficial femoral artery in the thigh, for the radical cure of the popliteal aneurism, leaving the aneurismal sac in the ham perfectly untouched. Mr. Hunter, according to all appearance, was not acquainted with what Anel had done in the case of aneurism at the bend of the arm; and even those who published the first happy success obtained by Mr. Hunter, made no mention of Anel's method. Mr. Hunter, therefore, in trying this new mode of cure for the popliteal aneurism, had no other guide than his own sublime genius, always active and unceasingly employed, so long as he lived, in extending the boundaries of the natural sciences, and of the arts useful to mankind, especially that of surgery. He, as well as his contemporaries, discouraged by the continual disasters accompanying the common method of curing the popliteal aneurism by means of the incision of the sac, and full of confidence in the resources which nature has reserved to herself in the anastomoses of the superior extremities round the elbow, and of the inferior extremities round the knee, and fully aware of the prodigious efficacy of the absorbent lymphatic system, proposed to try this new plan of operating. The happy event which followed in the first patient on whom he operated, and the other similar fortunate successes obtained by him, as also those which, in the sequel,

occured in the hands of other surgeons, proved the justice, as well as the great utility of the plan conceived for the cure of the popliteal aneurism; which discovery will form an eternal monument of glory to its author."

It is in the simplicity of Mr. Hunter's proposal, as improved and corrected by himself, that we are to seek, I conceive, for the model of those operations which have since been performed by surgeons upon the anterior iliac, carotid, and subclavian arteries; operations which evince as much boldness in the design, as dexterity and skill in the execution, and the success of which has afforded undeniable and most meritorious proofs of the present advanced state of English surgery.

To Ambrose Paré belongs the glory of having first proposed and practised the application of the ligature to the arteries divided in amputation. This improvement, undoubtedly the greatest that has ever been made in operative surgery, is mentioned by Paré in a small edition of his work published in 1564; but whether this was the first time that it was made known by him to the public, I am unable to say. It is spoken of with approbation by his countryman, Delachamps, in his Chirurgie Françoise, published in 1570. The opposition which it met with from his contemporary, M. Gourmelin, professor of surgery to the Faculty of Medicine in Paris, is well known, and was so far useful as it drew from Paré a spirited reply. By almost every other author, for nearly a century after this, Paré's improvement is overlooked, spoken of with indifference, or opposed. Even his favourite pupil Guillemeau, who had translated his works into Latin, speaks of it in less warm terms of praise than might have been expected from one who had often witnessed its effects, and to whose evidence in its favour Paré had directly appealed. After having seen and practised the operation of Paré, this author came at length to prefer the cautery to the ligature, in all cases of gangrened limbs requiring to be amputated, as he himself informs us in his Chirurgie Françoise, a work which may, in some measure, be regarded as a supplement to that of his master. The unwillingness, on the part of succeeding surgeons, to adopt the practice introduced by Paré, did not arise, I am convinced, from any deference for authority, nor, as has often erroneously been supposed, from the ig-

norance and obstinacy of those who were engaged in the practice of surgery. It had another and better foundation, in the difficulty which was experienced of applying the ligatures with sufficient quickness and certainty, so as to prevent the danger arising from an excessive loss of blood. The mode of suspending the circulation by means of compression, was not invented till nearly a century after the death of Ambrose Paré. But, without that invention, the improvement of Paré, I conceive, must for ever have remained incomplete. It is this compression alone which enables the surgeon of the present day to tie the arteries divided, in his operations, with so much ease, safety, and deliberation.

It was the want of the tourniquet which seems to have rendered Paré's proposal so unsafe and difficult in the execution. Guillemeau directed that the mouth of each large bleeding vessel should be closed, or pressed upon with the point of a finger, and that the fingers should be kept so placed till the limb was removed. But the sudden and profuse hemorrhage, occasioned by the incision of a number of arteries, all divided at the same time, must have made this a most difficult and hazardous undertaking.

Dionis, whose course of chirurgical operations was published in 1707, is the first author of any distinction after Ambrose Paré, who has ventured to recommend the ligature, in preference to the cautery, for the purpose of suppressing hemorrhage from the arteries divided in amputation. But in securing the arteries with the ligature, Dionis was able to avail himself of the use of the tourniquet. "Chirurgery furnishes us," says Dionis," with three ways of stopping the blood; first, by fire; secondly, by the vitriol button; and, thirdly, by ligature.

" Fire was so much in use among the ancients that they employed it in almost all their operations, as we see farriers do in all those which they apply to horses. They heated red hot their actual cauteries, of which some were shaped like a button, others like an olive, and a third sort like a platin; they applied them red-hot to the orifices of the vessels as soon as the member was separated; and by thus burning the vessel and adjoining flesh, they formed a scar, which hindered the issuing out of the blood: but this cruel way was uncertain, because when the scar came to fall, the blood

flew out with the same violence as on the day of the operation, which has put the artists of our profession on the search of gentler ways than that of fire.

" They have therefore invented the vitriol button, which is made of a little bit of broken vitriol, wrapt up in a little cotton. We prepare three or four of these, which we lay on the orifices of the vessels which are cut, one after another. This vitriol dissolving with the humidity of the blood, burns and cauterizes wherever it touches, and by the scar which it makes, stops the blood. This is the method used at the Hotel-Dieu at Paris, in all amputations. But this scar shares the same fate with that produced by fire, for coming to fall off, the blood may escape out; wherefore we retard its fall as long as we can; and the chirurgeons which make use of this way ought to have these buttons ready every time they dress the patient, in order to apply them whenever the blood issues out.

" There being no absolute certainty in either of these two first ways, the modern chirurgeons have invented the ligature of the vessels, and tried experiments which have succeeded; so that with a threaded needle they stop the blood more certainly than with fire or vitriol, which cannot produce scars without putting the sufferer to extreme pain, from which they at present save the poor patients, which, without that, endure enough. This ligature is made two ways; the first, by pinching the end of the artery with a crow's bill, or a pair of nippers, with a ring to close them, which we call a *valet à patin*. They slip on the instrument as far as to the artery, a thread prepared and noosed, and fasten it with a double knot; and that it may not be shoved off the end of the artery by the continual pulsations of the arterial blood, there is to be at one of the ends of the thread, a threaded needle, which they run through, across the body of the vessel, after which they secure the ligature by tying some knots. The second sort of ligature consists of two straight needles, threaded with the same thread, which is well waxed. One of these they run through above, and close to the artery, and the other below, and close to that vessel: then to make them come out at the knee-pan, two fingers' breadth above the incision which has been made, and a half finger's breadth distant from each other. They tie the two ends of the thread, one near the other, on a small bolster, in such manner that the vessels are closed by

the noose made by the thread, and the blood certainly stopt: we are withal to take care the noose of the thread do not take hold of the nerve which is cut, which, by being so tightly drawn thgether, would occasion convulsive motions, and a palpitation of the heart, which would very sensibly afflict the patient.

"By the description I have just been giving of these three ways of stopping the blood, I doubt not in the least but that you will decide in favour of the last, as the least painful and most secure."*

In the time of Dionis, the tying with a ligature the arteries divided by amputation came into general use, and the burning irons of the older surgeons were of course abandoned. Various ineffectual attempts have since been made to discover styptic and astringent substances, which, by constringing the orifices of divided arteries, should render the use of the ligature unnecessary. No reliance, however, is now placed by surgeons, in the use of these substances, for the suppression of hemorrhage from any vessel of a size sufficient to occasion alarm by its bleeding, or which, from its situation, admits of the application of a ligature.

Three modes of applying a ligature to divided blood-vessels have been followed. The first is by a needle armed with a ligature, which is passed through the soft parts surrounding the extremity of the artery to be tied. This is a practice which is described by Ambrose Paré, and which was in use long before his time. It is objectionable from the pain which it occasions, from the great length of time which the ligature takes to separate, and from the danger of hemorrhage, by the loosening of the ligature, occasioned by the wasting of the parts included in it. Surgeons now, therefore, never have recourse to the needle, unless when they have failed in securing the artery by other means. In the second way, the surgeon lays hold of the extremity of the vessel to be tied, with a pair of forceps, and pulls it gently out from the surface of the wound. This method seems to have been first practised by Ambrose Paré, and to have been chiefly followed by him. There are many cases of divided vessels in which it is easily practised; and wherever it is so, there are no objections to its use. The third way is that which is now commonly practised with

* Page, 408.

the tenaculum. This instrument is a sharp curved hook, resembling a needle, by the point of which the bleeding vessel, or the cellular substance immediately surrounding it, is transfixed, and the artery drawn out by the surgeon, so as to allow an assistant to apply a ligature to the vessel, beyond the place that is transfixed by the tenaculum. The ancients mention the practice of drawing out with a *hamus*, or hook, the extremities of blood-vessels which are to be tied; but the instrument for this purpose, of the form in which we at present use it, was proposed little more than forty years ago, by Mr. Bromfield, of London. He proposed and strongly recommended this mode of securing blood-vessels by the tenaculum, in place of that by needle and ligature.

The ligature that is to be put round the artery is formed of one or more threads, that have been previously well waxed. The wax prevents the ligature from being moistened by the blood, and its sides from falling together, which the sides of unwaxed threads, used as ligatures, are very liable to do. When the ligature is formed of more threads than one, the wax preserves the threads in the parallel position that had been given to them; and these seem to me to be the chief, if not the only, purposes which the waxing answers. The size and strength of the ligature should bear some proportion to that of the vessel which is to be tied. As the ligature is to be considered as a foreign body, which is introduced into the wound, the smaller it is, the less, it is evident, will it irritate the canal in which it lies, or separate the edges of the wound from each other. Cutting off one of the extremities of the ligature, after a knot upon the artery has been tied, is a manifest improvement; as in all cases in which several ligatures are applied, it diminishes, by one half, the number which must protrude from the wound. The ligature must be drawn, in tying the vessel, with such a degree of tightness as will prevent it from being forced off from the end of the vessel by the impetus which the blood receives from the action of the heart.

Desault first suggested that the two internal coats of the artery are generally, if not always, divided, when the ligature is drawn with the degree of tightness requisite to suppress hemorrhage; a fact which I have had many opportunities of confirming. Dr. Jones has shown also, by his experiments with regard to the effects of the ligature of blood-vessels, that this division of the two internal coats of the

artery, so far from retarding, tends powerfully, by its inducing the state of adhesive inflammation, to promote the closure of the divided extremities. In tying arteries, the extremity of the vessel which bleeds must be laid hold of by itself, and as little of the surrounding parts as possible included in the ligature by which it is tied. The enclosure of any considerable quantity of the parts immediately surrounding the artery, will prevent the ligature from dividing the two internal coats; will occasion the ligature to be longer in separating, and may give rise, as has been supposed, to spasmodic or convulsive affections, depending upon the enclosure of branches of nerves. No foreign body should ever be interposed between the ligature and the artery which it encloses; such as bits of rolled paper, plaster, cork, or wood. These were at one time supposed to be useful, by preventing the ligature from cutting the artery; but, in so far as their introduction prevented the division of the two interior coats, we now know that it must have been not only useless, but injurious. Besides, these foreign bodies, by the irritation which they excite, are liable to produce suppuration, and even ulceration, in the surfaces with which they come into contact. The introduction of a second ligature, the ligature, of security as it has been termed, to be tied in case of the failure of the first, is liable to the same objections. But it is unnecessary for me to dwell much longer on the mode of performing an operation which you may see every day done in the public hospitals, and which will be better learned from example and practice, than from any rules which can be laid down.

In tying the arteries in a wound, we always begin with the larger artery, and tie in succession every distinct vessel which continues to bleed a few minutes after the wound has been exposed to the air. If, either from faintness on the part of the patient, or from long exposure to the air, the bleeding from the divided arteries has ceased, we must give the patient a little wine, or some other cordial, and apply a moderately warm sponge to the wound, with a view to induce the arteries again to bleed. Not unfrequently this effect may be produced by drawing the nail of the finger over that portion of the surface of the wound from which the blood had formerly been observed to be propelled.

When the hemorrhage takes place from a great number of blood-vessels, few or none of which can be distinguished

by the surgeon, or secured by the ligature, we are then obliged to have recourse to the use of a moderate or graduated degree of pressure, by compresses and by bandaging. A bit of soft easily compressible sponge makes the best of all compresses for the suppression of hemorrhage; and where it is not at hand, pads, or compresses of raw or scraped lint, may be used in its place. The sponge swells with the moisture of the serum, or blood, which lint does not; in swelling it exerts a gentle pressure in every direction; the blood coagulates on entering the pores of the sponge; and this disposition in the blood to coagulate often extends into the mouths of the vessels from which it flows. The sponge, however, is never to be used where the hemorrhage can be suppressed by a ligature; but in cases where the bleeding vessel cannot be discovered, or where a ligature cannot be easily or safely applied, the sponge and bandage may serve to suppress many a hemorrhage from the smaller arteries, which, without their application, might prove extremely troublesome, if not fatal.

The bandage, which answers best to fasten down the sponge used for the suppression of hemorrhage, is the circular roller, which is formed by a narrow slip of cloth, rolled up upon itself. The judicious application of this roller is of the most extensive utility in the practice of our art. Several turns of this bandage are generally required to fasten down the sponge, and to render the pressure which it makes as equable as possible. When applied to the extremities, the rolling should always be begun from the points of the fingers and toes, and continued up from these over the place upon which the surgeon wishes the pressure to exert more directly its beneficial effects. It is by not attending to this rule, that we every day see so much mischief done by the application of the circular bandage for the suppression of hemorrhage, the cure of fractures, and the retention of dressings to wounds, sores, and ulcers.

Hemorrhage, may occur from vessels in situations in which, as in the cavity of the mouth and fauces, it is impossible to suppress it either by ligature or by compression. Here, if the hemorrhage be profuse, we must have recourse to the actual cautery or burning irons of the ancients, who employed this oftener than any other means in the suppression of hemorrhage.

Caustic, styptic, and astringent substances, are also some-

times applied in a solid, and at others in a liquid form, for the suppression of hemorrhage; but these substances are more advantageously applied in secondary hemorrhage, in that which arises from gangrene or ulceration, than in that which occurs in fresh wounds, which it must always be an important object with the surgeon to heal by the first intention. But this is an object which must be frustrated in all cases in which it is necessary to have recourse to caustic or styptic applications.

The edges of every incised wound are more or less retracted or drawn from each other, and this generally in proportion to the size of the wound and the nature of the parts upon which it is inflicted. The different soft textures of which the human body is composed, are more or less elastic, and are in the healthy condition of the body kept in a certain degree of tension. When the fibres, therefore, of any of these textures are divided, they recede from each other; those of skin farther than those of cellular membrane, and those of muscle farther than those of skin. The fibres of muscle contract most of all. The extremities of a divided artery recede considerably from each other; the veins less than the arteries; and the nerves probably less than the veins. To oppose this contraction of divided parts by suitable means, is one of the main objects which the surgeon proposes to himself in the cure of wounds; for the retraction of the edges of wounds from each other always prevents re-union by the first intention, and very often retards it for a long time by the second.

But the indication which has for its object to bring the divided parts into contact, and to retain them in that situation, applies chiefly, if not solely, to simple incised wounds; for there are wounds which it is impossible, and others which it would be improper, to attempt to heal by the first intention.

We have an example of wounds in which it is impossible to effect a cure by adhesion, in those which are accompanied by much loss of substance; in a wound, for example, where a part has been completely cut off by a sabre, as also in a wound made by the extirpation of the mamma, where a large portion of the integuments is cut off because they have become diseased; and in the separation of large portions of soft from hard parts, as of the pericranium from the cranium.

Of wounds, in which it would be in vain, and of course improper, to attempt re-union by the first intention, we have an example in such as have existed for some time before recourse has been had to art for their cure, and in wounds, the edges of which have become inflamed, and which seem to be passing into the state of suppurating sores. Union by the first intention is improper also in wounds containing foreign bodies, particularly when the foreign body has in it any thing of a poisonous quality. It would be useless to attempt this mode of re-union in gun-shot wounds, or in wounds attended with great contusion; for, in these wounds a portion of the deadened solid must separate in the form of a slough or eschair, before granulations can be formed or re-union be produced.

But in simple incised wounds, where none of these obstacles to re-union exist, the divided parts are to be brought into contact, and retained in that situation. Position, if judiciously employed, has often a very considerable effect in enabling us to effect the re-union of parts which have been divided, but it is seldom of itself sufficient for that purpose. In many wounds, as, for example, in those over the cranium, simple replacement of the parts is almost all that is necessary; nor can we, by altering the position of the head, change in any degree the relative situation of the edges of the wound. But when the wound is on the neck, on the chest, on the belly, or on any of the extremities, we can often bring the parts divided very nearly into contact by bending one part of the body upon another. Whatever, therefore, can be gained by position in the adduction of the edges of a wound should always be well considered by the surgeon in attempting to cure it.

Another means by which divided parts are brought and retained in contact is the application of bandages. Of these a very great number have been at different times employed and described by surgeons. But the form and size of the bandage, it is obvious, must necessarily be varied according to the situation and nature of the wound. The two forms of bandage now most commonly used in the dressing of simple wounds, are the single circular roller, and the double-headed roller or uniting bandage. These may be formed of linen, cotton, or woollen cloth, according to the pleasure of the surgeon, the nature of the wound, the season of the year, the climate, &c. The proper mode of applying these ban

dages can be learned only from practice. In rolling, care must be taken not to draw the bandage too tight, nor to leave it too slack; for in this, as in all other matters of practice, there is always a happy medium between dangerous extremes. If too tight, the bandage will occasion a stoppage of the circulation, inflammation, and perhaps gangrene. If too slack, the purpose for which it is applied will not be fully obtained.

Where position and bandaging are insufficient, they may be assisted with plasters. The plasters employed in surgery to retain the edges of recent wounds in contact, are formed by spreading substances which have an adhesive quality upon pieces of silk, linen, leather, or paper. Of these substances the chief difference among them is, that some are soluble, others insoluble in water.

Gum-arabic is one of the soluble substances most employed. It forms the principal ingredient in common court plaster. This plaster is said to contain a small admixture of opium. Fish glue, icthyoccolla, white of eggs, &c. are all substances more or less soluble in water. Plasters formed of these substances require to be moistened before they are applied, and they are useful only in very superficial wounds. From their solubility in water they are not to be employed in wounds where we either expect a slight oozing of blood, or the discharge of serous fluids.

A portion of resin, or of some of the warm gums, usually enters into the composition of those adhesive plasters which are insoluble in water. The formulæ for their composition are to be found in every Pharmacopeia and Dispensatory. The resinous plasters, instead of being moistened, require to be heated before they are applied. The skin to which they are to be applied must be carefully shaved and wiped dry, otherwise they will not adhere. But though moisture prevents them from adhering, these plasters, when they have been once properly applied, are not detached by slight oozings either of blood, serum, or pus. They are detached, however, from the surfaces of almost all wounds and sores by copious oozings. The number, the length, and breadth of the straps, or pieces into which these plasters are to be cut, must be proportioned to the size of the wound. For large wounds, these are usually from three-fourths of an inch to an inch in breadth, and may be several inches long. The mode of applying them must be learnt in private prac-

tice, or in public hospitals. Linen cloth is the web on which the plaster is commonly spread; but in public charities, or where the patients are very poor, its place may be very well supplied by a tough firm paper; a paper like that to which the manufacturers give the name of packing paper.

Of stiches or sutures you will find a great variety described in authors; but the only one which is now usually employed in the cure of wounds is the interrupted suture. The stiches are made, as in common sewing, with a needle and thread or ligature. The surgical needle should be semicircular, the point sharp with cutting edges, the head and eye not larger than the body; the eye should be grooved for the ligature, and the ligature should consist of waxed threads placed parallel to each other. The number of stiches and the size of the ligatures must be proportioned to the length and depth of the wound. Wiseman recommends a stich for every finger's breadth of a wound. They must not be so tight drawn in tying them as to interrupt the circulation. The stiches ought to be supported by the application of adhesive straps in the interstices between them.

The parts which, when divided, best admit of being stiched, are the skin and cellular membrane. Stiches are sometimes necessary in muscular parts, as in the operation for hare-lip, in wounds of the tongue, and in wounds of the neck; but it is always proper to avoid muscular parts, if possible, in the application of stiches, for they are very liable to be followed by spasmodic contractions of muscles into which they have been inserted, a tearing open of the wound, convulsive startings of the limbs, and in some cases it would seem even with locked-jaw or tetanus. Stiches are now very generally allowed to be particularly useful and often necessary in angular wounds, in wounds with great retraction of the edges, and in wounds penetrating into the cavity of the abdomen. They ought in general to be removed from the third to the seventh day. If allowed to remain longer, or even in some cases so long, they excite inflammation, and sometimes ulceration.

The continued stich, or Glover's suture, is now seldom, if ever employed. If there be any wounds in which it is required, it is probably in wounds of the intestines.

The last mode of re-uniting wounds, or parts which have been divided, is by pins and ligature, or, as it has been

termed, by the twisted suture. This mode of uniting parts is preferable to the interrupted suture in superficial wounds, as in those wounds of the lips and face, in which a stich is supposed to be required. The pins are formed of gold or silver, because these substances do not contract rust. The silver pins require steel points. The ligature, which is formed of waxed threads, placed parallel to one another, is twisted round the pins, so as to press gently the edges of the wound together. The pins must be taken out, like the common stitches, from the fourth to the seventh day. It has been proposed to heal the divisions of the lip by adhesive plasters, or by interrupted stitches; but pins and ligatures are to be preferred.

The utility of stitches, in some of the wounds I have mentioned, has been denied by some authors; and the uniting bandage and adhesive strap, it has been contended, may, in all cases of wounds, be advantageously substituted in their place. The celebrated Paracelsus is the first author, so far as I can find, who distinctly states this opinion. It has since been defended with much zeal by several authors, but particularly by M. Pibrac, a distinguished member of the late academy of surgery in France, and more lately by Mr. Young, in this country. In an essay inserted in the ninth volume of the octavo edition of the Memoirs of that Academy, Pibrac endeavours to prove that there are no wounds in which we ought not to abstain from the use of sutures. In proof of this, he enumerates a variety of instances in which he obtained great benefit from bandaging, and from the use of adhesive straps, where stitches had failed, and points out, at considerable length, some of the inconveniences which he supposes to be inseparable from the use of sutures.

Pibrac does not entirely proscribe stitches in very large wounds of the belly or parietes of the abdomen, a class of wounds in which sutures have almost always been supposed to be particularly necessary, and where the stitching has got a particular name, that of gastro-raphe; but he mentions a variety of cases in which cures were ultimately obtained without having recourse to them, and denies altogether their utility in small wounds. Wounds, however, of the parietes of the abdomen, whether made by a sabre, or with the scalpel as in the operation for hernia, surgeons still continue to stitch; and the stitches, I am inclined to believe, tend much to diminish the danger of a protrusion of the viscera from that

cavity, the muscles and skin of which should, previously to the introduction of the stitches, be relaxed as much as possible, by raising the thighs, pelvis, and shoulders, and in this way bending the body forwards upon itself.

The second class of wounds in which M. Pibrac contends that stitches are useless and hurtful, are those which the surgeon inflicts in the operation of hare-lip. He mentions several cases in which some of the members of the academy had succeeded in effecting a re-union of the divided edges of these wounds, merely by bandaging and by adhesive straps.

The celebrated M. Louis, secretary to the academy of surgery, adopted the opinion of Pibrac with regard to the superior utility of bandaging and straps to that of stitches in the cure of hare-lip. But the practice of stitching, in these wounds, is still continued, and that, I am inclined to believe, from the bandaging and straps not having been found to answer so well as those who first recommended them were led, from slight trials, to imagine. In this, as in many other wounds, it is right to support the stitches with adhesive straps and bandaging, and even to employ these after the stitches have been removed.

Pibrac proscribes, in the third place, sutures or stitches in wounds of the tongue, and relates a case in which he twice succeeded in effecting a cure by keeping the wounded tongue in a little bag or purse. This patient, a girl affected with epilepsy, had twice bit her tongue in the accessions of that disorder. But the truth is, that the tongue has often been stitched when it happened to be wounded; and of late years large portions of it, when diseased, have been removed by ligature, without any bad effects whatever having hitherto been observed to result from the practice.

The fourth species of wounds in which M. Pibrac conceives that the use of stitches may be dispensed with, are those of the neck, whether longitudinal, oblique, or transverse. He adduces examples of these wounds in which a cure was obtained without the use of stiches; and I could mention some also in which I was obliged to remove the stitches, from the bad condition of the wound, without effecting an entire re-union; but my belief of the propriety and utility of stitching, in the cases to which I allude, has not been in the least diminished by these failures.

The fifth kind of wounds which Pibrac mentions, those of tendons, will readily be allowed, I believe, by almost

all surgeons, to be improper subjects for stitches ; but, in a recent cut of the tendo achillis, I have stitched the skin over the tendon with advantage. The extremities of this tendon, when it happens to be divided, must be kept as nearly as possible in contact by position and bandaging.

As a general conclusion to his essay, M. Pibrac contends, that in wounds of all sorts stitches are equally unnecessary and improper; and, in proof of this, produces examples of wounds of the deltoid, gastrocnemius, and soleus muscles being cured without their use. It will be granted, even by those who believe that stitches are sometimes proper, that no utility, but much mischief, would probably have resulted from stitching these muscles. But it is not usually considered as a very valid argument against the employment of any practice or remedy, that it is unnecessary in some instances, or liable to be abused in others. The practice of stitching is undoubtedly much less followed at present than in any former period of the surgical art; and unless in superficial wounds, where we wish to heal by the first intention, or in wounds where, as in those of the abdomen, it is necessary that the edges should not be allowed to separate from each other, the use of stitches may be, in most instances, advantageously superseded by adhesive plasters and proper bandaging. It is by limiting the use of stiches, not by proscribing them altogether, that the surgeon is likely to derive advantage from the employment of means so powerful.

When, in the treatment of a wound, the re-union by adhesion, or by the first intention, has either not been attempted at all, or, if attempted, has failed, nature brings about a cure by that slower and more complicated operation which we now denominate the process of granulation, a process termed, as we have already remarked, by Galen, re-union by the second intention. By many of the older surgeons, this mode of healing wounds is described by the appellation of sysarcosis, or concarnation, terms less liable perhaps to objection than that of granulation, which, in strict propriety, is a term expressive of only one of the stages of this mode of re-union, and which of course, in order to avoid all ambiguity in the language we employ, ought not to have been used as a general term for the whole. In re-union by the second intention, the edges of the wound swell and inflame more than in the process by adhesion;

but as in that process, so in this, a layer of coagulable or organizable lymph is thrown out upon the divided surfaces. This layer is soon penetrated with blood-vessels, and, like the intermedium in adhesion, becomes an organized and living substance. So far these two modes of re-union are similar; but in a short time after this layer of coagulable lymph has been thrown out upon the open and exposed surfaces of a wound, there is thrown out also upon the same surfaces a quantity of pus, or the matter of sores. This fluid, like the coagulable lymph, is the immediate product of a change induced in the action of the capillary vessels existing in the divided surfaces of the wound—a change by which they seem to become secreting instead of circulating tubes. The action by which pus is formed is now denominated Suppuration: the older surgeons gave to it the name of Digestion.

When the surfaces of the wound have been severely injured, or when the patient is of a bad habit of body, a greater or less portion of these surfaces, losing its vitality, separates from the remaining sound parts, and comes away in the form of a slough. The older surgeons, who are most minutely accurate in the descriptions which they have left us of diseased appearances, call this the detersion, or mundification of the wound: the surgeons of the present day, sloughing, or the separation of the slough.

In the healthy conditions of the body, and when the edges of the wound are uninjured, the smooth surface of the layer of coagulable lymph which covers the bottom of the wound, is, in the course of a few days after the suppuration has taken place, raised into a number of small eminences, like grains or papillæ. These little eminences are termed granulations, and their formation in the healing of wounds, the process of granulation. By the older surgeons, this step in the process of re-union by the second intention was commonly termed Incarnation or Concarnation,—terms expressive of the formation of a portion of new flesh.

On the surfaces of these granulations, but most frequently on the edges of the wound next to the skin, small white specks appear; the quantity of pus which is secreted gradually diminishes, and the bluish white specks, by continuing to increase in number and size, come at last to cover the surface of the wound. On examination the surface of the wound will now be found to be covered by a kind of

new skin and cuticle. The formation of this new skin has long been denominated the process cicatrization, and the process of re-union by the second intention being now fully accomplished, the wound is said to be completely cicatrized. I have been the more particular in enumerating the different steps or stages of this process, that you might the more readily perceive what the circumstances are in which it agrees with, and in which it differs from, the process of re-union by the first intention. In both there is an effusion of coagulable lymph, the penetration of this lymph with blood-vessels, and the subsequent inosculation of the vessels from the opposite surfaces with each other; but in the process of re-union by the second intention, there is always the formation, for a longer or shorter period, of a quantity of pus, sometimes, though not always, the separation of a slough, the formation of the little eminences termed granulations, and, lastly, the production of a portion of new skin.

When an old surgeon, therefore, describes with much minuteness the digesting, mundifying, incarning, and cicatrizing of wounds, we perceive that he merely enumerates the different steps or stages in the process of re-union by the second intention; and though the language which he employs may be a little antiquated, yet it is not less just, and perhaps is more accurate, than that which modern surgeons have substituted in its stead.

The re-union of a wound by the first intention, is the work of one, two, or three days, while re-union by the second intention always requires a period of several days, and sometimes in diseased constitutions, or parts which have been much injured, of months or of years.

It is the number of steps or stages of which re-union by the second intention consists, and the number and complexity of the local and constitutional circumstances which may promote, retard, or prevent the healing in each of these stages, which renders the knowledge of this branch of surgery so difficult in the attainment, and so imperfect and uncertain in its application. It is here that a minute and extensive acquaintance with physic is particularly requisite, and in no department probably is the folly of assigning exclusive limits to the two professions made more completely manifest.

When the means which have been mentioned for procuring re-union by the first intention are judiciously employ-

ed, re-union generally take place. But union by adhesion may fail either by the excess or by the defect of inflammation in the divided parts. It usually takes place in young better than in middle-aged or elderly people, and this probably from the greater tendency in the arteries of young people to develope themselves, and to form numerous ramifications. In old people, the adhesion is more liable to fail from the defect than from the excess of inflammation, while in people of middle age, it is generally the excess of inflammation which prevents immediate re-union. Adhesion seems to be sometimes, though but seldom, I believe, prevented by the fluid which is poured out from the extremities of divided lymphatic vessels. This is liable to occur more frequently in wounds of the groin and axilla, than in those situated in other parts of the body.

Failure in the process of adhesion being a much more common effect of the excess than of the defect of inflammation, a principal indication in the treatment of wounds is to moderate the excessive inflammation which is liable to supervene in them, and to prevent the re-union of the divided parts.

A certain degree of inflammation is essentially necessary to re-union by adhesion, and the approach of this state is indicated by a sense of heat, pain, and fulness in the wound. If examined at this time, its edges will be observed to be red and slightly tumified. There are two periods of pain in wounds, that which succeeds immediately to the infliction of the wound, and that which I have already mentioned as occurring during the approach and continuance of the state of inflammation. The first often admits of relief by the shutting up of the wound from the access of air, and by the use of opiates: the second is generally aggravated by the use of these remedies. This is a point which does not appear to me to have been sufficiently attended to by those who prescribe opiates, particularly after operations. The disposition in the edges of a wound to inflammation must be subdued by the use, general and local, of that plan of cure which I have already described to you under the name of the Antiphlogistic Regimen; blood-letting is contra-indicated only in those cases in which there has been a very considerable loss of blood from the wound, or where there appears to be a strong tendency in the inflammation to pass speedily into the state of gangrene and sphacelus.

The state of inflammation in wounds is usually accompanied by a greater or less degree of symptomatic fever. The symptomatic fever from wounds usually comes on in a period varying from sixteen to thirty-six hours after the infliction of the injury. Its occurrence is indicated by an increased warmth of the skin, by increase in the frequency, and generally also in the strength of the action of the heart and arteries, by anxiety, thirst, and by the suppression of the powers of digestion. The symptomatic fever from wounds is generally of the inflammatory character; and it even sometimes happens that a very high degree of symptomatic fever occurs in debilitated constitutions, and in those who have previously lost a considerable quantity of blood. In these cases the frequency of the pulse, however, is often more remarkable than its strength, and the fever which occurs seems to resemble more an asthenic fever than it does one that is truly inflammatory. It is of great consequence to attend to the type of this fever in its treatment, for the loss of blood which may be required and sustained with impunity in the one species of fever, may prove most injurious, if not fatal, in the other.

Abstinence from animal food is equally necessary in the commencement of both species of symptomatic fever, for when given either in a liquid or solid form, it never fails to add greatly to the violence of the disease. The symptomatic fever accompanying wounds undergoes, in many instances, a kind of natural crisis or abatement upon adhesion taking place, and still more decidedly upon pus forming in a wound. The formation of pus in a wound is a never-failing effect either of much local inflammation, or of a high degree of symptomatic fever. In general, therefore, when these states of local inflammation and of symptomatic fever occur either singly, or, as they most frequently do, together, we must abandon the attempt of re-union by adhesion, and have recourse to those remedies which experience has shown to be best calculated to facilitate re-union by the second intention. To allay excessive inflammation in wounds, promote suppuration, and procure relief from pain, there are none of these remedies so generally applicable and useful as the common emollient poultice. This remedy is particularly useful in the first stages of suppuration. But its use is not to be continued too long in the state of granulation: for poultices are, as I shall afterwards have occasion to remark,

liable to occasion in suppurating surfaces not requiring them, first, a relaxed and unhealthy state of the suppurating surface; secondly, soft fungous granulations; and, thirdly, an excessive discharge of pus.

Most wounds admit of being healed partly in the way of adhesion, and partly also in that of granulation. We have very good examples of this, in the wounds made in amputation of the extremities, and in the extirpation of the mamma, or of other large tumours. We know, or at least we have reason in these instances from the first to suspect, that the whole of the wound will not heal by adhesion, but we are ignorant whether a large or a small portion will be healed by that process; and accordingly we at first proceed in the dressing of such wounds, as if we expected or intended that the whole should heal by adhesion. We bring the edges of the wound together by adhesive straps or stitches, and support these by proper bandaging. The adhesive straps are of great use even in those wounds in which it is impossible to bring the edges at first into contact. They bring and retain the edges near each other, they diminish the size of the wound, they keep surfaces in contact which have a disposition to adhere, and ultimately, by the gradual elongation of the old skin, even where the distance between the edges is at first considerable, they bring the separated edges to unite together.

The dressings which are applied to wounds are usually removed on the third, fourth, or fifth day after the infliction of the wound, according to the warmth of the climate, season of the year, quantity or quality of the discharge, or according to the supposed state of the wound. But as the success of the surgeon in the treatment of simple incised wounds, such as are daily inflicted in chirurgical operations, must be much influenced by his mode of procedure, I shall take this opportunity to make some observations, in the form of rules, with regard to the first and subsequent dressings, a due attention to which will be useful when you come to reduce these rules to practice.

The first rule I have to mention is one the propriety of which must be immediately obvious, and I should not now mention it, were it not that it would seem to be sometimes forgotten or neglected in the practice of our art. In examining or dressing a wound, as well as in operating with the knife, we ought never to give the patient more pain from

our modes of procedure, or methods of dressing, than is absolutely necessary for his present good and future security; we ought never to probe a wound, for instance, where probing can be of no use, and must be contented to remain ignorant of those things which, if known, could only gratify an idle curiosity.

It is unnecessary for me to remark, that in making the necessary examinations, there should be nothing harsh in our expressions, nor unfeeling in our conduct. We must never make a sport of that which gives our patients pain, nor seem in their presence to feel any pleasure but in the relief we procure for them. In the dressing of wounds, as in all our other intercourse with our fellow men, we have only to remember, and to practise the rule of the gospel, "To do to others as we would that others should do to us." We have only, by a slight effort of the imagination, to place ourselves in the situation of our patient, and the duties which we ought to perform, and the practices from which we ought to abstain, will be immediately felt and fully understood. In this imaginary situation, an inward monitor will impel us to do every thing in our power to alleviate the bodily pains and mental fears of our patient, and guard us from doing any thing that can aggravate them or destroy the confidence which he is disposed to place in our humanity and skill.

The practice of our profession, it is but too true, has a tendency to blunt our natural feelings, and to render us more insensible than other men to the appearances of bodily distress. Cases which appear so horrible to others as not to be looked on, awaken in us the feelings of curiosity,—feelings which it is just and proper we should entertain, but they are feelings which must not be idly indulged, for the appearance of them cannot fail, in the mind of the spectator, to excite disgust and indignation. That effort of the imagination which consists in supposing ourselves in the place of our patients in all the moments of our intercourse with them, is one which we ought frequently to practise; for, if it does not awaken in us the feelings of humanity, it cannot fail to remind us of our duty at least, and of the conduct which every impartial spectator will require.

The surgeon who is not sparing in his use of instruments, and tender in his mode of handling them, becomes by habit incapable of being so, and never fails to obtain among his

patients the character of having bad hands, and of being rough and cruel in his practice. Those who are in a situation requiring to be examined either with the hands or with instruments, are soon made sensible of the difference which exists among surgeons in this respect, and always manifest a strong reluctance to be re-examined by those who have formerly given them unnecessary pain. The dread which the patient has of an operation, of an examination, or dressing, is often more distressing than any bodily pain which he really suffers from them in the performance. How attentive therefore we ought to be to prevent and lessen these fears, whether reasonable or not, I need not consume any more of your time in observing, because our own interest well understood, it may be presumed, will always prompt us to show humanity, whether we feel it or not.

In proceeding to the dressing, the next rule I would have you observe, is to have all the fresh dressings in readiness before you proceed to remove those which have been first applied. Those consist of a sponge and warm water, adhesive straps, a piece of linen cloth spread with cerate called a pledgit, a quantity of charpee and of raw lint, a compress of folded linen or cotton cloth, and one or more bandages. The old dressings are removed, and the fresh dressings always best applied, by two persons who act in concert, and, as a considerable time must be consumed in this work, we ought carefully to consider what the position is in which the patient should be placed during this period, and that both for his own sake, and the ease of the surgeon. In proceeding to remove the bandage, we generally find that it has become hard and dry, and that its folds are glued together by the blood and other discharges which have taken place from the wound. With a view to soften and loosen this bandage, it is a very common practice to cover or enclose it the night before it is to be removed in a large poultice. The moisture, however, often sinks but a little way into the dressings; when this fails in moistening the bandage, we must soak it with the sponge and warm water, and we must be particularly careful not to attempt to take it off till it has been completely moistened, for every such attempt will occasion pain to the patient. In private practice, and where the value of the bandage is a matter of no consideration, we may cut through carefully the folds of the bandage, when they adhere, with a pair of scissors, and not put the patient to the

trouble or pain of having the folds separated from each other.

In removing the dressings which are under the bandage, I mean the compress, lint, and cerate pledgit, and which, in general, are more easily removed, from the circumstance of their being moistened with the puriform discharge from the wound, we must be particularly careful not to pull away any of the ligatures which had been previously put round the arteries. Pulling at the ligatures during the first dressing always occasions pain; and if in removing the dressings, they be incautiously torn off, a greater or less degree of hemorrhage may be produced, and much distress, if not danger, occasioned. To avoid this accident, therefore, we ought always to search for the ligatures previous to the removal of the dressings, and to separate them from these dressings when they adhere, as they most frequently do; and we must be particularly careful neither to stretch nor to loosen them. Having found and separated the ligatures, we must next proceed to remove the adhesive straps by which the edges of the wound are more immediately kept in contact. It seldom happens but that a greater or less portion of these straps, however accurately they may have been applied, or of whatever materials they may be composed, is loosened from the surface of the wound by the fluid which exudes from it. This is the part, therefore, from which we should first proceed to separate these straps, because it is here that the edges of the wound may be supposed to recede the farthest from each other, and the pus to have found the freest exit. But the manner in which the remaining adhering portion of strap is to be separated is not, as might at first sight appear to you, a matter of indifference. There is but one way in which it can be properly taken of, though it is one which is often neglected in practice. In removing these straps, we are always to lay hold of them by the ends, first by the one, and then by the other end, and to pull them of in the direction of the wound, taking care never to raise the end of the strap much above the level of the skin, nor to continue to pull by the end we hold after we have separated it as far as the wound. The reasons for this rule will become obvious the moment we begin to reflect on the effects of taking off the straps in a direction different from that which I have recommended. By pulling off the straps from and not towards the wound, we must pull the edges to which they

adhere farther from each other, tear open the slight adhesions which have formed, and render the process of re-union tedious and difficult. If we raise the end of the strap, which is but too often done by careless or ignorant practitioners, we tear, in the same manner, the edge of the wound from the part under it to which it adheres. Let us manage this affair of removing the adhesive straps as delicately as we can, we shall find that it always occasions more or less pain; and this pain will be greatly aggravated if the skin to which they are applied be covered with hair. It becomes, therefore, always a proper precaution to take off the hair with a razor before the straps are applied, and to shave the part, from time to time, in proportion as the hair may happen to grow.

Only one adhesive strap, or at most two, should be removed at once; and the part from which it has been removed being carefully wiped with the sponge, and dried with a soft linen cloth, a fresh strap is always to be applied before another is removed. It is by inattention to this rule that we see the surfaces of wounds and sores daily torn open at each dressing, merely by the weight of the parts which had just been re-united.

The edges of the wound, particularly if it be a large one, should always be held together, during the time of dressing, by an assistant. In practice, this rule, though an important one, is generally neglected.

When several wounds, (and this rule is, if possible, still more applicable to the dressing of burns,) in the same person, are to be dressed, it is almost unnecessary for me, I believe, to remark, that only one of these wounds should be exposed at one time; and that we ought to proceed to expose and dress each wound in succession, according to our own convenience, or the idea we have of its importance. A certain degree of pain and irritation are the necessary consequences of the exposure of the wound to the action of the air.

At each dressing care must be taken, by the proper application of bolsters or pads of lint, or charpee, and of compresses of folded cloth, as well as by the manner in which the adhesive straps are applied, to prevent the matter exuding, or secreted from the surface of the wound, from being lodged in any part of it, so as to form a kind of abscess. The particular manner in which this is to be done, in every case, it is impossible to describe. We must be directed in

this, as in the practice of many other parts of our art, by good sense, and by the knowledge we acquire, perhaps even by the errors we commit, of the real state of all the circumstances of the affection that is the more immediate object of our attention.

A pledgit of cloth spread with cerate, or some other mild ointment, is to be applied over the adhesive straps; and this should always be of a size more than sufficient to cover the wound. It keeps the part to which it is applied soft and easy; and from being covered with an oily substance, it does not contract adhesions to the parts to which it is applied, which unanointed cloth would do, in consequence of the moisture exuding from wounds. Over this pledgit we place a cushion, formed of some soft substance, such as charpee, lint, or tow, which is covered by a piece of cloth, to which we give the name of a compress. This cushion serves to defend the wound from the pain or injury which pressure might otherwise occasion.

The bandage is usually the last part of the dressings that is to be applied. Its form and size must be adapted to the nature of the wound, and the form of the part on which it is placed. The principal use of the bandage is to keep the other dressings in their place, to support and give to them an additional degree of firmness. When applied to any of the extremities, the rolling of this bandage may be begun, as after amputation, from the trunk of the body; but in simple wounds of the extremities it is better, or rather, as mentioned to you formerly, it is always proper to commence the rolling from the most distant points of the extremities, and to continue it upwards for some way above the wound. You may be asured that the bandage is too tight when it occasions much pain to the patient; and as its continuance is liable to occasion gangrenous inflammations, where it acts directly upon an inflamed part, we should remove, or slacken the bandage, the moment the patient begins to complain of its giving uneasiness.

In dressing wounds, particularly in hospital practice, where frequent change of linen is not at all times obtainable, it is of great consequence to the comfort of the patient, and to the general health and welfare of the other patients, that every attention, during dressing, should be paid to cleanliness, and that every thing filthy and offensive should be removed from the room or ward in which the

patient is placed, as quickly as possible. The surgeon and his dressers should take particular care that the matter exuding from wounds or sores be not permitted to come into contact with the bed-clothes; and, for this purpose, every wound or sore should be put out from the bed during the time of dressing, wherever the state of the patient is such as to admit of it.

The frequency of dressing must be regulated by the quantity and quality of the discharge from the wound, by the place of the wound, by the climate and season of the year, by the effects which it seems to produce, and by the feelings, and sometimes by the wishes, of the patient.

Much has been said, in the treatment of wounds, respecting the effects which are likely to result from the admission of air to the raw or suppurating surface. Hippocrates is the first author who has suggested that the air produces deleterious effects: but by no author with whom I am acquainted has this subject received so full and ample a discussion as from Magatus, in his learned work De Vulneribus. The deleterious action of the air upon suppurating surfaces has often been denied; but it is now a point which can happily be made the subject of experiment, without danger, in the human body, as well as in brute animals. To be satisfied of one at least of the effects which air produces, you have only to cover up, and alternately to expose, the slightest wound to and from the action of the air. A certain degree of smart pungent pain will be felt on each fresh exposure, that will gradually abate, if not entirely cease, soon after the air has been again excluded. If the experiment be repeated very often, the edges of the wound will inflame, and a wound, which might at first have been healed up by adhesion, will be converted into one that can be healed only by the second intention. In this state, that is, of suppuration, the accession of the external air never fails to occasion pain; and this is an effect, we now know, which depends upon the oxygen which it contains; for this pain may be greatly increased by immersing a fresh wound, or suppurating surface, in oxygen gas; or not excited at all by opening the wound, or suppurating surface, in a vessel filled with azotic gas, carbonic acid, or hydrogen air.

I shall take leave of the subject of dressing wounds with observing to you, that the patient should always be placed so as to allow the surgeon, at every dressing, to see distinct-

ly the state of the wound, in order that no mischief may be permitted to brood in any part of it, nor any morbid changes to take place, which, if observed in time, might have been prevented; such as a part, for example, becoming excoriated or gangrenous, by lying upon it; or the bone of a stump beginning to protrude in consequence of the integuments and other soft parts of the thigh not being sufficiently drawn down over it at each dressing.

In the stage of suppuration, the principal duty of the surgeon consists in keeping the granulations, which have always a greater or less disposition to adhere, as nearly in contact as possible. By never allowing these to separate in the manner I have already so fully described, much time will be gained in the cure, and pain saved to the patient.

The granulations covering the surface of a sore may exist, or may be in a healthy state, though when frequently torn open, injudiciously treated, or much exposed to the air, they lose their granulated form, become smooth, pale, and have a shining velvet-like appearance. This is the state that is described in books by the name of callous, or indolent ulcer,—a state which, in healthy constitutions, requires only for its cure the proper application of adhesive straps, cleanliness, and exclusion from the air.

Granulations, as I have already mentioned, may become gangrenous; in which case they usually separate from the wound or sore, in the form of a white slough; or they may be removed from the surfaces of wounds, sores, or ulcers without any appearance of sloughing, by the process of ulcerative absorption.

In other instances again, the granulations become soft and spongy, and rise considerably above the wound or sore. This is the appearance denominated *proud flesh*, or fungous granulation, or fungous ulcer; and when it occurs, is to be repressed, 1st. by Compression; 2d. Escharotics; or, 3d. Excision.

We have to support the strength of the patient during the long continued discharge of pus from the wound, and the progress of granulation and cicatrization, by nourishing diet and proper cordials. The most disagreeable termination, but one which not unfrequently happens in those who have received large wounds, or have undergone severe operations, is unhealthy granulations, attended by a general wasting of the body, and the supervention of hectic fever.

SUPPURATION.

Suppuration is that process in the animal œconomy succeeding to inflammation, by which pus, or the matter of sores, is formed. This is a process highly deserving of your attention, not only on account of the curious local phenomena which it exhibits, but also on account of the dangerous, and not unfrequently fatal constitutional symptoms by which its progress is accompanied. The length of time which inflammation continues, before it terminates by suppuration, is extremely various. In some instances this period occupies several days; in other instances, inflammation terminates by suppuration in the course of twelve or eighteen hours. Nor are the limits which the process of suppuration itself occupies better defined. In many instances suppuration continues from two to ten, twenty, or perhaps more days; while, in other instances, it may continue for months, or even for years. These diversities in the appearance and duration of the suppurating process seem, in some measure, to depend upon differences in the structure of the textures and organs in which it occurs, but more frequently, I believe, upon the general constitution and peculiar diathesis of the person affected with inflammation, and the specific nature of the disease in which this state has been excited.

The diversities to which I allude, are recognized in the use which practical writers make of the terms acute and chronic suppurations; terms which, in their strict signification, express merely differences in the duration of the suppurating process, but which, in the use that has been made of them, include also differences in the local and constitutional symptoms by which acute and chronic suppurations are attended. Suppuration, which is so often a spontaneous occurrence in animal bodies, may also be excited in various

textures and organs, by the application of mechanical and chemical stimuli; and it is in these artificial productions of suppuration that its phenomena can be most easily and best observed. I shall therefore first consider some of the various ways in which this process may be artificially excited, before I take notice of the phenomena which attend its spontaneous occurrence.

The texture in which suppuration seems to be most readily and speedily produced, by exciting in it a certain degree of inflammation, is mucous membrane, whether this lines excretory ducts or canals, or covers the inner surfaces of the respiratory or of the urinary organs. In a few hours after an irritating cause has been applied to these surfaces, the physical and chemical qualities of the fluid which they secrete in their natural state are changed; from a tough viscid substance, not easily miscible with water, the mucus of the nose and bronchia becomes, during an attack of inflammation, very readily miscible with water, of a yellowish white colour and fluid consistence. If in this state the secretion from these membranes be examined with the microscope, it will be found to contain small globules similar in appearance to those which are seen in blood; and these globules are found to increase in number in proportion to the degree and continuance of the inflammation. We have examples of the production of this pus, or at least of a puriform fluid, in the respiratory organs of persons affected with catarrh, and in the urinary organs of those who labour under gonorrhea. In the progress of these diseases, we can in general trace the changes which take place, by slow, but sensible degrees, in the nature of the secretion from mucus to pus, and from pus back again to the state of mucus. This puriform discharge from mucous membranes, in a state of inflammation, may be kept up for months without these membranes appearing to undergo any other morbid changes than a slight degree of redness and swelling.

It was indeed at one time supposed, that ulceration was necessary to the formation of pus in these membranes; but this state has not been found, after the most accurate examination, in one out of ten of the cases in which mucous membranes have been known to give out pus. The vessels, then of mucous membranes affected with inflammation, give out a substance which, in the act of its exudation, or, at least, immediately after it, exhibits properties which assimi-

late it in its nature to pus. I have added, 'or, at least, immediately after its exudation,' because from some experiments of Mr. Home's, which you will find in his observations on Ulcers, it would seem that the formation of globules, in the matter of sores, takes place after its exudation.

2dly. Suppuration may be readily produced in the skin, or cutaneous texture, by whatever excites inflammation in that texture, and causes the separation of the cuticle. We have examples of this in blisters from cantharides, and in vesications of the cuticle from superficial burns. If, in these instances, the cuticle covering a recent blister, or burn, be removed, and the cutis exposed to the irritation of the air, or of other stimulating substances, the qualities of the discharge will soon become altered, and, instead of serum, pus will exude from the abraded and stimulated surface. The appearance of the pus will, in general, be more or less early, and its quantity greater or less, in proportion to the degree of inflammation which has been excited by the application of stimulating and irritating substances to cutaneous texture deprived of its cuticle. Suppuration can be kept up in cutaneous texture for any indefinite length of time, as we see every day done intentionally in the management of issues. In most instances of superficial burns and blisters, attended by the production of pus, small specks of coagulable lymph are in general to be observed on the surface of the abraded cutis; but these disappear during the formation of the cuticle that is produced to supply the place of that which had been destroyed and removed. Ulceration is seldom observed to take place during suppuration in the surface of cutaneous texture, unless in those instances where the irritation is violent, or the inflammation of a specific nature. Loss of substance, therefore, you perceive, in cutaneous texture, is not necessary to the production of pus.

3dly. If the cutis be divided, as in a wound, or a portion of it removed, as in the extirpation of tumours, and either the air or any other external body be permitted to remain in contact with the divided surfaces, the process of suppuration is speedily induced in the cellular texture subjacent to the skin. After the hemorrhage, which takes place from the small vessels, has ceased, an oozing of a fluid, at first resembling serum, occurs, which is gradually changed into pus. But the surface of the wound, as I shall afterwards have occasion to explain, is, in this case, previously covered

with a layer of coagulable lymph, which is penetrated with blood-vessels, and gradually raised into the little red eminences termed granulations.

I have already remarked, that appearances similar, though slighter in degree, are observed in cutaneous suppuration; and this circumstance seems to render the opinion of Mr. Home extremely probable, that, in inflammation, a vascular surface is formed previously to the formation of pus in cellular membrane, and probably also in cutaneous texture. Whether a new vascular surface be generated in the inflammation of mucous membrane seems to be more doubtful. Indeed I am inclined to believe that it is not, and that there is, in this respect, a difference between mucous membrane and cellular substance in the state of suppuration. In cellular substance, and also, I believe, in serous membrane, pus is never formed till the inflamed surface secreting it is covered by a layer of coagulable lymph; but the exudation of this coagulable lymph does not occur, so far as can be observed, in suppurating mucous membrane. It deserves to be remarked, that in none of the three examples which I have given of the formation of pus in mucous membrane, in cutaneous texture, and in exposed cellular substance, does ulceration, or breach of substance, occur. On the contrary, in two of these textures, the cutaneous and cellular, there is an addition made to the texture by the exudation of coagulable lymph, which becomes organized.

Spontaneous suppuration takes place more frequently in cellular substance than in any other texture of the body. It is in this texture, therefore, that we most commonly meet with these collections of pus which are denominated abscesses. But suppuration may take place in any texture or organ. Occurring near to the skin, it produces superficial abscess; at a distance from this, deep-seated abscess. We give the name internal to those collections of pus which form within any of the three great cavities of the body, whether the pus produced be accumulated simply in these cavities, or confined in the substance of some of the viscera which these cavities contain. Deep-seated and internal abscesses are in general of larger extent, and slower in their formation and in their progress, than those which have their seat near to the skin. It is on this account that they are not unfrequently denominated chronic abscesses.

When pus is about to be formed either in pure cellular

membrane, or in that which enters into the composition of other parts of the body, a severe pain is usually felt of a beating or pulsating kind; the part feels warmer to the touch than natural, and if the affection be near to the surface of the body, there is always a considerable degree of swelling. This swelling is in most instances chiefly œdematous, though not wholly so. If in the commencement of this state an incision be made into the part, pus is not found to exist. The cellular membrane which is inflamed seems denser than usual in the seat of the pain, and exhibits strong marks of adhesive inflammation. But the local symptoms of inflammation continuing, if, instead of being opened, the abscess be left to itself, pus is at length formed, and this pus is always found in healthy inflammation in a distinct circumscribed cavity, of a capacity greater or less, according to circumstances. We do not find in this cavity, in the first period of its increase, a fluid of a nature different from pus, as one would be naturally enough led to imagine from the language which has been used to express the formation and progress of abscesses. Thus we speak of the ripening or maturation of abscesses, as if the fluid which is effused into the cavity of an abscess underwent, after its effusion, changes similar to those which vegetable juices undergo in the processes of vegetation and of fermentation. But this figurative language is calculated to mislead, by giving erroneous ideas with regard to the process of suppuration in the formation of abscess.

In many local, and in some general diseases, an effusion of serum takes place into the cellular substance, producing the states of œdema and anasarca. The fluid thus effused can pass from cell to cell, as we see happens when pressure is made, or an œdematous limb placed in a depending position. Now, if we were to suppose this serous fluid to be converted, during its separation from the blood by the exhalents, into pus, the pus thus formed would, like the serum, be diffused through the interstices of the cellular texture, instead of being collected, as it is in abscess, in a distinct and circumscribed cavity. Something like this diffusion of pus seems to occur in that species of inflammatory affection which has been denominated erysipelas phlegmonoides. But in this case the vitality of greater or less portions of the cellular substance is destroyed, the deadened portions are converted into dirty whitish ash-coloured

sloughs, and it becomes extremely difficult to say whether any part of the pus contained in the deadened cellular membrane has been formed in the cells in which it is contained, or has been absorbed into these cells after being separated from the parietes of the cavities containing the sloughs themselves. In erysipelas phlegmonoides, the suppuration most probably begins on the living surface of cellular membrane in contact with that which is dead, and which must be discharged in the form of slough. But for the adhesive inflammation which exists in this surface, the pus which is formed would enter it, and destroy fresh portions.

When an incision is made into an abscess, and its contents discharged, the cavity of the abscess is observed to be lined with a smooth membranous-looking substance, which is of a whitish ash-colour, and has a strong resemblance to coagulable lymph. The substance thus lining the cavity of the abscess has been termed the parietes, bag, sac, or cyst of the abscess. This sac, or cyst, seems in general to adhere by a vascular union to the cellular membrane which more immediately surrounds it, so firmly as not to be capable of being separated, or indeed, in every instance, of being distinguished from it.

The cellular membrane, again, immediately surrounding an abscess, is denser in texture than usual, and when injected it is found to be more vascular than in the natural state; in short, it exhibits the characters of cellular membrane in a state of adhesive inflammation. You will find it very justly remarked by Mr. Samuel Cooper, in his First Lines of Surgery, page 22, "That if there were not some boundary in an abscess, some partition between the pus and the cavities of the cellular substance, the matter would diffuse itself extensively on all sides, like the air in emphysema, or the water in œdema. To prevent this circumstance, we find that coagulating lymph is deposited immediately around the collection of matter, and becoming organized, assumes the appearance of a membranous cyst. In abscesses of long standing, the cysts are often of very considerable thickness, while in other collections of matter that have been sudden in their formation, and have not existed long, the surrounding lymph has scarcely had time to be converted into a vascular membranous cyst. The cysts of all abscesses are both secreting and absorbing surfaces. When the pus has been completely discharged by a puncture, the cavity soon be-

comes again filled with pus. Very large and palpable collections of matter are often observed to disappear entirely, and in a manner only to be explained by the action of the absorbents."

You will find also some remarks highly deserving of your attention, with regard to the effect which the occurrence of the adhesive inflammation in parts immediately surrounding those in which the process of suppuration is going on, has in preventing the diffusion of pus through these parts, at page 365 of Mr. Hunter's Treatise on Inflammation. "The adhesive inflammation serves as a check to the suppurative, by making parts, which otherwise must infallibly fall into that state, previously unite, in order to prevent its access, as was described in the adhesive inflammation being limited; and where it cannot produce this effect, so as altogether to hinder the suppurative inflammation itself from taking place, it becomes in most cases a check upon the extent of it. This we see evidently to be the case in large cavities, as in the tunica vaginalis after the operation of the hydrocele; for after the water has made its escape, parts of the collapsed sac frequently unite to other parts of the same sac by this inflammation, and thereby preclude the suppurative from extending beyond these adhesions, which so far prevents the intention of the surgeon from having its full effect; and often, on the other hand, the adhesive state of the inflammation takes place universally in this bag, in consequence of the palliative cure which produces the radical, and thereby prevents a relapse. In the hernia it performs a cure by uniting the two sides of the sac together, by means of slight pressure, so that we should understand perfectly its mode of action, where it can prevent a cure, and where it can perform one. In still larger cavities, such as the abdomen, where often only a partial inflammation takes place, as is frequently the case after child-bearing, and in wounds of this cavity, we find this inflammation produced, which either prevents the suppurative altogether, or if it does not, it unites the parts surrounding the suppurative centre, and confines the suppuration to that point; and as the abscess increases in size, the adhesive inflammation spreads, uniting the parts as it spreads, so that the general cavity is excluded. Thus the suppuration is confined to the first point, and forms there a kind of circumscribed abscess."

In the formation of an abscess in cellular membrane, therefore, it would seem that the adhesive inflammation, and the exudation of coagulable lymph, precede the process of suppuration, precisely in the same manner as we see adhesive inflammation and the exudation of coagulable lymph uniformly precede the production of pus in this texture, when it is exposed by the removal of a portion of the skin which covers it.

The opinion that pus may be formed without any previous inflammation, was first suggested, I believe, by Dr. De Haen of Vienna, and has since that time been adopted by many writers and teachers of surgery. Much of the controversy which has taken place with regard to this point, seems to me to have had its origin chiefly in the very vague notions which have been entertained with regard to the symptoms which necessarily characterise the state of inflammation, and also with regard to the properties by which pus is to be distinguished from other animal fluids. Accordingly, in almost all the examples which De Haen has adduced to prove the formation of pus, without the previous existence of inflammation, he has himself occasion to remark the exudation of coagulable lymph, and the existence of preternatural adhesions; phenomena which we now know are produced by that state which Mr. Hunter has denominated adhesive inflammation. But De Haen uses the term inflammation to express that state which we denominate ulceration or ulcerative absorption; for, in speaking of the cases of suppuration which he had adduced, he observes, that "in many of them no previous loss or consumption of substance could be perceived." An observation similar to this was made about the same time, or perhaps a little earlier, by Dr. William Hunter, and an account given of it in the second volume of the London Medical Observations and Inquiries.

Mr. Hunter, though he endeavours to establish it as an invariable fact that no suppuration takes place which is not preceded by inflammation, is of opinion that collections of what he terms extraneous matter, something like pus, may form in various parts of the body without the previous existence of inflammation in the parts in which it is formed; and accordingly you will find, at page 390 of his Treatise on Inflammation, a chapter entitled, "Of Collections of Matter without Inflammation."

After an attentive perusal of what Mr. Hunter has said in this chapter with regard to the formation of these collections, I am inclined to doubt whether he has investigated this point in Pathology with his usual acumen, and whether these collections of matter said to be formed without inflammation, would not have been more properly denominated scrofulous abscesses, or chronic suppurations. I am disposed to believe, that in whatever texture or organ of the body scrofula manifests itself, there inflammation will be found to exist. The phenomena, it is true, of inflammation, both local and constitutional, are modified by the existence of the scrofulous diathesis; but they are, I believe always present in such a degree as to justify us in giving to them the name of inflammation, and in classing most, if not all, local scrofulous affections, among inflammatory diseases. When the indolent swellings of which Mr. Hunter speaks occur near to the surface of the body, that part feels warmer than usual, as may be felt in white swellings of the joints. The swelling also is either preceded or accompanied with some degree of pain, though, when the affection is internal, the patient may not always be very accurate with regard to the precise seat of this pain. When cut into, the parts also affected with scrofulous swellings are always found more vascular than usual; in short, all the symptoms occur by which the state of inflammation is characterised.

That in chronic abscesses the degree of adhesive inflammation occurring in the cellular membrane which surrounds them, is less than in acute abscess, will not be denied. But unless we admit the existence of a certain degree of this inflammation in the parts surrounding chronic abscesses, how are we to account for the matter which they contain remaining, as we often see it do, for weeks or months, in the same circumscribed cavities?

The fact mentioned by Mr. Hunter of pus moving readily through the cellular substance surrounding chronic abscesses, is one, I am disposed to believe, of very rare occurrence. The degree of adhesive inflammation which occurs in the cellular membrane surrounding these abscesses may be slight, but still it must be sufficient to confine the pus of these abscesses in a distinct cavity. Were it not so, the pus, as I have already so often remarked, instead of forming an abscess, would be found diffused in the interstices of

the cellular texture. This is precisely what happens when a chronic abscess bursts, as it sometimes does, internally, and discharges its contents into the cellular membrane which surrounds it. Great devastation of that texture may be produced by this occurrence; but the effusion of pus into the cellular membrane surrounding them, forms no part, I am inclined to believe, of the usual series of events which occur in the formation and progress of chronic abscesses. Were the matter of chronic abscesses at liberty to extend itself in all directions, we should never find it included in a distinct cavity. Even in lumbar abscess, where the matter, in its progress to the surface, travels often through a great extent of solid parts, it is almost always included in a bag or sac, formed sometimes in the substance, and at others upon the surface of the psoæ muscles, by the exudation of coagulable lymph, and by the adhesion of the cells of the surrounding cellular membrane. It is only when the process of ulcerative absorption takes place, that the matter in lumbar abscess finds its way into the interstices of the surrounding uninflamed cellular substance, or into the shut sacs or cavities of the body. I do not remember to have seen an instance of this abscess in which the pus was not at first formed and confined in a distinct cavity. The matter, it must be granted, which is formed in chronic suppurations, does not always accurately resemble that which is formed in those which are more acute in their character; but it bears so strong an analogy to that which is formed in acute abscesses, both in its physical and chemical characters, as well as in the circumstances in which it is produced, that I can see no reason why it should not be called pus, or a puriform fluid.

There are perhaps few subjects in pathology concerning which more numerous or contradictory opinions have been entertained, than concerning the formation, nature, and uses of pus. The opinions of authors respecting its formation may all be reduced to the two following: 1st. That pus is formed within the vessels of inflamed parts by an action of these vessels, similar to that which takes place in secretion; and, 2dly. That pus is formed without the vessels of the part inflamed, by a change taking place either in the solids affected with inflammation, or by a change in the fluids extravasated, similar to that which occurs in fermentation or putrefaction. According to the first of these hy-

potheses, suppuration, it is evident, is a vital, according to the second, a purely chemical process.

That pus is formed in the vessels from which it exudes, by an action of these vessels analogous to secretion, was, so far as I know, first distinctly suggested by Dr. Simpson of St. Andrews, in his Dissertationes de re Medica, published in the year 1722. "If any foreign body," that author observes, "be introduced between the edges of a wound, and the external air excluded, pus will continue to be discharged as long as you please; so that, by this means, a kind of new gland is, as it were, produced. But if the wound be irritated, or too much compressed, the properties of the liquor discharged will be immediately altered, as is well known to surgeons. Hence it follows," adds Dr. Simpson, "that nothing is more easy than to change the secretions and humours of the body without the addition of any new matter or ferment, merely by changing the diameters and number of the secreting vessels."

An opinion similar to that of Dr. Simpson's suggested itself, about the year 1756, to De Haen, from the consideration of what takes place in some cases of phthisis pulmonalis. Pus, this author observed, was often expectorated, for a great length of time, by patients affected with phthisis, in whom, after death, no mark of ulceration could be perceived, not even the place in which the pus had been formed. From these circumstances, De Haen was led to conclude that the pus must have been immediately secreted from the blood itself, since there was no other source from which it could be derived in the lungs. The hypothesis of pus being a secretion was, however, first embodied into a doctrine, and subjected to a full discussion, by Dr. Morgan of Philadelphia, in his inaugural thesis printed at Edinburgh in the year 1763, entitled, Puopoieses sive Tentamen Medicum de Puris Confectione. Dr. Morgan alleges, that this hypothesis, which he represents as entirely new, had occurred to him some years before the publication of his thesis; but he might, I conceive, have found the germ of it at least, had he been so disposed, in the passages which I have quoted to you from De Haen's works, and which were among those which Dr. Morgan has chosen to overlook in the very ample and formal refutation which he gives of De Haen's opinion, that pus could be formed without inflammation.

The opinion that pus is a secretion, or formed at least by

an action of the vessels analogous to secretion, was adopted by Mr. Hunter, and pervades, you will perceive, every page of his works. Indeed the merit of the original suggestion of this hypothesis has been ascribed, but improperly, to Mr. Hunter. Brugmann, professor of botany at Leyden, has maintained the same doctrine in an excellent Thesis de Puogenia, published in 1785; and it is that, I believe, which is now very generally taught all over Europe. It has been alleged that we derive no advantage by calling the formation of pus a secretion, for that secretion is a process with the nature of which we are unacquainted. But in answer to this remark I may observe, that in saying that pus is a secretion, or that it is formed by an action analogous to that by which secreted fluids are formed, it is not meant to insinuate that we do, or ever can know, the affinities by which nature forms this substance from the blood. We should be limited greatly in the account to be given of the process of secretion, were we not permitted to assert that a substance was a secreted fluid, unless we were at the same time able to explain the manner in which secretion is performed. It has been said that secretion is performed only by glandular organs, and that we perceive no glandular structure in the body for the production of pus. But we may remark, that the definition of a secreting glandular part must be taken from its function, and not from its structure; for nothing can be more various than the internal structure of those organs that are denominated glandular secreting organs; they consist sometimes of convoluted vessels, sometimes of follicles or small hollow bags, and sometimes of transparent membranes, in which neither convoluted vessels nor mucous follicles can be perceived. The question at issue, respecting the formation of pus, involves two matters of fact, of the truth of which any person may satisfy himself with very little observation or experiment. The first of these is the fact that pus exudes directly from inflamed mucous surfaces, from inflamed cutaneous texture, and from cellular substance in the state of healing by granulation. In these three surfaces there can be no doubt of its being formed in the vessels from which it exudes. It does not seem very philosophical to suppose, that when pus is formed in the more internal parts of the body, a different process of nature is employed; the more so, that we see the internal cavities of abscesses, after they have been opened, putting on the appearance of those suppurating

sores in which the pus is seen to exude for days, weeks, or even months, directly from the mouths of the vessels in which it is formed. The second fact is, that no animal substance out of the vessels of living animals has, in any given combinations of circumstances, been formed or converted into a substance possessing the same, or nearly the same, physical and chemical qualities as those of pus. The greater part of those who have spoken of the wasting or dissolution of the solid parts of the body by suppuration, have confounded two processes with each other which are essentially distinct. I allude to the supposed melting down or wasting of any animal substance, or particular part of the body, by a process analogous to fermentation or putrefaction, with that wasting and disappearance of parts, which in the living body is the consequence of natural or morbid absorption.

Those who have attempted to explain the formation of pus by chemical changes going on without the living vessels, differ widely as to the substances which undergo this singular change. Boerhaave, and many of his disciples, attribute the formation of pus to the breaking down of the solids, and to the changes induced in extravasated blood. Sir John Pringle, Gaber, and Mr. Benjamin Bell, to the putrefaction of the serum; Gorter, Quesnai, and even De Haen, to changes induced upon the coagulable lymph; Hoffman and Grashius to the wasting or melting down of the fat; and Dr. Stewart to the putrefaction of chyle. But these hypotheses have deservedly become obsolete, and may be allowed to remain so, for they throw no light whatever on that process in animal bodies by which pus is produced.

The physical and chemical qualities of pus appear to differ according to the degree and kind of inflammation, and according to the nature of the textures in which it is produced. These variations in the properties of pus are indeed so numerous, as to render it difficult to state any thing very precise or definite respecting its chemical analysis. The results, accordingly, of most of the experiments which have hitherto been made upon this fluid, are extremely unsatisfactory.

Dr. George Pearson, in his late observations and experiments on pus, inserted into the Philosophical Transactions for the year 1811, conceives that the different kinds of this fluid may be distinguished by the following titles: 1st. The cream-like and equally consistent; 2d. The curdy and un-

equal in consistence; 3d. The serous and thin kind; and, 4th. The thick, viscid, or slimy. This is perhaps as good an arrangement of the different kinds of pus as the present state of our knowledge respecting it admits of. The cream-like is to be regarded as the purest. It is an unctuous-looking fluid, of a yellowish white colour, mild taste, and maukish smell. When examined with the microscope, it is found to consist of small globules swimming in a serous-like fluid. The globular structure of pus was first mentioned by M. Senac, in his Traite de Cœur, and has since been regarded by Mr. Hunter as one of its most distinguishing characteristics. When first secreted, pus is neither acid nor alkaline, but it is said to become acid before it passes to the state of putrefaction. It is known to putrefy very slowly, but the products which are formed in it by putrefaction have never, so far as I know, been accurately examined. Mr. Hunter found that pus was distinguished from every other animal fluid in being coagulated by a saturated solution of the muriate of ammonia. Several other neutral salts produce a similar effect, though in a less degree. Dr. Darwin, junior, in his essay on the distinction between pus and mucus, states, that when caustic alkaline lixivium was added to pus, it did not dissolve it, but that a semipellucid matter was formed, which was viscid, tough, and readily drawn into strings, but which could not, like pus, be diffused through water. The pus, so changed by alkalies, has a striking resemblance to the mucus secreted from the inner surface of the bladder in various diseased states of that viscus. The differences between simple pus and that which has been acted upon by an alkali, though very remarkable, have not hitherto been investigated by chemists. Pus is not coagulated by diluted acids, nor by alcohol, but pus which has been acted upon by an alkali is very readily coagulated by these re-agents; neither oxymuriate of mercury, nor acetite of lead, occasion any coagulation when added to pus, though they produce copious precipitates when added to a solution in water of pus, which has been changed into a viscid substance by the action of caustic alkalies. Pus has often an extremely fœtid smell. This seems in most instances to depend on a certain degree of putrefaction. But much is still wanting to complete our knowledge of this subject. The animal matter contained in pus seems in many of its properties to resemble albumen; but in what respects pus differs from serum,

and from mucus, are points still to be determined by the researches of chemists.

The process of suppuration, particularly when it occurs in the internal parts of the body, is often accompanied by constitutional symptoms which indicate its existence in a manner almost unequivocal.

In the progress of the fever accompanying acute inflammations, rigors or cold shiverings not unfrequently take place, which recur at irregular intervals, and are in general followed by a hot fit and slight increase of the febrile symptoms. These rigors, or cold shiverings, in general indicate, when they occur in the progress of inflammatory diseases, that pus either is formed, or is about to be so. In inflammation succeeding to injuries of the head, these rigors are often the first constitutional symptoms which give alarm to the well-informed practitioner, for they are generally, though perhaps not always, an indication that inflammation has already made a dangerous, if not fatal, progress. These rigors also accompany the formation of pus in the viscera contained within the cavities of the chest and belly, and are often the first symptoms which inform the practitioner that his endeavours to procure resolution have not been successful. Rigors may occur, it is true, in the progress of inflammatory diseases, as from accidental exposure to cold, which do not arise from the formation of pus, but they are not on that account the less alarming, because we are never able to say, in cases of internal inflammation, to what cause, if not to the formation of pus, the rigors which occur are to be ascribed. We are completely ignorant of the relation or connection which subsists between the formation of pus, and the occurrence of rigors. All we know, and all we shall probably ever know, with regard to this point is, that it is a general fact, or, in other words, a law of our constitution, that rigors of longer or shorter duration, and of greater or less degrees of intensity usually accompany the production of pus in all the organs and regions in which it is formed.

Rigors, Mr. Hunter very justly remarks, are more common at the commencement of spontaneous inflammations, than in inflammations which arise from external injury. They seldom occur in the suppurations which succeed to operation. In these, on the contrary, the febrile symptoms suffer an abatement, and in many instances disappear,—un-

dergo, as it were, a natural crisis, upon the commencement of the state of suppuration.

Rigors, however, are not peculiar to the state of suppuration, for we find them occurring in the commencement of febrile, as well as of inflammatory diseases. Thus, most fevers, whether arising from cold or from contagion, whether of a continued, remittent, intermittent or eruptive kind, are ushered in by a cold fit. Rigors also, it deserves to be remarked, are often produced by local irritation, in cases where inflammation does not exist. This is remarkably the case in whatever affects the urethra. The introduction of a bougee, of a sound, or of caustic, into that canal often excites them, and in this case, instead of being in every instance followed by a hot fit, they frequently terminate by vomiting, or end in a cold clammy sweat. Rigor is now well known to be a symptom arising from the presence of stricture in the urethra. I have repeatedly known the rigors which accompany stricture in the urethra mistaken for, and treated as intermittent fever. Indeed the appearances are in many instances so similar, as to render this, in those who are ignorant of this effect of stricture, a very pardonable mistake. This is another proof, if any more were wanting, of the difficulty of distinguishing often in practice between idiopathic and symptomatic fevers. A smart attack of rigor runs in general through all the stages of a true intermittent.

The constitutional symptoms which attend the formation of pus in the progress of chronic suppurations, are generally comprehended under the name of hectic fever. The train of symptoms which occur in hectic, bears some resemblance to that of an intermittent. Hectic generally resembles intermittent of the quotidian type, at other times it puts on the appearance, by its periodic returns, of a regular tertian or quartan, and the similarity of these two diseases is sometimes so striking, as to deceive for a time even the most skilful practitioners. Were we to attempt to distinguish them from the symptoms which occur in a single paroxysm, we should find it difficult, if not impossible, to fix on any one symptom which could be considered as truly pathognomonic of hectic. It is from the history and progress of these diseases, and not from the symptoms which occur during a single fit, that we must seek for an accurate diagnosis.

In the incipient stage of hectic, the paroxysms are so very

slight as to render their accessions almost imperceptible. When it creeps on in this slow and insidious manner, the constitution may be frequently undermined, before the existence of hectic is even suspected. A very slight degree of emaciation, a pulse a little quicker than ordinary, with a small increase of heat, particularly after meals, are the first symptoms which can lead us to suspect the formation of hectic.

Intermittent fever, on the contrary, seldom remains long in the constitution without discovering itself, and the symptoms which accompany its first appearance are in general more violent, and more distinctly marked, than those which accompany the commencement of hectic. Even in the remissions of hectic, the pulse is commonly small, and from ten to twenty beats in the minute quicker than in health, and its frequency is very remarkably increased by taking food, or by using only very moderate exercise. During the intervals of an intermittent, the pulse is almost always of the natural degree of frequency and strength. In hectic, the increased heat of the body is more constant and uniform than in intermittent fever, and is accompanied with a very peculiar sensation of pungent heat in the palms of the hands, and soles of the feet. Patients labouring under intermittent fever want that florid circumscribed suffusion of the cheeks, which is so constant an attendant on hectic.

The hectic paroxysm is seldom accompanied, like that of an intermittent fever, with nausea or vomiting during the shivering fit. The vomiting which occurs in hectic generally takes place towards morning, at a time when the paroxysm begins to go off.

The return of a hectic paroxysm in not so regular as that of a true intermittent. It seldom takes place for more than three or four paroxysms at a period perfectly regular. The paroxysms then begin to recur at irregular intervals, or perhaps disappear entirely for ten or twelve days.

The different stages of the hectic paroxysm are often but very indistinctly marked. The hot stage does not always succeed to the cold; and, what is peculiar to hectic, the cold sometimes returns even in the middle of the hot stage. In hectic, the patient is not, as in a genuine intermittent, relieved by the appearance of sweat; a degree of listlessness and anxiety is almost always present in hectic, so that the state of apyrexia, or the interval of the paroxysms, is in this

fever but often very indistinctly marked. Could any mark of distinction be taken from a subject so variable in its qualities as the urine, we might also observe, that it does not vary so regularly in the different stages of an hectic, as in those of an intermittent fever. In intermittent, the urine is clear in the fits, and turbid in the intervals; but in hectic, it does not appear to follow any general rule, as it may be clear or turbid in any stage of the disease.

Hectic supervenes to such a variety of morbid local affections, that I think it may still be fairly questioned, whether it ever occurs as an original idiopathic disease. It must be confessed, however, that there are a few cases of this kind mentioned by authors; but the descriptions which they have left us are in general so very inaccurate, as to afford no proper data in forming a decided opinion. The very unfrequent occurrence of idiopathic hectic, if indeed it ever occurs at all, and the knowledge of the fact, that hectic frequently supervenes in the latter stages only of many local disorders, are circumstances which operate powerfully in inducing me to believe, that hectic is, in every instance, purely a symptomatic affection, and derives its origin from some other disease already existing in the constitution.

Till lately the most common opinion respecting the production of hectic fever was, that it depended on the presence of a quantity of puriform matter in the mass of blood. The frequent co-existence of purulency with hectic was perhaps the only circumstance upon which this hypothesis was founded. It has been urged against this supposition, that pus is a mild bland fluid, and destitute of all poisonous and acrimonious qualities; that no vestige of purulency can be detected in the blood ; and that pus may frequently exist for a great length of time, in various cavities of the body, without exciting hectic, as in lumbar abscess, abscesses of the liver, wounds from chirurgical operation, &c.

But what militates still more strongly against this hypothesis is, that pus, even of the worst kinds, is very frequently absorbed, without producing any one symptom of hectic. The complete disappearance of a suppurated phlegmon, bubo, or scrofulous abscess, not to mention more instances, appears to prove decisively that the specific action of absorbed pus is not, in every instance at least, necessarily connected with the formation of hectic.

It has been also asserted, that hectic frequently super-

venes to diseases in which no mark of purulency can be detected, and consequently, that it must derive its origin from some other cause than the presence or absorption of pus. Should the truth of this latter position be fully established by future observation and experience, we shall then be obliged to adopt pathological ideas with regard to the formation of hectic, very different from those which have been commonly entertained. But till facts more decisive, and cases more accurately described than any which have yet appeared, are produced in proof of that opinion, I shall think myself justified in adopting the common opinion, and in believing that hectic fever is in every instance connected, if not with the absorption, at least with the formation of pus. This opinion appears to me to receive no small additional support, from the not unfrequent cure of hectic by the removal of the morbid part; a fact which seems to prove also, that hectic, even in debilitated constitutions, does not depend upon the quantity of pus that is formed; for the quantity of pus secreted by the surface of an amputated stump is often much greater than that which, previously to the amputation, had been formed during the existence of hectic.

Hectic fever comes on at very different periods after the commencement of suppuration. This is probably owing to peculiarities of constitution, or to differences in the structure and functions of the organ that is locally affected. The species of hectic that is most commonly described in books, and probably also that which is best marked in its symptoms, is the hectic which accompanies the latter stages of pulmonary consumption.

But there is much reason to think, that hectic fever differs considerably in its appearances and character, if not in the method of treatment which it requires, according to the seat which the suppuration occupies, and the importance of the organ affected to the general œconomy. This is a subject which has been but little investigated, and which is very deserving of your attention. It would be desirable to compare carefully the effects of the different kinds of food, in the hectic which accompanies pulmonary consumption, with the effects of the same kinds of food in the hectic, attendant upon disordered joints, extensive burns, frost-bite, or in ill-conditioned wounds succeeding to chirurgical operations; for in these latter cases, I suspect, that the effects which are

often produced by a generous and nourishing diet, and by the use of wine and other cordials, are often specifically different from those which are produced by the same regimen in pulmonary hectic.

There is nothing which aggravates all the symptoms of pulmonary hectic more than a free use of animal food; but I am unable to say, whether this kind of food produces a similar aggravation of symptoms in the hectic depending upon other local affections. I am inclined to think that it does not; but of this I will not be positive. This also is a matter which merits your most serious attention.

In the treatment of hectic, we must distinguish carefully between that which arises from a local complaint, capable of being removed by operation, and that which arises from the morbid state of an organ, which cannot be removed, or from a general diseased state of the constitution. In the first case, operation is the sole remedy; in the latter we can only hope to palliate symptoms.

The means which I mentioned as useful in the treatment of symptomatic inflammatory fever, are some of them inadmissible in hectic.

Blood-letting, for example, is in very few instances to be employed; and in those cases only in which the hectic is accompanied with evident marks of inflammation in some vital organ.

Purging, particularly with neutral salts, is also to be avoided. Indeed the antiphlogistic method, if pursued in any great degree, never fails to aggravate the sufferings of the patient, and to accelerate his death.

The use of bark has been much commended, but I am doubtful whether deservedly or not. The bark, when used in hectic, should be given in the form of decoction or extract. When given in powder, I have known it occasion a very distressing sickness, or obstinate diarrhœa. Opium and myrrh have been much recommended in cases where slight tonics were required. The opium appears to be useful by relieving pain, procuring rest, or moderating the diarrhœa, sometimes occurring in the latter stage of the disease. The myrrh acts chiefly as an expectorant.

Digitalis is the latest fashionable remedy in hectic fever. To those who are ignorant of the history of medicine, and of the innumerable fallacies to which we are liable in judging of the effects of any remedy, the cases which have been

already published of the efficacy of digitalis, in checking the progress of hectic, must appear highly satisfactory. My own observation of the effects of this drug in hectic, does not incline me to entertain any very sanguine expectations of good from its future employment.

In the treatment of parts passing, or which have already passed into the state of suppuration, various indications present themselves, which require corresponding diversities in the means of cure. In some instances it becomes the object of the practitioner to promote, and in others to moderate, or even to put an entire stop to the suppurative process. We succeed best, in attaining these objects, by regulating our practice according to the more or less acute character of the local and constitutional symptoms by which that process is accompanied. So long indeed as any thing acute in the character of these symptoms exists, the antiphlogistic regimen must be strictly pursued. It is only after the inflammatory symptoms have disappeared, that a nourishing diet, or stimulating cordials, can with any propriety be allowed.

The process of suppuration, in mucous membranes, is almost always, at its first commencement, preceded by a high degree of local inflammation. In some instances this inflammation is so violent as to prevent, rather than promote, the formation of pus. The inflamed and dry state of these membranes is a state in which more advantage is at all times obtained from the use of general, than of local remedies. The inhalation, however, of the steam of warm water often gives relief in this inflamed state of the mucous membrane of the nose, fauces, and bronchia, as the semicupium, or general warm-bath, do also in acute inflammation of the mucous membranes of the urinary and genital organs Suppuration, after it has subsisted for some time in mucous texture, always assumes more or less of a chronic character; and it is in this state, that advantage is so often obtained from the use of astringent, tonic, and stimulating remedies.

Nothing can be more various than the degree of inflammation which precedes, and at first accompanies, the suppurative process, when it is the necessary consequence of the infliction of a wound, or other external injury. In many instances of this kind, the inflammation is so moderate as to leave but little room for the interference of art; while in others, it is so violent as to require all the assistance which

art can afford. In these cases general or local blood-letting must be employed, according to the urgency of the symptoms, and according to the degree of relief which they procure. Every article of diet or medicine must be avoided, that can add to the violence of the vascular action which prevails; and the suppurative process must be promoted by every means in our power. Of these, none are so useful as fomentations with cloths wrung out of warm water, and applied as hot as the feelings of the patient can well bear, and the continued application of warm emollient poultices. Here, as in acute inflammation of mucous membranes, the occurrence of suppuration usually brings relief; and the wound or sore, after a longer or shorter interval, usually passes into an indolent or chronic state.

The collections of pus which form in the cellular membrane, have already been distinguished into acute and chronic abscesses. Perhaps the best, because the most frequent, example which we have of acute abscesses, is in that form of inflammatory disease which is denominated phlegmon. By this term is usually understood, a tense, painful, red, circumscribed swelling, more or less raised above the level of the surrounding integuments, attended by a sense of throbbing, and a tendency to suppuration. Phlegmon has usually its seat in the cellular texture, and is one of the simplest forms in which inflammatory diseases appear. It is that also, I believe, the progress and treatment of which is best understood. When phlegmonous inflammation occurs, as it not unfrequently does, in a lymphatic absorbent gland, it is denominated a bubo. The terms phlegmon and abscess are often used in medical writings as synonymous, but this use of these terms is incorrect; for abscess, so far from being the same with, or even a necessary consequence of phlegmon, may form in various parts of the body without being preceded by the state of phlegmonic inflammation. When phlegmon, however, terminates by suppuration, an abscess is always produced. Phlegmon may arise spontaneously, that it to say, from causes with which we are unacquainted, or it may be produced by contusions, burns, wounds, fractures, &c., in short, by every thing capable of exciting inflammation, and of course suppuration in the cellular membrane. Phlegmon not only forms most frequently in those places of the body where the cellular substance is loose and abundant, but it also acquires there a

larger size, as occurs in phlegmonous abscesses of the cellular membrane situated in the arm-pits, groins, and neighbourhood of the anus.

The progress of phlegmon is very various. In some instances, it passes through the inflammatory and suppurative stages in the course of twelve or eighteen hours. In other instances again, these stages occupy a period of several days. This difference in the progress of phlegmonic abscess, is to be ascribed to the influence of those circumstances which render the inflammation more or less acute, and which modify and regulate more or less the violence and duration of all inflammatory diseases.

When, in any case of active local inflammation, resolution does not spontaneously take place, or is not produced by the remedies which have been used, when rigors occur, and when the different local symptoms of inflammation go on increasing instead of being diminished, we have reason to believe that matter is forming, and must vary in some respects our plan of treatment accordingly.

In general, during the suppurative stage, the diet may be a little more nutritive, than during the period in which we wish to procure resolution. The diet, however, must not be of a heating quality. A larger proportion of vegetable food may be allowed ; but seldom, unless in particular cases, till the violence of the inflammatory fever has abated, should there be any admixture of animal. In cases where the patient is of a very weakly constitution, or where the antiphlogistic plan has been carried too far, a moderate allowance of wine may be given, with a view to support the strength of the patient, and to promote suppuration. But as we would not in this stage of inflammation retard a necessary process, so neither must we, by an injudicious use of wine, or other cordials and stimulants, add to the violence of the action by which suppuration is produced. The internal use of opium, after pus has distinctly begun to form, is often of singular use, by the ease and rest which it procures.

The local treatment in phlegmonous abscesses is still more simple than that by which we endeavour to procure resolution. It consists almost solely in the application of a moderate degree of warmth and moisture to the inflamed part, either by means of fomentations or poultices. The manner in which these means act in promoting suppuration

is unknown. Independently of their temperature, it seems very doubtful whether fomentations and poultices have any power of promoting suppuration in the parts to which they are applied. They keep the cuticle moist and warm, they promote perspiration, they soothe and allay pain in many inflammations, and these are probably the only immediate effects which they produce. The rest is the work of nature. In suppurations attended by very severe pain, the use of warm fomentations is often found to afford singular relief, not only by their effect in easing pain, but also by their seeming to shorten the duration of the suppurative stage. In the cases of suppuration in which they give relief, they should be repeated every four or six hours. The most common way of employing them, is by wringing linen or woollen cloths out of warm water, and applying these to the inflamed part of as high a temperature as the feelings of the patient can bear. Decoctions of herbs were formerly much employed in the way of embrocation, and were then, and are still by many practitioners, supposed to possess peculiar virtues in promoting suppuration. Whether embrocations with the narcotic herbs might not in some cases be beneficial by producing a sedative effect in allaying pain, I am unable to say, though I am inclined to believe that even they act chiefly by their warmth and moisture. In cases where you find it necessary to use an embrocation with herbs, the flowers of camomile may in general be substituted in place of the leaves of flowers of almost every other plant. These flowers readily imbibe and retain moisture. They are, when moist, of a soft consistence, and can be easily moulded to the figure of the parts to which they are to be applied. By virtue of these qualities, they make an excellent fomenting catapalsm or poultice.

In the intervals of the fomentations, poultices are to be applied, and these may be formed of a variety of substances, moistened with, or boiled in water. The three substances which in this country are most frequently used for making the suppurating cataplasm, or the poultice applied to promote suppuration, are oat-meal, linseed-meal, and the soft part of wheaten loaf. These are boiled for a few minutes in milk or water. By some, the water, by others, the milk is preferred. Perhaps there are diseased and inflamed states of the skin, in which sometimes the one and sometimes the other liquid is preferable. The manner of

preparing poultices, the degree of consistence that should be given them, and the modes of applying them, can be best learned by practice. You will not find attention to these in practice matters of indifference, as they are but too often regarded by the young and thoughtless. The very various effects produced by poultices upon the inflamed and irritable surfaces to which they are applied, renders attention to their composition and application an object of great importance to the surgeon, as well as to his patients.

The linseed poultice has something oily in its composition, and separates therefore, in general, readily from the surface to which it has been applied. Not so in all cases the poultices which are formed of oat-meal, or of the crumbs of bread, particularly when they have been allowed to remain too long. That they may sit easy, and separate readily, we generally anoint the surface of the poultice, before applying it, with a little hog's lard, sweet oil, or fresh butter. By some, the addition of these oily substances has been regarded as injurious; but, after some attention to this point, I have not found it so in practice. Whatever substance may be used for poultice, it is necessary to take some precautions to prevent the dissipation of its warmth and moisture; perhaps the simplest, and the best, because the simplest, means of doing this is to cover the poultice with some folds of flannel cloth. Poultices when applied to parts at a distance from the heart, and where they may be supposed to produce some effect in promoting suppuration, by the heat which they impart, should be repeated every five or six hours or even oftener, whenever this can be done without putting the patient to much inconvenience. The temperature of the poultice must be regulated by the feelings of the patient. He will seldom I believe, be able to endure a heat higher than that of the human blood, which is 98° or 100° of Fahrenheit—seldom, I believe a heat even so high as that which I have mentioned.

We judge that suppuration has actually taken place, when the throbbing pain abates or ceases entirely; when the pulse becomes soft and the skin moist; when the phlegmonous swelling becomes soft, and a fluid can be distinctly felt to fluctuate in it. The pus at this period is not found dispersed through the interstices of the cellular membrane, but is contained, as I have already had occasion to remark, in a distinct sac or cavity. If the phlegmon occurs in the

cellular texture, near to the skin, the parts which cover it becoming thinner, gradually disappear, and the skin at last bursts, and affords an outlet to the pus which has been formed. But if, on the contrary, the abscess be deep seated, and the parts which cover it but little changed from their natural appearance, it may become necessary for the surgeon to employ those means which are known to hasten the progress of abscesses to the surface of the body ; or, without employing these means, to procure an outlet for the matter of the abscess by an artificial opening. It must not be imagined, however, that every abscess which is long in opening of itself, requires to be opened by chirurgical means ; for abscesses have been known to disappear spontaneously, and this either, first, by what has been termed metastasis, where the matter of an abscess is suddenly absorbed into the system, and does not travel, as the term imports, and, as indeed has actually been supposed, from one part of the body to another ; or, secondly, and this is by far the most common case, by the slow and gradual absorption of the matter which has been secreted. We see daily numerous examples of this slow and gradual absorption, in the disappearance of suppurated bŭboes during the use of mercury. Is this absorption of the matter of an abscess more frequent, when the abscess has its seat in a gland, than when it is seated in cellular texture?

The means employed to hasten the progress of abscesses to the skin, all agree in the property which they possess of exciting inflammation in the parts to which they are immediately applied. Of this kind are dry cupping, the application of the warm and stimulating gums, roasted onions, acrid vegetables, and repeated blisters. When the abscess lies deep, these have often the most beneficial effects in accelerating the progress to the surface. These stimulating remedies are sometimes required in the treatment of chronic or scrofulous abscesses, though, in general, it is better to leave most subcutaneous scrofulous abscesses to burst of themselves, than to irritate them too much by stimulating applications, or to open them with the knife, or with caustic. There are undoubtedly many cases in which the spontaneous rupture of an abscess may be permitted to take place ; and it becomes therefore a matter of some moment, to be able to determine what the cases of abscess are in which this process may be safely left to nature.

Perhaps we may, in most instances, leave those cases of abscess to open of themselves, in which the abscess is superficial, and at a distance from parts of any great importance in the machine; and we must defer, as long as possible, to open those abscesses which are long in forming, and which are surrounded with great hardness of the contiguous parts. Too early an opening often excites a degree of inflammation which is unfavourable to suppuration; and, besides, the longer the opening is deferred, the less pain in general will the operation occasion, and the more speedily the abscess afterwards heals. There are cases again of abscess in which it becomes prudent, and others in which it is absolutely necessary, to discharge the matter of the abscess by an artificial opening, almost as soon as it is formed. To this class belong:—

1st. Cases where the matter of abscess is collected under the fasciæ of the upper or lower extremities. These fasciæ being of a considerable degree of thickness, and of a firm unyielding texture, the pus which is situated under them becomes in general widely diffused. This early opening is rendered more particularly necessary, when the matter is situated under the aponeurotic expansions covering the palms of the hands and the soles of the feet; for, when confined in these situations, it makes its way more readily into the sheaths of the muscles, than through the thick and firm body of the aponeurosis, and of the skin which covers it.

2dly. Where the abscess is situated over the larger cavities of the body. Though in these situations the matter seems to have a natural tendency to the external surface, yet, in some rare instances, it has been observed to point inward, and actually to burst into the cavity of the chest or belly. To prevent this occurrence, all abscesses situated immediately over these cavities, should be opened, and their contents evacuated as soon as from the fluctuation of the matter it becomes evident that it exists.

3dly. Abscesses are to be opened at an early period, which are formed in the vicinity of the larger blood-vessels, or which are likely to come into contact with them. Arteries, it is true, are not very susceptible of the state of ulcerative absorption. They appear to be less so than the veins. Abscesses situated in the immediate neighbourhood of large arteries are liable to be mistaken for aneurisms.

4th. Those abscesses ought to be opened early, that are

situated in parts through which the matter is liable to become widely diffused. This is particularly the case, with abscesses that are situated on the forepart of the neck, or in the cavity of the axilla, or by the side of the rectum. When matter is formed in the cavity of the axilla, if it does not speedily obtain an external outlet, it is very liable to pass up towards the clavicle in the course of the axillary plexus of nerves and vessels, or forwards, under the pectoral muscles. I have repeatedly seen axillary abscess take both of these directions at the same time, forming one of the most painful and difficult cases to treat, which occurs in the management of abscesses.

5th. An early opening is proper and necessary, where the matter is lodged, as in some cases of whitloe, in the sheaths of the tendons. The existence of matter in this situation is not very clearly indicated by any symptoms with which we are at present acquainted; but even in a doubtful case, much less danger, I believe, would result to the patient, from a free incision into these sheaths, than from the lodgement even of a small quantity of matter.

6th. Where matter is formed under the periostium, there also a speedy opening should be made; nor should we wait for the ulcerative absorption of the integuments. The timely evacuation of the matter in this case is productive of the most sensible relief, and often puts a stop, which no other means are capable of doing, to the farther destruction of bone.

7th. Where an abscess is situated either in the cellular texture, or in one of the bursæ lying over any of the larger joints of the body. And, lastly, Where an abscess is deep seated.

In this enumeration, I do not by any means pretend to have included all the cases of abscess, in which it is necessary or proper to make an artificial opening. For in this, as in the practice of every other part of our art, much must be left to the knowledge and judgment of the practitioner; something to the will, often ill directed, of the patient; and much, in every instance, must be determined by the progress and particular circumstances of the disease.

There are three methods at present in use of opening an abscess: these are incision, caustic, and seton. Each of these methods has, perhaps, its individual advantages; but in the treatment of the abscesses which daily occur, it is

often with the best informed a matter of doubt, to which of these methods the preference should be given.

The first method, which is performed by puncture or incision with a lancet, trocar, or scalpel, is that which is most commonly employed. In this way, the abscess may be opened quickly, and with little pain ; the puncture does not leave behind it any ill-looking scar, and the incision can be made of the exact size, and in the particular direction which is judged most convenient and proper.

The place of the abscess into which the incision should be made, is that which is most prominent, that in which the integuments are the thinnest, and in which the fluctuation can be most distinctly perceived.

It is impossible to lay down any precise rules with regard to the size of the opening, for this must vary according to the size of the abscess, the state of the integuments, and the particular views which the practitioner may entertain, with regard to the manner in which the abscess should afterwards be healed. Where the opening has been long delayed, and where the integuments have become very thin and inflamed, and where of course they must ulcerate, there, I conceive, no mischief can arise from a large and free incision ; but, on the contrary, where the integuments are sound, or but little affected by the subjacent abscess, a free division of them may not only be unnecessary, but hurtful. In this case it is in general better to evacuate the matter by a small puncture, and to allow the sides of the abscess to contract a little, before we have recourse to a large opening. In cases again where an abscess is very large, or much diffused, as happens in abscesses under the fasciæ of the upper or lower extremity, it is often better to make two or more small punctures with the point of the lancet at a distance from one another, than to make one very large opening. Indeed, in most instances where the integuments are sound, or nearly so, I am inclined to believe, that the less the opening, by which matter is evacuated at first from an abscess, so much the better. The cavity of the abscess is often diminished by being evacuated, and may be still more diminished by bandaging and proper treatment ; should the abscess not heal up with a small opening, or should it even degenerate into a fistulous sore, we have it still in our power to make the opening afterwards of any extent which may appear to be necessary.

The direction of the incision, is also an object to which, in opening abscesses, we must particularly attend. In general, this should be towards the more depending part, so as to admit of a constant and easy evacuation of the matter which may afterwards form. The rule, however, of carrying the incision in abscesses towards the most depending part, is, like every other rule in surgery, liable in its application to many particular exceptions. It may be improper or dangerous to carry our incision towards the most depending part, from the hazard we might run of dividing some large blood-vessel, or other part of consequence. Besides, it is generally unnecessary to cut through parts which are sound, when they are on the more depending side of an abscess. Parts in the healthy state have a strong disposition to heal, and little advantage, but much pain, may be occasioned by their division.

The second mode of opening an abscess is by caustic. Under this name is generally comprehended all those chemical re-agents, which, when applied to the solid parts of the body in the living as well as in the dead state, produce a decomposition, and destruction of these parts. Caustics form a very numerous class of substances, which differ so widely in their chemical properties from each other, that in decomposing the solid parts of our bodies, it is impossible for us to conceive, that they can all act upon precisely the same chemical principle. To this class we may refer the concentrated mineral acids, the pure alkalies, many metallic oxides, and metallic salts. These substances, however widely they may differ in their chemical properties, all agree in producing, in the parts of the living body to which they are applied, a mortified portion of a greater or less extent, which, when dry, is denominated an eschar, when wet or moist, a slough. Caustic remedies were much used in the ancient practice of surgery. They often served as a substitute for the knife, in cases where it was dreaded that a hemorrhage might take place from the incision of parts that were to be divided; and they were used also with a view to stop hemorrhage, in cases where it had actually been produced. If the ancients employed caustics too frequently, and in cases in which their use is now rendered not only nugatory, but in which it would be pernicious, the moderns have probably neglected their use too much. This suspicion seems at least to be justified by some of the very bene-

ficial effects, which some of the moderns have derived from the employment of caustics in their practice. In proof of this, I might refer to the cures of diseased spine by Mr. Pott, of deep-seated abscesses of the hip-joint by Mr. Ford, and of strictures in the urethra by Mr. Home.

The two substances which are at present most commonly used as caustic applications, are the causticum commune mitius, and lunar caustic. The caustic operates more slowly, and occasions a great deal more pain than the knife. It necessarily forms an opening of a considerable size, and, in some instances, leaves behind it a disagreeable mark or scar. In spite of every precaution to limit its operation, the effects of the caustic often spread farther than we could wish ; and in some people, it excites a very alarming degree of inflammation and fever. The length of time which it should be allowed to remain, will vary according to our conception of the state and depth of the parts covering the abscess. It is to be regretted, that, previously to the removal of the caustic, we have no means of knowing how far it has extended, nor whether it has produced the effects which we wished it should produce.

The cases in which a preference is to be given to the caustic in opening abscesses, are not very well ascertained. The principal effects of the caustic, when properly applied, are limited to the skin ; and therefore it ought to be seldom employed in opening deep-seated abscesses. This mode is said to be useful where the abscess is deep seated, where it has been long of forming, where the surrounding integuments are in a hard and indolent state, and where it is necessary to excite a certain degree of inflammation in order to effectuate a cure.

The method of opening abscesses by seton, has been particularly recommended. 1st, In cases of large abscess, where the skin is in a healthy state, and capable of uniting with the opposite side, or bottom, of the abscess. 2dly, In cases also where we wish to draw off the matter of an abscess slowly ; and, 3dly, In cases where we wish to excite a certain degree of irritation in the cavity of the abscess. The seton, or cord, has also been supposed to be particularly useful in cases of large or deep-seated abscesses, where we wish to prevent the admission of air into the cavity of the abscess. Here, however, it does not appear to me to possess any advantage over a puncture, whether made with a lancet or a

trocar, and the irritation which it occasions is sometimes such as to render its removal necessary, and when this does not happen, the part through which the cord has been introduced sometimes degenerates into a fistulous sore, which requires to be afterwards opened by incision. Setons are now less employed than they were a few years ago, and I know of few cases of abscess, in which every advantage they can procure, may not with more ease to the patient, and less trouble to the surgeon, be obtained from puncture with the trocar or lancet. The healing up of the puncture immediately after opening a large abscess, is perhaps one of the most material improvements, which has been introduced of late times, into this branch of surgery. It would be injustice to Mr. Abernethy, not to acknowledge that we are chiefly indebted to him for our knowledge of the good effects which attend this mode of practice, in that most incurable of all abscesses, lumbar abscess.

The principal difference between this puncture and the common method of opening an abscess, seems to consist in the healing up of the wound by the first intention, and in the complete exclusion of the atmospherical air. It has been doubted of late years, whether atmospherical air can exert any pernicious effects, when admitted to surfaces in a state of suppuration. But the effects of air in altering the condition of suppurating surfaces, and consequently the nature of the secreted fluid, appear to me to have been denied upon too slight grounds, and indeed, in opposition to the observation and experience of almost every well-informed practitioner. These effects have been denied, partly because it is not easy to point out the precise manner in which they are produced, and partly also, because there are suppurating surfaces, upon which the air may certainly be allowed to act for a few minutes, without occasioning any very injurious consequences.

That atmospherical air, however, can produce pernicious effects, when permitted to come into contact with surfaces recently divided, or secreting pus, is proved, I conceive, by facts which have been established beyond all cavil. Thus, it is well known, that if the covering be removed from a part which has been recently deprived of its skin by a blister, by a burn, by a wound, or by any other means, a smarting kind of pain is immediately perceived; that if this part be covered up from the air, or if it be brought into

contact with azotic gas or carbonic acid gas, little or no pain will be experienced; but that if, on the contrary, you apply oxygen gas to the sore or wound, the pain will not only be felt, but it will be much smarter than that which arises from the application of atmospherical air. These, and various other facts to the same purpose, were experimentally ascertained by the late Dr. Beddoes. Air introduced also in the way of experiment into the cavities of the pleura and peritoneum of quadrupeds, has been found to excite inflammation, and this effect is more speedily produced by oxygen gas, than by atmospherical air. Indeed every practitioner knows how necessary it is, in wounds penetrating any of the great cavities, or shut sacs of the body, to exclude the access of atmospherical air. This is a point in practice that was known to Hippocrates, and which has been particularly insisted upon, as I have already remarked, by Magatus, in his treatise de Vulneribus, and more recently by Dr. Monro, in his work on the Bursæ Mucosæ.

I know not how we are to account for the violence of the local and constitutional symptoms, which are known to supervene to the free admission of air into the cavities of lumbar abscesses and abscesses of the liver, unless by supposing, that the air so admitted has the power of exciting inflammation. The oxygen gas which the atmospherical air contains, may not be limited in its operation upon inflamed and suppurating surfaces, merely to the production of pain; it may alter also the action of the blood-vessels, or it may act as a chemical re-agent on the fluids which they secrete. In producing the effects which we see result from its admission, it may act in a manner of which we are altogether ignorant, but it concerns us especially to know, that if a lumbar abscess, or an abscess of the liver, be opened with the point of the lancet, or with the trocar, and the air be carefully excluded, no disagreeable effect will in general succeed immediately to this opening; but that if, on the contrary, the opening which is made be large, and air be admitted, a violent symptomatic fever will be induced in the course of a few hours, succeeded by hectic fever, and in most instances, sooner or later, by death.

When an abscess has been opened either by art or by nature and its contents fully discharged, very little in general remains to be done by the surgeon. In a sound state of the parts, the healing process now commences, the cavity of

the abscess diminishes by degrees, and a new skin is at length formed over the surface which had been abraded. The treatment of abscess in this stage, is to be regulated by the kind of opening which has been made, by the condition of the parts surrounding the abscess, and by the particular views which the practitioner may entertain with regard to the manner in which the abscess ought to be healed. Thus, for example, when an abscess has been punctured, as is now the best practice in cases of lumbar abscess, so as to allow the contents of the abscess to escape, and its cavity to contract a little, we must be careful to exclude the air from the cavity of the abscess during the evacuation of the matter, and to heal up the puncture afterwards as speedily as possible. The first object, the exclusion of the air, is easily obtained by applying graduated compression with a roller in proportion as the fluid runs out, and the edges of the puncture may in general be made to adhere together, by keeping them in contact with a bit of adhesive plaster. When an abscess is opened in this manner, the pus gradually collects again; but the abscess should be re-opened, before it is permitted to acquire its former size. By opening lumbar abscess in this way, not only has the accession of hectic fever in many instances been prevented, but it would seem that in some rare cases, the cavity of the abscess goes on diminishing in size, till it is wholly obliterated. This mode of opening abscesses, and of treating them afterwards, has perhaps been but too little followed. From the success which has attended it in opening lumbar abscess, there is reason to hope that it will be found equally beneficial in other cases of large, indolent, or chronic abscesses.

There are some abscesses in which the opening, having a tendency to close, requires to be kept open by artificial means. This is the case in empyema, or abscesses communicating with the cavity of the chest, and in abscesses of the liver which have either been opened with the knife or have burst externally. The substances used for this purpose are known by the name of tents in surgery. They were formerly much employed, but have of late years sunk into a neglect, in some respects, perhaps, but too well merited. The form and substance of the tent was varied according sometimes to the pleasure of the surgeon, and according to the particular purpose which it was meant that it should serve. When intended to dilate the opening into an abscess

which had been formed by nature, and in which the use of the knife was judged to be dangerous, the tent was formed of prepared sponge, or of the root of some plant which swelled by imbibing moisture. The disadvantages of these substances are, that they irritate and inflame the parts into which they are introduced; that they prevent, when solid, the escape of the matter which is formed in the abscess, and to a certain degree prevent the contraction of its cavity. But the occasional and temporary use of tents is not liable to the objections which I have stated to their permanent use, and I know from experience, that much advantage may be occasionally derived from their employment. They are often of use, in dilating the orifices of abscesses situated in the cavities of the chest or belly, so as to allow hollow tubes to be introduced into them, and in dilating the orifices of punctured wounds, so as to afford a ready exit for extraneous bodies, or to enable us to discover them more readily where they exist.

But the cases which I have described are particular, and may in some measure be regarded as exceptions to the general rules to be observed in the treatment of abscesses. Most frequently the parts which are to be divided in opening abscesses are either incapable of adhering together, or in no danger of contracting round the orifice of the abscess. The skin is usually destroyed by a previous absorption, or rendered so thin as to be incapable of granulating, and the abscess is opened by an incision nearly equal in length to one-half or two-thirds of the diameter. It is in cases similar to this, that we are to consider what the best means are of healing up the abscess, after it has been converted into an open sore.

One of the best means to be employed after an abscess has been opened, is a moderate degree of pressure. This assists the natural tendency which the cavity of a healthy abscess has to contract, and, by keeping the sides of the abscess together, tends in some degree to prevent an excessive secretion of pus. This pressure is best employed by means of the spiral roller and by compresses of soft linen. The pressure which the bandage makes must be very gentle, otherwise it is liable to occasion pain and inflammation in the abscess, or a swelling of the contiguous parts, from the stop which it puts to the circulation.

Care must be taken also, to preserve a due degree of

temperature in the suppurating part. This is generally done by continuing, for some days after the opening of the abscess, the application of the warm emollient poultice, that had been used to promote suppuration in the part. There are many abscesses which heal up readily by this mode of treatment alone; and indeed it may be doubted, whether there be any other application so generally useful, when applied to surfaces in a state of suppuration. When, however, the poultice is disagreeable to the patient, as it often is, from its weight or moisture, or even smell, it may be laid aside, and dry dressings employed in its place. These generally consist of dry lint, or charpee, with a compress or roller.

In some instances, the charpee is introduced into the cavity of the abscess, in others, it is merely laid over its surface. It is usual to cover that side of the charpee which comes into contact with the abscess with some mild ointment, for the dry charpee is found to irritate the surfaces of some abscesses too much ; and, besides, it forms a hard cake with the matter which exudes from the abscess, that adheres firmly to the subjacent parts, and often occasions a great deal of pain in the removal. It is to prevent these evils, and not from any healing qualities which they possess, that the mild ointments are used. These may consist of oil, butter, or hogs-lard, either alone, or mixed with a greater or less quantity of bees-wax. This substance gives to the oils a firmer degree of consistence than they naturally possess, and this, I believe, is the principal reason, why it is so much used in the composition of unguents. The number and thickness of the compresses must always be varied according to the nature of the case. They may be formed of lint pressed together, of pieces of charpee or folds of cloth. In abscesses secreting much pus, the lint is useful by absorbing it.

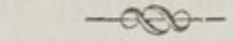
The bandage, which may be either of linen, cotton, or woollen cloth, should be applied so as not only to admit of, but to facilitate the discharge of the pus, It is scarcely necessary for me to remark, that, for reasons which must be obvious, the surface of the sore should in dressing be exposed for as short a time as possible to the action of the air. The dressings may be repeated one, two, three, or even four times in the course of twenty-four hours, according to the quantity and quality of the discharge, the situation of the abscess, and warmth of the weather, &c.

When the pus is either in great quantity, or has acquired

any acrid tendency, cutaneous inflammation is often excited, and much mischief occasioned, by allowing the discharge to remain too long in contact with the sore. This is a state of parts, which is much benefitted by the use of lime water, and solutions of sugar of lead.

The general treatment during the healing of abscesses will, like the local, be adapted, by a judicious surgeon, to the particular circumstances of the case. A more nourishing diet may, in general, be allowed than during the first suppurating stage. When the abscess is large, or the discharge copious, the strength of the patient requires to be supported with easily digested and nourishing food, and a proper allowance of wine. Bark, with or without the diluted sulphuric acid, is often prescribed as a remedy. By the adoption of this, or of similar modes of treatment, nature, in most instances, effectuates a cure; but it also often happens from disease in the constitution, or from error in the treatment of an abscess, that, instead of healing, it degenerates into a long-continued, sloughy, ill-conditioned sore or ulcer, and in this state may remain for months or for years.

ULCERATION.



The vessels composing the absorbent system appear to arise from every point of the internal surfaces of the different cavities of the body, and from every point also in the substance of its different organs and textures. It remains still to be determined whether the absorbents on the external surface of the body are, like the exhalent vessels, continued by pores through the cuticle; or whether, as seems most probable, they terminate immediately under that membrane. The manner in which these vessels take up the fluid substances which they contain is not at all known, but their absorbing and propelling powers have been satisfactorily enough established by experiment and by the effects of the functions which they perform.

These vessels may be employed, first, in taking up and conveying into the general circulation various extraneous substances, some of which are useful, others injurious to the system; and, secondly, in taking up and removing parts of the body itself, which have become either useless or diseased.

I. The variety of extraneous matters, capable of being taken up by the absorbents, is almost infinite. Indeed it seems doubtful, whether there be any substances which these vessels do not in some circumstances or other absorb. The most striking and most important example of the action of the absorbents, in taking up extraneous matter, is afforded in the absorption of the chyle by the lacteal absorbents. This constitutes what has been termed nutritive absorption, and is in all its relations an object of physiological rather than of pathological inquiry. We have also daily proofs of extraneous matters being taken up in the absorption of serous fluid, fat, blood, pus, bile, milk, contagious matters, medicinal substances, and in the absorption of various mat-

ters introduced into the body, either accidentally or for the sake of experiment.

If the serous fluid, which is constantly poured out by the exhalent vessels into the cavities lined with serous membranes, and into the interstices of the cellular texture, be not taken up by the absorbents in proportion as it is secreted, a morbid accumulation must occur, producing more or less of the state to which we give the name of dropsy. This is an affection which sometimes spontaneously disappears; more frequently, however, it requires the use of the remedies termed diuretics. In curing dropsy, these remedies seem to produce two effects: The first consists in disposing the mouths of the absorbent vessels to take up, in a manner quite unknown to us, the serous fluid, and to convey it into the general circulation. The second, in increasing the secreting action of the arteries by which the urine is formed. If water or atmospherical air be injected into the usual seats of dropsy, they disappear, after a short time having been taken up into the circulating system, by the vessels which naturally absorb the serous fluid.

I am not acquainted with any observations, in which fat has actually been found in the lymphatic absorbent vessels; but that it is taken up by these vessels, in the states both of health and disease, we have every reason to conclude, from the varieties in the degrees of obesity which we perceive at different times in the same individual, and from our often finding, upon dissection, an unusual deficiency of this fluid, or its place supplied by a substance which resembles serum.

The absorption of fat is always very rapid in febrile diseases, and the consumption of its carbonaceous matter in the lungs, is probably the cause of that increase of temperature, which, in these diseases, is kept up for a period of days or weeks, in individuals who have tasted nothing but water.

It does not appear, that in the healthy state of the circulating organs, the absorbents take up red blood from the vessels in which it is contained; but various facts, now well ascertained, clearly show that blood may be absorbed from these vessels in the state of disease, and, in many instances, also from the natural and preternatural cavities of the body in which it is accidentally extravasated. "In animals strangled," says Mr. Cruikshank, "or dying of some violent death, the lymphatics about the spleen, and in the cavity of the abdomen, in general, are almost always found

turgid with blood, though I have never seen, on these occasions, any marks of extravasation of that fluid into the cellular membrane. In peritoneal inflammation, I have demonstrated the lacteals full of blood, though, in this inflammation, there is little or no swelling, of course no extravasation of blood into the cellular membrane. I have seen the absorbents of the lungs also loaded with blood in the peripneumony, or inflammation of their substance, and, on all these occasions, have been induced to believe that the lymphatics arose from the internal surface of arteries and veins."*

Blood coagulating in an obstructed artery or vein, is slowly and gradually absorbed, the capacity of the vessel disappears, and it is at last converted into an impervious cord-like substance. This absorption takes place in cases where the circulation in arteries or veins has been stopt by the application of a ligature, by the pressure of a tumour, or by the spontaneous coagulation of blood in the vessels of limbs affected with mortification. We have a still more remarkable example of the absorption of blood, and of coagulable lymph, in the gradual disappearance of the contents of an aneurismal sac, after the circulation through it has been stopt by a ligature, as in Mr. Hunter's operation for popliteal aneurism.

Part of the blood which is extravasated in spontaneous hemorrhages, in wounds, and in contusions, has often been observed to be absorbed. Mr. Cruikshank remarks, "that he had repeatedly seen, in animals dying of hæmoptoe, and in the human subject itself, the lymphatics of the lungs, which at other times contain a transparent fluid, turgid with blood, which they had absorbed from the air cells."† And Sommering mentions his having several times observed blood in the absorbent vessels of the lungs, diaphragm, and pleura, in cases in which that fluid had been previously extravasated into the cavity of the thorax. Similar appearances have been observed, both by Sommering and Mascagni, in cases in which blood had been extravasated into the cavity of the abdomen. Ludwig mentions, in the notes which he has added to the German translation of Mascag-

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* See Cruikshank, p. 50.
† See Cruikshank, p. 42.

ni's work on the Absorbent System, a case of injury of the head, attended with a considerable hemorrhage from the left ear, in which he had an opportunity, in the presence of several of his friends, of seeing distinctly the absorbents on both sides of the brain filled with a coloured lymph. Extravasations of blood are very common consequences of contusions; and, in these cases, the blood is effused either into the interstices of the cellular membrane, producing the appearance termed ecchymosis, or it is poured into a distinct cavity formed in the cellular membrane, to which we give the name of thrombus. Superficial ecchymosis is attended with a dark-red colour of the skin, deeper seated ecchymosis and thrombus, with a blue, livid, or leaden colour.

Blood effused into the interstices of cellular membrane which has not been deprived of its vitality, is in general taken up by the absorbent vessels, and conveyed by them into the circulating mass of fluids. This gradual absorption of the effused blood may be inferred to be taking place, from that series of changes which we see going on in the colour of the contused part during the recovery, from red to blue, from blue to green and yellow, and from yellow to the natural hue.

When the blood is effused into a common cavity, the events which take place vary, according to the size and kind of the vessels from which it is poured out, and according to the state of the soft parts which cover and enclose it. But when, either from the quantity of the blood effused, or from the inactive state of the absorbents in the parts surrounding the effusion, absorption does not take place, the blood must be removed by an operation, or be left to be brought to the surface, and discharged by means of the spontaneous disappearance of the parts which cover it. In this process, a portion of the solid matter of the machine itself, as I shall afterwards have occasion more fully to state, must necessarily be removed by absorption.

We have frequent examples of the absorption of blood in the spontaneous disappearance of the red spots, blotches, and discolourations, which occur from its extravasation in land and in sea scurvy.

Pus and puriform fluids are often absorbed; pus has been observed in the lymphatic absorbents of the lungs, in those who have died of consumption; and Sommering mentions,

that he had repeatedly seen this fluid in the lacteal absorbents, in the dissection of those who had died of dysentery. We have proofs of this absorption of pus, in the pain and swelling which so often occur in the lymphatic absorbent glands, through which absorbent vessels pass from suppurating surfaces, and in the not unfrequent disappearance of abscesses and buboes, after it has become evident, from the fluctuation which takes place, that matter is formed in them. It is not improbable, that the thinner parts of abscesses, if not even the thicker, are absorbed during their formation and progress. But for the removal of their contents by absorption, and fresh depositions by secretion, it seems difficult to account for the matters which they contain remaining for weeks or months, without manifesting any disposition to enter into the state of putrefactive decomposition.

Bile may be taken up by the lymphatic absorbents of the liver in obstructions of the hepatic duct, by those of the gall bladder in obstructions of the cystic duct or ductus communis choledochus, and by the lacteal absorbents in cases where the bile is secreted in unusually large quantities into the cavity of the intestines. In all these instances, a tinge of yellow, greater or less, according to the quantity of bile absorbed, is communicated to the skin, and to the white and colourless parts of the body.

Milk is absorbed from the lactiferous ducts in every instance in which, after its secretion, it is not drawn off by natural or artificial means.

The semen is probably absorbed in chaste people from the semeniferous tubes; but of this we have not the same direct evidence as of the absorption of milk.

The absorption of urine from the cavity of the bladder has been supposed to be by no means an uncommon occurrence. In proof of this absorption, we are told, that the inclination to void urine often goes off during a copious flow of perspiration, and that in long-continued retentions of urine, the peculiar smell of this fluid, may, in general, be perceived in the matter which is perspired. In retention of urine, a fever is produced, which has been termed urinous; but, if this fever in retention is to be ascribed to the absorption of that fluid from the bladder, why does it not arise from the former as well as from the latter instance of absorption? The urinous smell of the perspiration is no

certain proof that urine has been absorbed; for the urine and sweat are in some cases vicarious secretions.

That several contagious matters produce their specific effects, by entering into the body through the medium of the absorbent system, seems to be satisfactorily enough established by the changes which these matters occasion in the parts through which they pass. A morbid poison is usually produced by secretion in the place at which the contagious matter had entered, possessing qualities the same with those of the matter which had been introduced. Previously, in some instances, and posterior in others, to the production of this poison, red lines are observed in the course of the lymphatic absorbents, indicating, in an unequivocal manner, the existence of inflammation, and painful swellings occur in the glands, into which these vessels enter, which not unfrequently terminate in suppuration.

Through what medium, the morbid poisons which exist in the state of effluvia, or miasmata, act, is far from being well known. From analogy, we suppose it to be by absorption, but the analogy fails in the want of all appearance of local irritation. If by absorption, this must take place either from the surface of the body, or from the surface of the lungs. The effect of the cuticle in preventing absorption from the surface of the body, has already been remarked, and is perhaps more powerful than has usually been conceived. A very slight degree of pressure, it is true, is sufficient to overcome the resistance which the cuticle opposes to the entrance of foreign bodies by the skin. But without this pressure, it seems doubtful whether any of these bodies would be absorbed. The absorption of bodies in the state of effluvia by the lungs, is supposed to be demonstrated by the effects which succeed to their inhalation. Thus the smell of turpentine is said to be readily communicated to the urine of those who breathe the vapours of that substance. Salivation is readily induced by mercurial fumigations; and persons, it has been said, have not only felt the taste of mercury in their mouths, but have been affected with severe salivations, merely by breathing the same air with those who were using that remedy. Are the contagious effluvia inhaled into the lungs deposited in the aqueous vapour which is secreted in these organs, and afterwards taken up with it into the circulating mass; or do

they produce their effects more immediately, by acting upon the nerves distributed on the inner surface of the lungs? These are questions to which, in the present state of our knowledge, it does not seem possible to give very precise or satisfactory answers.

The cutaneous and pulmonary absorption of water has been supposed to be proved by a great number of experiments and observations. Thus, putting the feet in warm water has been said to be followed, for a succession of times, by a discharge of urine in persons who had not swallowed any fluids for weeks; and the exposure of the body for a few hours to a moist atmosphere, is said to have been often productive of a considerable increase of weight. Diabetic patients also have been said to void, for weeks, a quantity of urine considerably superior in weight to that of all the solid and fluid nourishment which they had taken during that period. These, however, we now know, from accurate experiments, are by no means constant phenomena; and, if they ever do take place, it must be owing to some irregular action of the absorbent vessels, by which they are sometimes disposed, at others not disposed, to absorb the fluids with which they come into contact. We see something like this occurring in dropsy, where the lymphatic vessels remain in contact with the extravasated serous fluid for weeks or months, without taking it up, till their absorbing activity is, somehow or other, exerted or increased by the use of diuretic remedies.

The absorption of medicinal substances may take place from the surface of the intestines, from the surface of the body, and perhaps also from the surface of the lungs. Whether there be any substances which, in certain circumstances, the lacteal absorbents refuse to take up, is a point which cannot be said to be fully ascertained, though the presumption seems to be, that no such substances exist. The absorption of acids, alkalies, and neutral salts, is rendered evident by the presence of these substances in the urine of those who swallow them. Sufficient pains have not yet been taken to detect metallic oxydes, and metallic salts, in that fluid, though there are strong grounds to believe that it is chiefly by this excretion they are conveyed out, after having been received into the body. The presence of mercury in the matter of perspiration, is proved by the tarnishing effects which it produces upon silver and gold.

The absorption of vegetable matters from the intestinal canal, is manifested by the peculiar smell which asparagus and turpentine communicate to urine, and by the various colours which this fluid receives from the use of the beet-root, burdock, rhubarb, &c. The effects which are produced in the kidneys and bladder by the tincture of cantharides, afford indisputable proofs of the absorption of an animal substance in its undecomposed state.

That medicinal substances may be taken in from the surface of the body, seems to have been long known; but the most common and best example which we have of this, is in the effects resulting from the inunction of the skin with ointments containing mercury. A certain degree of mechanical pressure seems necessary, in most instances, to force the mercury, and other external bodies, through the cuticle, in order that they may come into contact with the orifices of the absorbent vessels; but this pressure is, in many instances, so slight, as to leave it doubtful how far it contributed to the absorption. Whether there be certain states of the cuticle in which external bodies may enter from the surface without pressure, is still far from being accurately determined. This membrane prevents the transudation of water or serum, but it admits readily both of sensible and insensible perspiration.

That narcotics, emetics, purgatives, and diuretics, may be introduced into the body, and made to produce their specific effects through the medium of the skin, has been long known. We are not, however, perhaps yet fully acquainted with the circumstances which may, in particular diseases, and in particular constitutions, render this mode of introduction preferable to that of the stomach and intestinal canal.

The instantaneously invigorating and depressing effects of certain odours, the intoxicating quality of an atmosphere loaded with the fumes of alcohol, and the singular sensations, emotions, and ideas which are excited by breathing nitrous oxyde, are all so many proofs that medicines may be made to operate in the animal frame through the organs of respiration. It seems doubtful, however, whether, in any of the instances I have mentioned, there be any portion of the extraneous matters absorbed, and, even if absorbed, whether their primary and principal effects are not produced immediately on the extremities of the nerves with

which they come into contact. Breathing the vapours of turpentine, as I have already remarked, has been said to communicate the smell of that substance to the urine, and salivation is produced by fumigation with mercury, or may, it has been said, be excited by living in the same room with those who are taking mercury. In these instances, there can be no doubt, that the turpentine and mercury must be taken up by the absorbents on the inner surface of the lungs; but they are at present the only instances, in which pulmonary absorption is known to take place.

The very flattering expectations which were for some years entertained of curing phthisis, asthma, and other pulmonary affections, by the inhalation of the different sorts of airs or gases, have now passed away; and the histories of the cases of cures supposed to be effected by their means, remain striking, but melancholy examples of the ease with which the credulity of the public may be abused. The most recent and accurate experiments on the subject of respiration, leave us little room to suppose, that any species of air is absorbed in the lungs.

Various other examples of the absorption of extraneous substances are afforded, in the disappearance of matters intentionally or accidentally introduced into the cavities of the body, or into the cellular texture, in many instances of which the substance absorbed may be detected in the absorbent vessels proceeding from the part, while, in other instances, the body gradually disappears, without our being able to perceive any part of it in the absorbents.

Besides the various proofs which I have already enumerated of the absorption of extraneous substances, perhaps I ought, before concluding this part of the subject, to mention those which occasionally occur, and may, at all times, be so readily observed in the aqueous chambers of the eye. If blood be extravasated, or pus formed in these chambers, the blood and pus gradually disappear. Whether these substances be dissolved previously to absorption, is a point which has not yet been ascertained. It has been long known, that if the crystalline lens be depressed into the vitreous humour, it becomes gradually smaller and smaller, till it at last disappears altogether. Many recent observations show that the same disappearance of the lens takes place, if it be denuded of its capsule, and pushed forwards from its natural situation into the aqueous chambers. The capsule,

when broken into parts, is absorbed, as well as the lens, in the aqueous chambers of the eye; but it has been said, that the lens is not absorbed from the vitreous humour, so long as it remains shut up in its capsule. I am unable to say how far this observation is well founded.

II. It has of late years been usually supposed by medical men, that in the developement, growth, support, and decay of animal bodies, the elementary particles of which they are composed, are in a state of perpetual circulation or change; that the absorbent vessels are in every part of living systems unceasingly employed in removing the old, while the arteries are as unremittingly preparing and depositing new materials; and that it is by the reciprocal action of these two orders of vessels, that the form, organization, and identity of the different animal textures and organs are maintained.* These suppositions are rendered extremely probable not only by the apparent necessity of repair in organs, which are kept in a state of unceasing motion, and by the constant supply of nourishment which is required for the support of animal bodies, even after they have arrived at maturity, but also by a variety of observations and experimental researches, which have at different times been made on the growth of bones in particular, and on the changes which these parts undergo in the different states of health and disease. Among the various experiments which have been made upon this subject, I do not know of any which are so happily imagined, or which lead to conclusions so direct and precise, as those made by Mr. Hunter. We are indebted for the account of these experiments to his brother-in-law, Sir Everard Home, who, in becoming the residuary legatee of his opinions and reputation, has, with a solicitude

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* "Dans les corps vivans, chaque partie a sa composition propre et distincte; aucune de leurs molécules ne reste en place; toutes entrent et sortent successivement: la vie est un tourbillon continuel, dont la direction, toute compliquée qu'elle est, demeure constante, ainsi que l'espèce des molécules qui y sont entraînées, mais non les molécules individuelles elles-mêmes; au contraire, la matière actuelle du corps vivant n'y sera bientôt plus, et cependant elle est dépositaire de la force qui contraindra la matière future à marcher dans le même sens qu'elle. Ainsi la forme de ces corps leur est plus essentielle que leur matière, puisque celle-ci change sans cesse, tandis que l'autre se conserve, et que d'ailleurs ce sont les formes qui constituent les différences des espèces, et non les combinaisons des matières, qui sont presque les mêmes dans toutes."—*Cuvier, Rapport Historique sur les Progres des Sciences Naturelles. Paris,* 1810.

worthy of the trust, endeavoured to secure for his friend the honour of the improvements and discoveries of which he was the author.

"Mr. Hunter began his experiments by feeding animals with madder, which has a property of tinging with a red colour that part only of the bone which is added while the animal is confined to this particular food.

"He fed two pigs with madder for a fortnight, and at the end of that period one of them was killed; the bones upon examination externally had a red appearance; when sections were made of them the exterior part was found to be principally coloured, and the interior was much less tinged.

"The other pig was allowed to live a fortnight longer, but had now no madder in its food; it was then killed, and the exterior part of the bones was found of the natural colour, but the interior was red.

"He made many other experiments of the same kind, upon the increase of the thickness of the neck and head of the thigh-bone. From these it appeared that the addition of new matter was made to the upper surface, and a proportional quantity of the old removed from the lower, so as to keep the neck of the same form, and relatively in its place.

"To ascertain that the cylindrical bones are not elongated by new matter being interposed in the interstices of the old, he made the following experiment: he bored two holes in the tibia of a pig, one near the upper end and the other near the lower; the space between the holes was exactly two inches; a small leaden shot was inserted into each hole; when the bone had been increased in its length by the growth of the animal, the pig was killed, and the space between the two shot was also exactly two inches.

"This experiment was repeated several times on different pigs, but the space between the two shot was never increased during the growth of the bone.

"From these experiments he ascertained the changes which take place in bones during their growth, and the readiness with which the materials of bones are absorbed; and from these facts laid it down as an established principle, that the absorbents are the agents, by means of which the bones, during their growth, are modelled, as it were, and kept in the same shape.

"Bones, according to Mr. Hunter's doctrine, grow by two processes going on at the same time and assisting each

other; the arteries bring the supplies to the bone for its increase; the absorbents at the same time are employed in removing portions of the old bone, so as to give to the new the proper form. By these means the bone becomes larger, without having any material change produced in its external shape."*

Perhaps one of the finest illustrations that is any where to be met with of the truth of Mr. Hunter's doctrine, is an experiment, which was meant to support a very different hypothesis, by Du Hamel. That ingenious physiologist enclosed one of the bones of the leg of a young pigeon in a piece of silver wire, taking care, in the application of the wire to exclude all the soft parts except the periosteum. On killing the animal some time after, Du Hamel found, that the ring of wire had passed from the out to the inside of the bone. The cylinder of bone which the ring at first enclosed had disappeared, and in its place a medullary canal was found equal in diameter to that of the ring. It appears to me to be impossible to explain the phenomena of this experiment, unless on the principle of an internal absorption and external deposition of bone, a principle which is applicable, I conceive, not only to the growth of bones, but to that of all the hollow organs, and perhaps also to that of all the solid parts of animals. But these are points which have not yet been investigated.

When the quantity of matter which is deposited, in any given time, is equal to the quantity which in the same time is removed by absorption, the weight and volume of the body during that period must continue stationary. The balance between the action of the absorbing and circulating system, undergoes indeed slight variations, in the different periods of growth and decay. In infancy and youth, the deposition is greater than the absorption, while in the latter periods of life, the absorption usually exceeds the powers of repair. In this natural and healthy absorption, the absorbent vessels, as Mr. Hunter justly remarks, "are to be considered as the modellers of the original construction of the body; and if we were to consider them fully in this view, we should find that no alteration can take place in the original formation of many of the parts, either in the natural growth,

* Transactions of a Society for the Improvement of Medical and Chirurgical Knowledge, vol. II. p. 278.

or that formation arising from disease, in which the absorbents are not in action, and take not a considerable part. This absorption," he adds, "I shall call modelling absorption."

The more obvious and remarkable changes induced in the solids by the absorbent vessels, are those which take place in particular states of the body, and in certain forms of disease. Morbid absorption of the solid parts, or that which takes place without being accompanied by a corresponding deposition and repair, may extend to the whole machine, every part of which shall become smaller and lighter, or it may be limited in its operation to some particular part, organ, or region. We have examples of general morbid absorption, in the wasting of the body in febrile diseases, and of absorption in particular parts, in the complete disappearance of the thymus gland and membrana pupillaris, in the wasting of muscles from paralysis, or from some injury done to their nerves, and of the testicle, from causes with the operation of which we are at present unacquainted. The volume of the part in which the process of absorption is going on, is in all these cases gradually and imperceptibly diminished, and this is a change effected by the absorption of matter from every point of its substance. This mode of morbid absorption, Mr. Hunter denominates *interstitial* absorption, because it consists "in removing parts of the body out of the interstices of that part which remains, leaving the part still as a perfect whole." In interstitial absorption, there is no change in the form of the part in which it occurs, no abrasion of its surface, no solution of continuity, in a word, nothing like sore, abscess, or ulcer is produced. It is not attended with, neither does it produce adhesion nor suppuration. In some instances, interstitial absorption would seem to arise simply from pressure or distention. I remember to have seen, many years ago, in company with my much esteemed friend and first instructer in medicine, Dr. John White of Paisley, a case of ascites abdominalis, in which the integuments had become so thin, that after the water was drawn off by a trocar, the peristaltic motion of the intestines could be distinctly seen through them. In this case the cellular membrane, fat, and abdominal muscles, appeared to have been removed by the process of interstitial absorption, and the intestines left covered on the fore part of the belly, by only a very thin layer of cutis. I have seen

similar absorptions of the cellular substance in cases of femoral, scrotal, and umbilical herniæ, where the parts covering the herniæ were so thin, as to allow the motions of the intestines included in the sac to be distinctly perceived. Dr. Monro mentions a very remarkable example of the absorption of a portion of the abdominal muscles, in a person who, for upwards of a year before his death, had been distressed with pains in the intestines. "On opening his body," he observes, "we found, to our surprise, that the distended sigmoid flexure of the colon was firmly united with the skin, and that the abdominal muscles were entirely removed from a space larger than the whole hand could cover."*

But the more common, and not less remarkable examples of the local absorption of living parts, to which I wish at present to direct your attention, are those which we see every day taking place: 1st. In the formation of ulcers by loss of substance, occasioning a solution of continuity. This mode of absorption Mr. Hunter terms *ulcerative*. 2d. In the gradual disappearance of the solid parts covering abscesses, aneurisms, and deep-seated tumours of all sorts, in their progress to the skin. This Mr. Hunter denominates *progressive* absorption; and, 3dly. In the separation of dead or mortified parts from those which retain their vitality. If it were necessary to distinguish this from the other modes of morbid absorption, it might be termed the *disjunctive*.

Mr. Hunter remarks, p. 442, that "This process of the removal of a whole solid part of the body, or that power which the animal œconomy has of taking part of itself into the circulation, by means of the absorbing vessels, whenever it is necessary, is a fact which has not in the least been attended to, nor was it even supposed; and having now been noticed, I mean to give a general idea of it. I may just be allowed, once more, to observe, that the oil or fat of animals, and the earth of bones, have always been considered as subject to absorption, and some other parts of the body being liable to wasting, have been supposed to suffer this by absorption, but that any solid part should totally be absorbed, is a new doctrine."

"This use of the absorbents I have long been able to demonstrate, and the first hints I received of it were in the

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* See three Treatises on the Brain, the Eye, and the Ear, p. 49.

waste of the sockets of the teeth, as also in the fangs of the shedding teeth."

"It may be difficult at first to conceive how a part of the body can be removed by itself, but it is just as difficult to conceive how a body can form itself, which we see daily taking place: they are both equally facts, and the knowledge of their mode of action would answer, perhaps, very little purpose; but this I may assert, that, whenever any solid part of our bodies undergoes a diminution, or is broken in upon in consequence of any disease, it is the absorbing system which does it."

"When it becomes necessary that some whole living part should be removed, it is evident that nature, in order to effect this, must not only confer a new activity on the absorbents, but must throw the part to be absorbed into such a state as to yield to this operation."

"This is the only animal power capable of producing such effects; and, like all other operations of the machine, arises from a stimulus, or an irritation, all other methods of destruction being either mechanical or chemical. The first by knives, saws, &c.; the second by caustics, metallic salts," &c.

"The process of ulceration is of the same general nature in all cases; but some of the causes and effects are very different from one another."

"The knowledge of the use of this system is but of late date, and the knowledge of its different modes of action is still later. Physiologists have laboured to account for its modes of action; and the principle of capillary tubes was at first the most general idea, because it was a familiar one. But this is too confined a principle of an animal machine, nor will it account for every kind of absorption. Capillary tubes can only attract fluids; but as these inquirers found that solids were often absorped, such as scirrhous tumours, coagulated blood, the earth of bones, &c., they were driven to the necessity of supposing a solvent; this may or may not be true; it is one of those hypotheses that can never be proved or disproved, and may for ever rest upon opinion. But my conception of this matter is, that nature leaves as little as possible to chance, and that the whole operation of absorption is performed by an action in the mouths of absorbents. But even under the idea of capillary tubes, physiologists were still obliged to have recourse to the action of

those vessels, to carry it along after it was absorbed, and might, therefore, as well have carried this action to the mouths of these vessels."

"As we know nothing of the mode of action of the mouths of these vessels, it is impossible we can form any opinion that can be relied upon; but, as they are capable of absorbing substances in two different states, that of solidity and fluidity, it is reasonable to suppose that they have different modes of action; for, although any construction of parts that is capable of absorbing a solid, may also be such as is capable of absorbing a fluid, yet I can suppose a construction only capable of absorbing a fluid, and not at all fitted for absorbing a solid, though this is not likely; and, to see the propriety of this remark more forcibly, let us only conceive the mouths of different animals, and I will venture to say, that the mouths of all the different animals have not a greater variety of substances to work upon, than the absorbents have; and we may observe, that, with all the variety of mouths in different animals, this variety is only for the purpose of adapting them to absorb solids which admit of great variety in form, texture, &c., every one being capable of absorbing fluid matter which admits of no variety."

"This process of the removal of parts of the body, either by interstitial or progressive absorption, answers very material purposes in the machine, without which, many local diseases could not be removed, and which, if allowed to remain, would destroy the person. It may be called, in such cases, the natural surgeon."

"It is by the progressive absorption, that matter or pus, and extraneous bodies of all kinds, whether in consequence of, or producing inflammation and suppuration, are brought to the external surface; it is by means of this, that bones exfoliate; it is this operation which separates sloughs; it is the absorbents which are removing whole bones, while the arteries are supplying new ones; and although, in the last cases of bones, it arises from disease, yet it is somewhat similar to the modelling process of this system in the natural formation of bone; it is this operation that removes useless parts, as the alveolar process when the teeth drop out, or when they are removed by art, as also the fangs of the shedding teeth which allows them to drop off; and it is by these means ulcers are formed."

"It becomes a substitute, in many cases, for mortification,

which is another mode of the loss of substance ; and, in such cases, it seems to owe its taking place of mortification, to a degree of strength or vigour superior to that where mortification takes place ; for, although it arises often from weakness, yet it is an action, while mortification is the loss of all action. In many cases it finishes what mortification had begun, by separating the mortified part."

1st. Ulcerative absorption is a morbid process, which must have presented itself in every age, and with the appearances of which, medical men must have been at all times very familiarly acquainted. The phenomena which it exhibits were denominated erosion by Galen. Since his time, it has usually been supposed that the solution of continuity which occurs in erosion, is produced by the corrosive or solvent power of the fluids which are generated in that process.

Mr. Hunter was the first who ventured to call this opinion of Galen's in question, and who pointed out to future observers the share which the absorbent vessels have in this process. The part of his treatise which relates to this subject, is particularly deserving of your study. It contains a great number of well-chosen and apposite illustrations of the phenomena and effects of ulceration, and is perhaps the most successful effort that has hitherto been made by any pathologist, to apply the knowledge of a living function to the explanation of morbid appearances.

In most instances of inflammation, in which the process of ulcerative absorption occurs, it usually begins in a single point, forming a small sore or ulcer, in others in several points, either at the same time, or in succession. In many instances, its operation appears to be diffused over a considerable extent of surface, and in others again, it is limited to a very narrow line, producing a chink or fissure, an appearance similar to that which occurs in the separation of mortified parts. The progress of ulcerative absorption is very various in different textures, and in the same texture in different individuals, according to the nature of the inflammation, the degree in which it exists, and perhaps also, according to the particular constitution of the person in whom it occurs. In some instances, the process of ulcerative absorption is exceedingly slow or chronic in its progress, the sores which it forms remaining long open, without manifesting any disposition to extend themselves into the parts

more immediately surrounding them. In other instances again, it acts with great rapidity, removing and destroying considerable portions of textures or organs in the course of a few hours.

Pain, of a pricking or lancinating nature, is an almost constant attendant upon attacks of ulcerative absorption; but this varies exceedingly in different textures, in different kinds of inflammation, and according as the absorption is more rapid or slow.

Every organized part of the body seems liable to ulcerative absorption, but we see it occur more frequently in cutaneous texture, and in mucous membrane, than in any of the other textures of the body. In all the parts in which it occurs, it is preceded by a certain degree of inflammation, and this inflammation is usually the adhesive; but ulcerative absorption may supervene in parts affected with suppurative, or gangrenous inflammation. The inflammation which precedes and accompanies ulcerative absorption, may be either of a simple or of a specific nature, and great differences will be produced by this circumstance in the appearances and effects of the sores or ulcers which are formed.

Ulcerative absorption in simple inflammation may arise from a great number of causes, as from pressure upon parts in a state of inflammation. We see this effect daily produced in cases of simple and compound fractures, where the limbs are often, of necessity, left long in one posture. It may be produced by the application of irritating substances to inflamed surfaces, or by the too long retention of excreted fluids upon surfaces in a state of suppuration.

Many specific inflammations seem to give a disposition to ulcerative absorption, and the sores or ulcers which are formed, are most of them very difficult to heal, if they are not, in their nature, absolutely incurable. This difficulty is often very remarkable in scrofulous, syphilitic, cancerous, and lupous ulcerations. The ulcerative absorption which occurs first in cutaneous texture, may, in its progress, be confined to that texture, removing a considerable portion of skin, and exposing the parts which lie under it; or, without extending far along the surface, it may penetrate into the interior parts of the body. In doing this, it often successively attacks and removes skin, cellular membrane, fasciæ, muscle, blood-vessel, absorbent, nerve, and bone. We have examples of this in the progress of cancerous and lupous

ulceration. The constant precedence of the state of inflammation, to that of ulcerative absorption, is not only manifested by the occurrence of redness, pain, heat, and swelling in the parts which are contiguous to those in which the ulceration appears, but also in that closure which is effected by adhesion, of the canals of the blood-vessels and absorbents divided in ulcerative absorption, and without which, a certain degree of hemorrhage would be the never failing and constant attendant upon the state of ulceration.

When, in the healing of sores, the skin which immediately surrounds them becomes red, hot, swollen, and painful, we have reason to dread an extension of the sore, by the progress of ulcerative absorption. In some instances, this process occurs in the whole circumference, producing an extremely irritable and painful ulcer; in others, the ulcerative absorption is confined in its operation to a particular spot, which is always more inflamed and painful than the other parts of the sore. Certain states and degrees of gangrenous inflammation have a tendency to terminate in ulcerative absorption; and, when the ulcerating and sphacelating processes occur together in the same diseased surface, dreadful is the havock and destruction of parts which they occasion.

Mucous membrane, next to cutaneous texture, seems to be most liable to attacks of ulcerative absorption. In mucous membranes, the ulcerating process often appears in the form of small round sores, which are termed aphthæ when they appear in the mouth or fauces, and chancres when on the parts of generation. These, like the ulcerations in cutaneous texture, may be either of a simple or specific nature, and it is often extremely difficult, from the appearances which they exhibit, to determine to which division we ought to refer them.

Bone is another texture which seems to be very liable to ulceration. In this texture this process may begin in a single point, or in several points at the same time. When it occurs in bone, it is almost always the consequence of specific inflammation. Beginning in one point in bone, and proceeding from this point, it forms a single opening in that texture; but when it begins in a number of points, it produces an appearance nearly the same as if the bone had been eaten or perforated by worms, an appearance to which surgeons have long given the name of caries in bone.

Ulcerative absorption very seldom begins originally in muscle, tendon, fascia, blood-vessels, absorbents, or nerves, though, in the progress of disease, it may attack all these structures.

Synovial membranes are often the seat of ulceration, particularly in the progress of the chronic inflammations which attack the articulating surfaces of the joints. Here the ulcerative process begins most frequently in the synovial membrane, and from this extends to the articulating cartilage, and afterwards to the bone.

Of the internal viscera, there are none which seem so liable to ulcerative absorption as the stomach and intestinal canal. Death is almost always the constant and speedy effect of ulceration, when it eats through the coats of these viscera, by the escape which takes place of their contents into the cavity of the abdomen.

If ulcerative absorption be preceded by the adhesive inflammation, it is almost, in all instances, accompanied, or soon followed, by the suppurative inflammation, and by the formation of granulations. Healthy pus, and the appearance of granulations, are always agreeable occurrences in the progress of an ulcer, as they indicate that a stop has been put, for a time at least, to the process of ulcerative absorption.

New formed parts, as Mr. Hunter observes, are more liable than natural structure to ulcerative absorption. This is seen in the absorption of granulations, cicatrices, and callus. The healing of sores is often long retarded by the absorption of the granulations which are formed upon them, sometimes with, and at other times without an extension of the absorbing process to the skin surrounding the sores or ulcers.

2d, The series of local appearances which takes place in the progress of abscesses, aneurisms, and tumours, to the surface of the body, has hitherto been but little investigated, unless by Mr. Hunter. To distinguish this species or mode of absorption from every other, that great pathologist has denominated it progressive absorption, a term by which it is meant to express, that abscesses, aneurisms, and tumours arrive at the surface of the body, in consequence of the gradual and progressive disappearance or absorption of the parts which cover them.

When an abscess is seated immediately under the skin,

and exterior to the fasciæ covering the muscles, the swelling which it forms is usually round or oval, and elevated; the skin which covers it is tense and glistening, the lozenge-shaped spaces of this texture disappear, it becomes distended, but in general there is no time left for its elongation by growth, cutaneous inflammation occurs, the abscess bursts, and the swelling gradually disappears.

But the train of appearances which present themselves in the progress of deep-seated abscesses to the skin, are somewhat different. The abscesses must either pass directly, and by the shortest road, to the skin, or make their way to that texture by some easier, though more circuitous path. Nature employs both of these modes of bringing deep-seated and chronic abscess to the surface of the body, but the circuitous mode much more frequently, I believe, than the direct.

Some parts of the body appear to be more susceptible of the process of progressive absorption than others; skin, cellular substance, muscle, and even bone and cartilage, are very susceptible of this process; ligamentous, or fibrous fasciæ, and tendon, less so. When abscesses, therefore, form under ligamentous or fibrous fasciæ, we find that they are long in getting to the surface, and that they seldom arrive at this by the shortest and most direct road, but usually by passing through some texture or organ that is more susceptible of being absorbed; when, therefore, an abscess, formed under a thick tendinous or fibrous fascia, arrives speedily at the skin, there is, in general, reason to believe, that the abscess has made its way through some interstice, or natural division of the fascia, not by the absorption of its substance. Where some interstice of this kind does not exist, the matter formed under the fascia may remain for weeks or months in its original situation, or may cause the absorption of the other textures with which it comes into contact. Hence the necessity of a speedy opening to evacuate purulent matter, in almost all the cases in which we suspect it to exist under a tendinous fascia. When, from the opposition of tendinous fasciæ, or of other substances not very susceptible of being absorbed, abscesses do not find a ready way to the skin, they are sometimes discharged by nature into the internal cavities and canals of the body, and there produce injurious, and sometimes fatal effects; an additional

reason, I need scarcely remark, for the early opening of such abscesses.

The tendency which abscesses have to come to the surface of the body, has been long known. Indeed, it must have been in all ages a matter of daily observation, but the circumstances which determine them to take one road to this surface rather than another, and the fact that that portion of the body through which they pass is always removed by the process of absorption, do not appear to have engaged the attention of pathologists before the time of Mr. Hunter. We have an example of the manner in which a deep-seated abscess is brought to the surface of the body, in the progress of that which forms in the substance of the psoas muscle, and which is known by the name of psoas abscess. In this abscess, the matter, as I formerly remarked to you, is contained in a distinct cavity, but in a cavity formed by the absorption of a portion of the cellular membrane which connects the muscular fibres together, or by the absorption of a greater or less portion of the muscular fibres themselves. Often the whole, or at least the greater part of these muscular fibres disappear, and the matter is contained in the fibrous fascia which naturally covers the psoas muscle. This fascia is sometimes apparently much thickened in substance by the deposition of coagulable lymph upon its internal surface. In making its way to the surface of the body, the matter of the abscess passes down into the course of the muscle, more or less of which is removed by absorption, as the abscess proceeds downwards; at length, passing under Poupart's ligament, it arrives at the upper and forepart of the thigh, where it often remains for a long time, forming a soft elastic tumour of considerable size, and in many instances entirely free from pain. The integuments which cover the abscess undergo a considerable degree of extension, sometimes becoming thinner, at other times retaining their usual thickness. This extension of the skin is a natural process, which we see occurring in a number of cases, some of which only can be regarded as morbid. We see it occur in a sudden increase of fatness: hence the sleek and smooth skin of fat people. It occurs also in the parietes of the abdomen in pregnancy; but the extension in this case, particularly in a first pregnancy, is attended with such a degree of distention as to separate the parts of the cutis from each other, and to occasion the formation of those in-

terstital marks that are almost always to be observed in the abdominal integuments of women who have had children. Similar appearances may be occasioned by a collection of water, or by the growth of tumours, in the abdomen.

The extension or elongation of the skin and subjacent cellular membrane, becomes very apparent in the growth of many indolent tumours under it, some of which are of a fleshy or solid, and others of a more or less fluid consistence, as in the growth of large steatomatous tumours upon the trunk or extremities of the body. These tumours often increase to an enormous size, without any apparent diminution in the thickness of the integuments which cover them. In these morbid tumours, the skin which covers them has seldom any traces in it of the lozenge-shaped spaces observable in ordinary skin, so that it is smoother than ordinary skin, and remains so even when the distension is removed by its division. The same process of extension appears in the great enlargement of the scrotum in diseases of the testicle, in hydrocele, and in inguinal herniæ.

After a psoas abscess has existed for some time at the upper part of the thigh, the integuments covering it become gradually thinner and thinner, till at length it seems to be covered only by cutaneous texture. In some species of subcutaneous inflammation, as in phlegmon, the cutaneous texture is in general from the first attack in a state of inflammation, but in deep-seated abscesses, which have made their way to the surface the body, this thinning of the integuments goes on to a considerable extent, before any external mark of inflammation appears. It is only when the abscess or tumour approaches very near to the skin, that that texture begins to inflame. Previously to this period, the thinning of the integuments, though it has actually commenced, is gradual, slow, and insensible. During this process, they are not merely diminished in thickness, their form and substance remaining the same, but they are slowly and progressively absorbed, layer after layer, till at last, with the exception of the cuticle, they totally disappear. Perhaps I cannot illustrate Mr. Hunter's ideas, with regard to the progress of abscesses to the skin, better than by quoting a case which you will find at page 461, of his Treatise on Inflammation.

"A lad about thirteen years of age, was attacked with a violent inflammation in his belly, without any apparent cause. The usual means were used, but without effect. His belly

began to swell in a few days after the attack, and his skin became cold and clammy, especially his feet and hands. Once, when he made water, it was transparent like spring water, with a little cloud of mucus. In several places of the belly, there appeared a pointing, as if from matter; one of those, which was just below the sternum, became pretty large, and discoloured with a red tint. Although there was not any undulation or perfect fluctuation, (there not being fluid enough for such a feel,) yet it was plain there was a fluid, and most probably, from the pointings, it was matter in consequence of inflammation, and that it was producing ulceration on the inside of the abdomen for its exit; therefore it was thought advisable, as early as possible, to open the belly at one of these parts. I made a small opening into the pointing part, just below the sternum, hardly an inch long: when I was performing the operation, I saw plainly the head of the rectus muscle, which I cut through in the direction of its fibres. There was immediately discharged by this wound about two or three quarts of a thin bloody matter. The swelling of the abdomen subsided of course; his pulse began to rise and become more full and soft; and his extremities became warmer; he was ordered bark, etc. but he lived only about sixty hours after the operation.

"On opening his abdomen after death we found little or no matter lying loose; all had made its escape through the wound. The whole intestines, stomach, and liver, were united by a very thick covering of the coagulating lymph, which also passed into all the interstices between them, by which means they were all united into one mass: the liver also adhered to the diaphragm, but none of the viscera adhered to the inside of the belly on its fore part, for there the matter had given the stimulus for ulceration, which prevents all adhesions. The process of ulceration had gone on so far as to have destroyed the whole of the peritoneum on the fore part of the abdomen, and the transversales, and recti muscles, were cleanly dissected on their inside.

"The tendons of the lateral muscles that pass behind the heads of the recti, were in rags, partly gone, and partly in the form of a slough.

"From this view of the case, we must see how nature had guarded all the most essential parts. In the time of the adhesive stage, she had covered all the intestines with a coat of coagulating lymph, so as to guard them; and this, pro-

bably, upon two principles, one, from their being canals, and therefore loath to admit of penetration in that way; the other, from their being more internal than the parietes of the abdomen; one side is therefore thickened for their defence, while the other is thinned for the relief of the part.

"Here the cavity of the abdomen had assumed all the properties of an abscess, but it was so connected with the vital parts, which also suffered much in the inflammation, that the patient could not support the necessary processes towards what would be called a radical cure in many other parts; and indeed, considering the mischief done to the abdomen and its viscera, it is astonishing he lived so long.

"The most curious circumstance that happened, was the appearance of pointing in several places; for why one part of the abdomen should have pointed more than another is not easily accounted for, since every part of the anterior portion was nearly equally thin, each part was equally involved in the abscess, and the ulceration had not yet begun with any of the muscles. To account for this, let us suppose that one, two, or three parts (by some accident) were more susceptible of the ulcerative stimulus than the others, and that the parts were ready to give way; but although these parts which were pointing, were the places where ulceration would have gone on brisker, yet it had not proceeded further here than in any other part; it had only gone through the peritoneum, and the tendons of the broad muscles; and the recti muscles were sound and perfect at the place where I made the opening, which was the most protuberant of any; therefore this pointing did not appear to arise from weakness or thinness of this part; and, even supposing that the pointing was an effect of weakness, it would imply a great deal of pressure on the inside, (which at least was not the case here,) and simple pressure, although a hundred times greater, which we often see take place in dropsies, would not produce a pointing, if not attended with some specific power."

A train of appearances, somewhat similar to that which occurs in the progress of abscesses to the skin, takes place in the enlargement of aneurisms, and in their progress also to the surface of the body. Let us, by way of illustration, suppose the aneurism to have its seat in the thoracic aorta. The aneurism may incline to either side of the chest, or, in

its enlargement, it may pass backwards to the spine, or come forwards to the sternum. The dilated sac, during its progress to the surface of the body, adheres by the process of adhesive inflammation to the parts with which it comes into contact. A union of the surface of the sac to the pleura costalis is thus produced, but in progress of time the central part of this adhesion disappears, or is removed by absorption. The side of the aneurism corresponding to the adhesion is then absorbed, but the blood is prevented from escaping into the cavity of the chest, by the same layers of lymph which attach the sac to the pleura. The pleura is next removed by absorption; and at last the bones themselves are absorbed layer after layer, but without any appearance of caries or exfoliation. Morgagni mentions, that he had repeatedly seen vertebræ destroyed in the progress of aneurisms to the surface of the body, while the intervertebral or cartilaginous substances, which connect the bones of the spine together, appeared to be little, if at all, affected. Several very remarkable examples of this are preserved in Dr. William Hunter's Museum. In spontaneous diseases of the spine, it is the intervertebral substance that is usually first absorbed, the vertebræ being only subsequently destroyed. It is this removal of one texture after another, first the sac of the aneurism, then the pleura costalis, then muscles, bones, cellular substance, and cutis, layer by layer, that Mr. Hunter wishes to express by the term Progressive Absorption,—a term certainly sufficiently expressive of the general phenomena which it exhibits, and of the gradual and successive disappearance of the parts which cover abscesses, aneurisms, and tumours, in their constant and uniform progress to the skin. In this process, the adhesive inflammation precedes the progress outward of the aneurism, and limits, as in phlegmon, the extent of the swelling, and, as it were, directs it to the surface of the body. It may not be easy to say, whether, in many instances, a great part of the phenomena which have been described, are not produced by that action which Mr. Hunter has denominated interstitial absorption. Yet in interstitial absorption, we do not remark that successive abrasion of the surface of the parts which cover externally abscesses, aneurisms, and tumours; an appearance which may always be observed, I believe, in that process which Mr. Hunter denominates progressive absorption.

A few passages from his own work will, I conceive, best illustrate his opinions.

"I have already observed, that the progressive absorption is divisible into two kinds; one without suppuration, the other with. I shall now observe, that the absorption which does not produce suppuration may take place, either from pressure made by sound parts upon diseased parts, or by diseased upon sound parts; as the effect that the pressure of the coagulated blood has in aneurisms, the moving blood in the same, which is a sound part, contained in diseased arteries not capable of supporting the pressure of the moving blood; as also many tumours, which are diseased parts, pressing upon natural sound parts, and these diseased parts are simply endowed with life, which I apprehend makes some difference in the effects respecting the formation of pus; also uncommon pressure made by such substances, as are not endowed with any irritating quality sufficient to produce the suppurative inflammation, as a piece of glass, a lead bullet, etc. all of which I shall now fully explain.

"Of this first division, viz. from pressure without suppuration, we have several instances; in aneurisms, especially when they are in the aorta, and principally at the curve; and when arrived at a considerable size, so as to press against the surrounding parts, particularly against the backbone, as also against the sternum; all of which will be according to the situation of the aneurism; we find in such cases, that from the dilatation of the artery, (which arises from the force of the heart,) the artery is pressed against those bones, and that the substance of the artery in the part pressed is taken into the constitution. This absorption begins at the external surface of the artery, where it comes in contact with the bone, and continues there till the whole artery is absorbed; then the bone itself comes in contact with the circulating blood, and not being naturally intended to be washed by moving blood, the bone or bones are also absorbed from the pressure and motion of the blood against them. The adhesive, or strengthening disposition, takes place in the surrounding parts, and is of great service here, as it unites the circumference of the unabsorbed part of the artery to the surrounding parts; as also the cellular membrane beyond the surface of absorption, (when in soft parts,) similar to the preceding adhesive inflammation go-

ing before ulceration in an abscess; but it is here much stronger, for strength is wanted as well as adhesion while it is dilating; so that a cavity of some strength for the moving blood is always kept entire, and no extravasation can take place, nor can the parts readily give way.

"Another instance of this absorption occurs in those cases where living tumours make their way to the skin without the formation of an abscess. I once saw a remarkable instance of this in a highland soldier, in the Dutch service, who had a solid tumour formed, either in the substance of the brain, or, what is more probable, upon it, viz. in the pia mater, for it seemed to be covered by that membrane: the tumour was oblong, above an inch thick, and two or more inches long; it was sunk near its whole length into the brain, seemingly by the simple effects of pressure; but the outer end of it, by pressing against the dura mater, had produced the absorbing disposition in that membrane, so that this membrane was entirely gone at that part.

"The same irritation from pressure had been given to the scull, which also was absorbed at this part; after which, the same disposition was continued on to the scalp.

"As these respective parts gave way, the tumour was pushed further and further out, so that its outer end came to be in this new passage the absorbents were making for it in the scalp, by which it probably would have been discharged in time, if the man had lived; but it was so connected with the vital parts that the man died before the parts could relieve themselves; while all these exterior parts were in a state of absorption, the internal parts which pressed upon the inner end of the tumour, and which pressure was sufficient to push it out, did not in the least ulcerate, nor did the tumour itself, which was pressed upon all sides, in the least give way in its substance. No matter was to be observed here from either the dura mater, the unconnected edge of the bones of the scull, nor from that part of the scalp which had given way; and perhaps the reason was, the tumour being a living part, and not an extraneous one. The general effect was, however, similar to the progress of an abscess, insomuch that it was on that side nearest to the external surface of the body that the irritation for absorption took place."*

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* P. 454.

It is only to be regretted that we have no very accurate descriptions of the internal surfaces of the external parietes of abscesses or aneurisms, nor, consequently, of the series of changes which take place in these surfaces during the progress of abscesses and aneurisms to the skin. Minute injections, and a careful examination of these parts, will, it is to be hoped, throw some light on this curious process.

3d. The separation of dead from living parts is a vital process, not explicable on physical principles, nor by the laws of dead matter. The phenomena of this very interesting process may be best studied in skin and in bone, because these are the textures in which they are most distinct and evident. When the process of separation between dead and living parts is about to take place, a red line varying in breadth in different cases, usually appears in the living surface contiguous to the dead. This red line is occasioned by the occurrence of the adhesive inflammation. The excitement of this state seems to be the means which nature employs, to put a stop to the progress of the mortification, and to prepare the living surface for the separation which is about to be produced.

After this red line of adhesive inflammation has existed for some time, a slight solution of continuity may generally be seen beginning in one or more points, which resemble very minute ulcers; these little hollow points uniting, form a hollow line or chink, which extends all round between the dead and living parts. This loss of substance, chink, or excavation, is at first confined to the outer layer of the cutis, but in time it extends through the inner layer also. When the whole depth of the skin has been divided in this manner by ulcerative absorption, the edges separate from each other, partly in consequence of the elasticity of the sound skin, and partly also by the gradual contraction from evaporation or loss of substance in the dead.

The subjacent cellular membrane usually now appears in the enlarged chink or hollow line, of a dirty whitish yellow colour, and the dead portion of this membrane in its turn separates from the living in the form of a slough. From the moment that the separation by ulcerative absorption commences in the outer layer of the skin, till it is completed, a fluid, having more or less of a watery and seriform consistence, exudes from the hollow line or chink that is formed. In a short time this fluid contains an admixture of puriform

matter, and this puriform matter is poured out by the raw and granulating surface of the skin and cellular membrane; for the surface of the cellular membrane from which the dead portion is separated, is always seen covered with coagulable lymph, which is soon formed into granulations. This separation by ulcerative absorption goes on through muscle, blood-vessel, and nerve, with various degrees of celerity, according to texture, age, constitution, &c. till it at length arrives at the bone, and here its progress seems to be stopped, or at least for a time suspended. At the end, however, of a few weeks, the dead bone also drops off, and the surface from which it is detached is seen covered with raw flesh or granulations. From the solidity of bone, and from the slowness with which the separation goes on between the living and dead surfaces, this is, of all textures perhaps, that in which the phenomena of the process of separation can be best observed, and in which they are least liable to be confounded with, or mistaken for other, and merely accidental phenomena. It is to the phenomena of this process in bone, therefore, that I wish particularly to direct your attention.

Bones, like all the other organized parts of the body, are liable to inflammation, and though the phenomena of that state are always more or less modified by the texture in which it appears, yet they are sufficiently obvious in many of the diseases to which bones are liable. We can produce inflammation in bones artificially by wound or by fracture, and that affection, in whatever manner it has been produced in bone, passes occasionally through the four stages of adhesion, suppuration, ulceration, and mortification. From the susceptibility, therefore, of the state of inflammation in bones, it happens that when the extremity of a long bone, as of the femur or tibia, is denuded by the occurrence of a mortification which has stopt spontaneously somewhere in the course of the limb, we find, in the surface of the living bone contiguous to the dead, marks of the adhesive inflammation. But from the hard, firm, compact, unyielding nature of bone, the phenomena of the adhesive inflammation, even should it exist, will not at first be very apparent in the bony texture. We must search for the phenomena of this state, in the parts immediately contiguous to, and connected with the line of living bone, which we suspect to be entering into the state of adhesive inflammation. The texture most intimately connected with bone is the periosteum,

and the extremity of the living periosteum in contact with the dead bone, or rather with the dead portion of periosteum, supposing it not to have been removed, will, like the corresponding termination of all the soft parts, be found on examination, to be thickened in its substance, of a red colour and soft fleshy consistence,—in short, to exhibit all the marks of adhesive inflammation.

Some time after the termination of the periosteum in immediate contact with the living extremity of bone has become inflamed, a small narrow solution of continuity, chink, or notch will be found in the bone, situated in the line between the living and dead parts, and this notch or fissure will continue to penetrate deeper and deeper into the line of contact between the dead and living bone, till the bone at last drops off, when the extremity of the living bone will be found covered with granulations; the surface of a living bone, from which a portion of dead has separated, appearing uniformly in the state of suppurative inflammation. To this no exception has ever been remarked. Precisely the same appearances take place in the lateral separation, or exfoliation as it has been termed, of a portion of bone. To understand this, let us suppose a portion of the side of a long bone, as of the tibia for example, to be exposed and to become dead, this dead portion must be thrown off, must separate or exfoliate, before a proper cure can be obtained. This is a death or sphacelus which we can produce at any time, by the application of caustic to the surface of bone, and the phenomena which occur in the separation of the portion killed by caustic, will, it is to be presumed, be the same, or nearly so, with those occurring in the natural process of exfoliation. If, in an artificial case or experiment, therefore, we examine the extremity of the periosteum contiguous to the denuded and dead portion of bone to which the caustic had been applied, we shall find it thickened, red and inflamed. Where this periosteum terminates, a notch, chink, or fissure, soon takes place between the living and dead bone, which slowly, but gradually, extends inwards to the cavity of the bone; or, instead of passing directly to this cavity, it may take a more oblique direction between the laminæ or plates of bone. This more oblique direction always take place, when only a thin lamina of the bone is to be separated. The fissure of division in this case extends gradually from the circumference of the

mortified portion inwards to the centre, and when the continuity of the central portion has been at last destroyed by its absorption, the dead portion falls off, and allows the surface of the living to come into our view. Here, as in the former instance, this surface also is covered with granulations.

From this account of the phenomena of separation, it is evident, that the occurrence of the adhesive inflammation is the first step in this process. Its effects are seen in the thickening of parts by the exudation of coagulable lymph, and in the closure of the extremities of the divided blood-vessels. The disappearance of a portion of the animal solid, in the line of contact between the dead and the living parts, has not been very generally observed, nor, when observed, has it been uniformly accounted for on the same principles, by chirurgical pathologists. Mr. Hunter, it is to be regretted, gives in no part of his writings so minute an account of this process as could have been wished; but it is obvious, from various passages of his chapter on ulcerative inflammation, that he conceived the separation of dead from living parts to be uniformly produced by the process of ulcerative absorption, and that opinion, I conceive, is justified, not only by the constant disappearance of a portion of the solid parts of the body in the line of contact between dead and living parts, but also by the whole train of phenomena which accompanies the separation. Inflammation of the adhesive kind is not only the first mark of incipient separation, but it is the first visible step in the process of ulceration; for a part never ulcerates till it has become inflamed.

The existence of inflammation is proved in the process of separation, even in the hardest parts of the body, as has been already remarked, by the state of the periosteum, and by the formation of granulations on the living extremity of bone. The process of ulceration, as Mr. Hunter very justly remarks, or of absorption with suppuration, is almost constantly attended with inflammation; but it cannot be called, he adds, an original inflammation, but a consequent, which gave rise to the term ulcerative inflammation.

The ulcerative inflammation, he adds, is always preceded by the adhesive inflammation, and perhaps it is simply this inflammation which attends it. But this is a circumstance, upon the advantages and effects of which I have been

already sufficiently minute, in the account which I gave you of the progress of abscess to the surface of the body; and you have only to remember, that, but for the constant precedence of the adhesive to the ulcerative inflammation, the matter of abscesses would be uniformly diffused through the cells of the cellular texture, and the mouths of the divided vessels, whether blood-vessels or absorbents, would, in the separation of dead from living parts, be uniformly left open.

The breadth of the portion of solid between the living and dead matter which disappears in the act of separation, varies in every individual case, and even in the different parts of the same line of separation; and, accordingly, you will find that the ulcerative action, by which the dead part is detached, does not always remain fixed, but often extends for a considerable way into the living parts. In many instances, after a distinct line of separation has formed, greater or less portions of the skin above it not unfrequently fall into the state of mortification, and the separation seems to proceed partly in the way of ulceration, and partly in that of mortification.

Why, it may be asked, in these two instances, does the part disappear in the one case, by the process of ulcerative absorption, and in the other, by that of gangrene? Because, says Mr. Hunter, ulceration takes place in parts possessing a greater degree of strength or vigour than those in which mortification occurs; for although, he adds, ulceration arises from weakness, it is an action, (a vital action,) while mortification is the loss of all action. Ulceration, in many cases, finishes what mortification had begun, by separating the mortified part from the living, and in such cases it may be called the natural surgeon.

The absorption of bone, like that of soft parts, may be distinguished into interstitial, progressive, and ulcerative. We have ample proofs of the interstitial absorption, or that which is daily, hourly, and unceasingly taking place from every part of the substance of bone, in the deposition and removal of phosphat of lime that has been tinged with madder. If too much earth be removed, the quantity of animal matter will be relatively increased, and a disposition given to softness of the bones—a state which exists in the bones of children in the disease called the rickets, and in the bones of older people in that denominated mollities ossium, or the rickets of grown people.

I have already had occasion to mention the effects of the progressive absorption of bone, as manifested in the progress of aneurisms and other tumours to the skin. This is a process which may be accompanied with the formation of pus on the side of the soft parts next to the tumour that is passing to the skin; but the formation of pus is by no means a necessary, constant, or even frequent attendant on the process of progressive absorption of bone. Hydatids in the brains of sheep, tumours growing from the pia or dura mater in the human body, or aneurism seated over the cranium, or within the cavity of the chest, are often the cause of the whole substance of a bone being removed, layer after layer, by progressive absorption, without the formation of a single particle of pus. This state of the bone has often been confounded, but improperly, with that state of the bone which arises from ulcerative absorption, the state which is properly denominated caries, and in which, one or more solutions of continuity may be produced upon the surface, or in the substance of the bones. The ulcerations occasioned in bones by the venereal disease, afford by far the best marked examples of the effects and appearances of ulcerative absorption, or caries in bones, which I can point out to your notice.

Ulceration in bone, as well as in soft parts, is a process going on in living, not in dead matter, and accompanied by, if it does not always necessarily succeed to, adhesive inflammation; so that, on examining the small ulcers produced in bone, you will generally find marks of adhesive and ossific inflammation in the bony growths deposited round them.

The termination by mortification or sphacelus, in which a portion of the bone dies, or loses its vitality, and becomes a body foreign to the system, has received a great variety of names, such as dry caries, necrosis, exfoliation, &c. The external appearances of bones which die, and come away by the process of exfoliation, are extremely different; in some instances, smooth like sound bone, in others, rough and excavated. These differences may depend on three circumstances; first, The more or less compact texture of the bone which has become dead; secondly, The previous existence of disease in the bone; as, for example, of ulceration producing solution of continuity in many points of its substance, and exhibiting an appearance as if it had been eaten by worms. The third difference in the appearance of exfo-

liated bones, may arise from the action of the parts surrounding them, after they have become dead, and before they have separated. These parts are in general either the pus, more or less healthy, or the granulations by which it is formed. The more solid and compact texture of bone does not seem to be acted on by pus ; but whether putrid pus be altogether incapable of promoting the decomposition of bone, is a matter which requires more investigation than it has yet received, before we can be entitled to form any very decided opinion concerning it. That the granulations surrounding a portion of dead bone act upon it in the way of absorbing it, is a point which I am inclined to believe may be admitted without much hesitation, although, unquestionably, it often happens, that very small fragments of compact bone often remain surrounded by granulations for weeks and months, without being absorbed. It has been said, that the weight of a solid piece of bone is diminished by keeping it applied for some time to the surface of a granulating ulcer ; but we want a regular series of experiments upon this subject, made on brute animals, by the introduction of pieces of bone of different degrees of compactness, into wounds of various parts, and under different states, to enable us to say with precision, how far, and under what conditions, the granulations of a sore are capable of absorbing the dead portions of bone with which they come into contact.

When the separation of a portion of bone, the vitality of which has been destroyed either by an external or by an internal cause, is accompanied by the formation of a portion of new bone to supply its place, the death of the old bone, and the formation of the new, are processes which are now usually included under the general name of Necrosis. This repair of the loss of greater or less portions of bone, is a process which we see taking place most frequently in the compact cylindrical bones, more seldom in the flat and spongy. Of the cylindrical bones, it is the middle and compact parts, not the spongy extremities, that are the usual seats of that mode of destruction and repair in bone which is termed necrosis.

Necrosis may be confined to a small spot, or it may include a large portion of the bone. In the cylindrical bones, it may take place in a part, or in the whole of the circumfe-

rence; it may extend along the whole, or only a small part of the length of the bone; it may occur in one spot only, or it may take place in several parts of the same bone.

The very singular process in the animal œconomy, by which a portion of new bone may, at any time, be produced by the destruction of the old bone, has been very successfully investigated, in the way of experiment, by Troja, David, Blumenbach, Koehler, and by my friend and pupil the late Dr. Alexander M'Donald. In this investigation, it is true, the circumstances in which the new bone is produced, may be somewhat different from those upon which the spontaneous formation of new bone depends in the human body, but still much light has been thrown upon the process, by the experiments which have been instituted. These experiments have generally been made upon the long bones. They succeed best in fowls. To see the phenomena of this process, we have only to amputate the lower extremity of one of the bones of the leg of the fowl, and to destroy its medulla with a probe, or to make a lateral perforation in the bone, and destroy its medulla without amputating the limb. It is necessary to fill up the canal of the bone with some soft substance, otherwise the experiment does not always succeed, particularly in young subjects. When, in making the experiment, this precaution is omitted, I have seen the canal of the old bone filled up first with blood, and afterwards with coagulable lymph, which became the nidus for ossification in the canal of the bone.

In a day or two after the medulla has been destroyed, and its canal filled up with a foreign body, the limb is observed to be swollen, and if an incision be made down to the bone, the periosteum will be found to separate from it more easily than from sound bone. If injected, this membrane will be seen to have been inflamed, and between it and the surface of the bone, on the second and third day after the destruction of medulla, one can almost always see distinctly an exudation of a gelatinous-looking substance, which gradually becomes thicker and firmer in its consistence, and which at last forms a soft covering under the periosteum for the old bone. This lymph, or gelatinous substance, like that which exudes from the extremities of fractured bones, and the soft parts which surround them, becomes vascular. If the animal is killed at this period, and its vessels injected with coloured size, they are seen penetrating this substance at

nearly right angles to the long axis of the bone. In process of time these arteries deposit earthy matter, and the presence of the first particles deposited can, at all times, be easily detected, by feeding the animal upon which the experiment is made with madder, so as to tinge the phosphat of lime. By the successive deposition of this osseous matter, a new bony cylinder at length is formed, which surrounds the old bone; and the old bone, which at first is firmly grasped by the new bone, becomes loose by degrees, and at last drops out. The periosteum, the cartilages almost always with the epiphyses, though sometimes without them, and the ligaments which connect together the cartilages of the joint, are, by this process, separated from the old bone, transferred and attached to the new. In process of time the inner surface of the new bone becomes cellular, and is lined with a membrane containing medulla: with the formation of this the process of regeneration may be said to be completed. The regeneration of the medulla was first observed by Koehler, and afterwards in an extensive series of experiments which I made with Dr. Alexander M'Donald, of which an account has been published in his inaugural dissertation, printed at Edinburgh in the year 1799.

I have said, that the new bone which is produced in these experiments, is formed between the surface of the old bone and the periosteum. But I am aware that the accuracy of this statement has been doubted by several authors. Leveille, in an essay which he has written upon the subject of Necrosis, says, "that either the external or internal layers of a long bone may be killed at pleasure, by destroying the blood-vessels of the external or internal periosteum." This, I doubt not, may occur, but it will give rise to the process of exfoliation,—a process different in some respects from that which I have described to you under the name of Necrosis.

The exfoliation, or, in other words, the death and subsequent separation of a portion of bone, may take place from a great variety of external and internal causes. Among some of the principal of the external we may reckon,

First, The denudation of bone by depriving it of its periosteum. The superficial extent and depth of the bone which is killed by denudation will, in some measure, depend on particular constitution, and in some measure also on the extent of the periosteum, and the manner in which it has been removed. If periosteum, which has been simply torn off in a

healthy subject, be immediately replaced, it not unfrequently re-adheres; but if it be not immediately replaced, and if any substance, fluid, or solid, be interposed between it and the bone, or if the subject on which the experiment is made be unhealthy, adhesion will not take place, and the separation of a greater or less portion of bone becomes necessary. We see this every day in wounds and burns, where the integuments have been removed or destroyed.

A second mode of producing exfoliation is by contusion, as from falls, blows, or the impulse of cannon and musket balls. The degree of contusion may be such as to destroy the vitality of the soft parts which cover the contused bone; but this is by no means necessary to the production of death in the bone, for it often happens, that a considerable portion of bone is killed by contusion, and must afterwards come away by exfoliation, though the integuments, and other soft parts covering it, were apparently but very inconsiderably injured at the time the contusion was inflicted. Contusion, according to its degree, and according to varieties of constitution, may produce three distinct effects upon bone; first, It may excite a certain degree of adhesive inflammation in bone, or in the periosteum immediately covering it, the effect of which will be the deposition of a greater or less quantity of phosphat of lime, extending either over a large surface, and producing an appearance similar to that denominated ossific inflammation by Mr. Hunter, or confined more to one spot, and producing the bony growth denominated exostosis. A second effect which may result from the contusion of a bone is ulcerative absorption, and this may begin in one point, removing, so far as it goes, the whole substance of the bone; or it may begin in a number of points at the same time, and produce the numerous solutions of continuity in bone which constitute the state of caries. Thirdly, A portion of bone may be killed by contusion, in which neither adhesion nor ulceration appears. In this case, the living bone in the line of contact between the dead and the living inflames, and the dead portion is separated by the absorption of this bone. It not unfrequently happens, that the three different effects I have mentioned, as resulting separately from contusion, take place in one and the same injury. The periosteum, and surrounding soft parts, pass into the state of ossific inflammation. The bone in some places is only partially killed, and ulceration comes upon

these places, while other portions of it are placed beyond the reach of this process, by the complete destruction of their vitality.

A third mode of producing exfoliation is by the application to bone of caustic substances. Mr. Home informs us, that, besides the experiments on the growth of bones, Mr. Hunter made others to determine the process of their exfoliation. He cauterized portions of bone in the same way in several different animals, so as to be able to examine the bones in the different stages of this process, and found that the earthy part of the living bone in contact with the dead portion was first absorbed; afterwards the animal mucilage itself, so as to form a groove between the two, which became deeper and deeper, till the dead bone was entirely detached, the dead portion itself having undergone no change.* The preparations which these experiments afforded are preserved in his museum, and I shall perhaps render the description which I have attempted of this process more accurate and plain, by detailing to you some of the appearances which they exhibit.

Mr. Hunter laid bare by incision the tibia of an ass, and applied to the bare bone the lunar caustic. A certain portion of the surface of the bone was killed by this application. But as the edges of the wound were permitted to come into contact, they re-adhered, and shut up in a distinct cavity the dead portion of the bone, now rendered a body extraneous to the living system; the periosteum all round the portion of dead bone became inflamed, and coagulable lymph was secreted from it, as well as from the inner surface of the integuments covering the dead bone. This lymph became first vascular, and afterwards bony, so that the dead portion of bone was at length covered on the fore and lateral parts by a new bony growth, every where including the old bone. In this situation the dead bone separated from the living, by having its line of contact absorbed, and lay detached as a loose foreign body in the bony cavity now formed for it. A portion of dead bone so situated could be removed from its enclosure, only by one of two ways; either, first, by the gradual removal of the exterior surface of the enclosure, by the open mouths of the absorb-

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* See Transactions of a Society, &c.

ents in the parts surrounding it, or, by nature procuring for it, some outlet through the parts covering it, in its solid aggregate form. The last was the means which she adopted. Pus was secreted from the inner surface of the cavity in which the bone was lodged. This cavity became an abscess. The tendency arose, which occurs in abscess, to pass to the skin. Progressive absorption took place on the side next to the surface of the body; an opening was made in the new bone covering the dead portion; and the fluid contents of the abscess were discharged. A fistulous opening was formed, and matter continued to be discharged, till the granulations arising from the posterior surface pushed the dead portion of bone into the external opening, where it remained for a longer or shorter time, according to the proportion which its size bore to that of the aperture through which it has to pass. The size of the dead portion of bone, it is true, may be gradually diminished by the absorption, or by the decomposition of a portion of its surface, and the size of the aperture through which it has to pass, may be enlarged by successive attacks of ulceration; but from the slowness with which dead bone is absorbed, and from the tendency to granulation and to ossification in the canal through which it has to pass, the ejection of dead bone must, in all circumstances, you perceive, be a tedious and difficult process. Every thing that has been said of the separation of a piece of bone killed by caustic, is applicable to the separation of bone dying from an internal cause; and this simple experiment of Mr. Hunter's exhibits a complete view of the phenomena which successively occur in the internal exfoliation of a small portion of dead bone. These phenomena are the same, whether the dead bone belongs to the external or internal surface of a bone, whether it be a small portion only, a large portion, or even the whole body of a bone. If the whole of a long bone has to separate and come away, more than one fistulous opening will, in all probability, be formed, and portions of the bone and matter will be discharged from each opening. The new cylinder of bone which encloses the old may be more or less perfect, but the matter and dead bone which it contains will, in general, be found to make their way to the surface by the shortest roads, and to come out by the sides where they are most thinly covered. The only part of the process in the separation of a complete bone, which differs from that of a partial separation, is that

which relates to the transfer of the cartilages, ligaments, and periosteum, from the old to the new bone,—a process which I have already pointed out to your notice, in mentioning the experiments by which necrosis had been artificially induced.

The carious appearance of bone may be produced by the process of ulcerative absorption in it while alive, or by the absorbent action of granulations upon it after it has become dead.

GRANULATION.

On the surfaces of wounds, the edges of which cannot be brought into contact; on the internal surfaces of abscesses which have burst of themselves, or which have been opened by art; on the living surfaces from which sphacelated portions of the body have separated; and on the surfaces of the sores formed by the process of ulcerative absorption, I have had occasion to remark, that coagulable, or, as I rather would term it, organizable lymph, is, in the healthy conditions of the body, and in the healthy state of these surfaces, uniformly poured out, and gradually converted, by processes inherent in the animal system, into the little red eminences well known to surgeons by the name of Granulations. But an appearance which is so common in local diseases, and the occurrence of which seems to be so necessary to the process of healing, must be highly deserving of the attention of the surgeon. Much, indeed, of his success in practice depends, and must ever depend, upon the knowledge which he acquires of the various appearances of granulating surfaces, and of the different methods of treatment which, in different conditions, these surfaces require. This must be my apology, if any apology can be necessary, for entering a little more minutely than we have hitherto done, into the consideration of the process of granulation, or, in other words, into the consideration of the series of appearances which occurs in suppurating surfaces, during the process of healing.

The phenomena which present themselves in the formation of granulations, may be seen with almost equal advantage, in the healing state of any of the four suppurating surfaces which I have had occasion to mention, namely, the suppurating surfaces produced by wound, by abscess, by mortification, and by ulceration; but, for various reasons which will become apparent as we proceed, I shall, in tracing the successive steps of the formation of granulations, endea-

vour to direct your attention chiefly to these phenomena, as they appear upon the surfaces of abscesses after they have burst, and their contents have been discharged.

I have already described to you the manner in which abscesses are brought to the surface of the body, by the gradual and successive absorption and disappearance of the parts which cover them,—a process first well described by Mr. Hunter, and to which he has given the name of progressive absorption; but we are now to take a view of the phenomena which appear in the healing of abscesses, or, in other words, of the changes which, during this process, occur in succession upon the internal parietes of these cavities. These changes may all, I conceive, be comprehended under the five following particulars:—

1st, The enlargement of the opening of the abscess, by the continuance for a time of the process of ulcerative absorption. The process of ulcerative absorption in inflamed skin, does not always cease at the moment that an abscess is opened by it, but continues to go on to a greater or less extent, according to circumstances, with which we are at present but very imperfectly acquainted; we may, however, remark, that the skin covering an abscess, which has been much inflamed, or thinned in its substance previously to the opening, is usually observed to disappear by the process of ulcerative absorption. In this inflamed and thin state, the skin seems to be incapable of having new flesh or granulations formed on its surface, and, of course, of forming an adhesion with the granulations which are formed upon the opposite side or bottom of the abscess. It is by the continuance of the ulcerative absorption that the orifice of the abscess is enlarged, and this often continues to go on enlarging, while the internal cavity of the abscess is diminishing in every other quarter. In all those cases, in which this ulcerative absorption does not take place in the skin previously to the artificial opening of an abscess, it becomes necessary, where we wish to keep the orifice open, to introduce into it a thin slip of linen dipt in oil, or spread over with some mild ointment; for if in the healing condition of the skin covering an abscess, this precaution be omitted, the edges of the opening will, in all probability, unite again, so as to render a fresh opening necessary.

2dly. After an abscess has been opened, either by art or by nature, the swelling and hardness of the surrounding

parts gradually disappear. This swelling depends partly, as you already know, on the effusion of serum into the interstices of the cellular membrane, which often exudes to a considerable distance from the seat of the abscess, and partly also on the exudation of coagulable lymph into the cellular membrane more immediately surrounding the abscess. This exudation of coagulable lymph is the means which nature employs to limit the extent and progress of the suppuration. When it either does not take place, or when it is speedily absorbed, the pus may become diffused like serum in the cells of the cellular texture, and extend to an unlimited distance from the original point of suppuration. Something like this occasionally happens, as in the erysipelas phlegmonoides, and the pus in these instances produces dreadful havock, by passing into and destroying the cellular membrane which enters between, and connects together, muscles, blood-vessels, nerves, and bones; more frequently, however, this diffusion of pus, or puriform fluids, is preventd by the cells being filled and their communications shut up by the coagulable lymph exuded during the adhesive inflammation. This lymph is not, like water or serum which has been effused into the cellular texture, to be regarded as a foreign body; for by being penetrated with blood-vessels, it may constitute a part of the solid into which it is poured. In cases where lymph has been thrown out in great quantity, a degree of swelling may continue for life; but more frequently this effusion is slowly and gradually taken up by the absorbents, and conveyed into the circulating mass of fluids. It is taken up by that mode of absorption of the solid parts, which leaves their form, texture, and organization uninjured, and which Mr. Hunter has distinguished by the name of interstitial absorption. This disappearance of the hardness and swelling of the parts surrounding an abscess, goes on more readily in the cases where a suppuration takes place speedily; but the suppuration is to be regarded merely as a mark of the healthy condition of the parts, and the disappearance of the swelling is to be ascribed to the process of absorption, not, as was formerly done, to any depletion of the vessels which the suppuration may be supposed to produce.

The third appearance which we may remark on the surface of abscesses, is the separation of a slough. In most instances, after an abscess has been opened, and particularly when the

abscess is of the chronic kind, a slough more or less firm in its consistence, and varying in its thickness, comes away either entire, or gradually in one or more distinct pieces. The formation and separation of sloughs are processes in the animal machine which have hitherto been but little investigated, but they are sufficiently curious and important to require the most minute attention. By a slough is usually understood, a thin, foul, or mortified substance in a moist state, which very frequently appears on the surfaces of parts in the states of suppuration and ulceration. These sloughs may be produced by a great variety of causes; by any power, mechanical or chemical, capable of altering the secreting action, or of destroying the life of the part to which it is immediately applied. Thus, caustic substances form sloughs which are termed eschars. Contusions produce sloughs, the thickness and extent of which vary with the degree of contusion. A musket-ball produces a slough, or mortified part, in the passage which it makes for itself. But the sloughs which we have the most frequent occasion to observe, are the products of parts in the state of inflammation.

Sloughs on inflamed surfaces seem to be of two different kinds; one consisting of morbid exudations or secretions from the vessels of the part inflamed; the other consisting of portions of the animal solid, which have been deprived of their vitality, and changed into dead unorganized substances. In many cases it is difficult to distinguish the slough that is formed by exudation, from that which is produced by the death of the surface on which it exists. Perhaps many of the sloughs which form on the surfaces of foul abscesses and sores, consist partly of exudation, and partly of deadened or sphacelated substance. When the solid texture of deadened bone is removed, the separation is effected, as I have already sufficiently explained, by the process of ulcerative absorption; but in the separation of soft parts, such as sloughs formed upon the surfaces of suppurating sores by mortification, it remains to be ascertained, whether they may not be forced off from their attachments by the exudation of coagulable lymph, or whether, as in the separation of bone, a line of living substance must be absorbed. The cellular substance appears to be often the seat of those sloughs, and this would seem to show that the life of this part is more easily destroyed, than that of almost any other texture. When pus is diffused through this texture, as happens in some

abscesses of a very malignant nature, and in cases of erysipelas where the inflammation passes from the skin into the subjacent cellular texture, the whole of the cellular membrane into which the pus has penetrated, comes away in the form of a slough, leaving the parts under which it was placed, and which it covered, in a loose and detached state. In ordinary abscess the sloughing which occurs is much less considerable. It amounts often only to the separation of a whitish, viscid, tenacious film, with which the abscess is covered, and which resembles more an exudation from the vessels opening into the cavity of the abscess, than a portion of the internal side of the abscess itself. In some cases, this slough has a membranous-like appearance, and, on examination is found to consist of condensed coagulable lymph. The abscess in this case is said to be seated in a bag or cyst. The thickness of these sacs or bags of coagulable lymph, and the number of layers of which they are composed, vary much in different cases. They have no vascular adhesion to the parts in which they are formed, and require to be removed, before the cavities in which they are seated can be healed up. The inside of every abscess in a sound state may be compared, not unaptly, to one of these cysts, to a cyst united by a vascular union to the parts in which it exists. Perhaps the most accurate idea we can form of an abscess, is that of a hollow bag or cavity formed by the exudation of coagulable lymph.

The fourth change taking place on the internal surface of an abscess, which I have to mention to you, is the formation of the small red points and eminences, of a glassy shining appearance, which are termed granulations. The manner in which nature forms granulations may be best seen by injecting, and by examining carefully the internal surfaces of abscesses, or the granulating surfaces of healthy sores or ulcers. From numerous observations made in this way, it appears that the exudation of a layer of coagulable lymph may be regarded as the first step in the process of granulation. The second would seem to consist in the penetration of this lymph with blood-vessels, nerves, and absorbents. The third, in the inosculation, or union by open extremities, of the vessels in these granulations; and in the last step, if it may be called so, of their formation, the granulations are covered over with cuticular substance, by which the farther secretion of pus is prevented, and the

process of healing by granulation completed. In speaking of the formation of granulations, Mr. Hunter makes the following remarks, which you will find at page 477 : "Granulations," says he, "and this new-formed substance, are an accretion of animal matter upon the wounded or exposed surface; they are formed by an exudation of the coagulating lymph from the vessels, into which new substance both the old vessels very probably extend, and also entirely new ones form, so that the granulations come to be very vascular, and indeed they are more so than almost any other animal substance. That this is the case, is seen in sores every day. I have often been able to trace the growth and vascularity of this new substance. I have seen upon a sore a white substance, exactly similar, in every visible respect, to coagulating lymph. I have not attempted to wipe it off, and the next day of dressing I have found this very substance vascular; for, by wiping or touching it with a probe, it has bled freely. I have observed the same appearance on the surface of a bone that has been laid bare. I once scraped off some of the external surface of a bone of the foot, to see if the surface would granulate. I remarked, the following day, that the surface of the bone was covered with a whitish substance, having a tinge of blue; when I passed my probe into it, I did not feel the bone bare, but only its resistance. I conceived this substance to be coagulating lymph thrown out from inflammation, and that it would be forced off when suppuration came on; but, on the succeeding day, I found it vascular, and appearing like healthy granulations.

"The vessels of granulations pass from the original parts, whatever these are, to the basis of the granulations; from thence towards their external surface, in pretty regular parallel lines, and would almost appear to terminate there."

"The surface of this new substance, or granulations, continue to have the same disposition for the secretion of pus as the parts from which they were produced; it is therefore reasonable to suppose that the nature of the vessels does not alter by forming the granulations, but that they were completely changed for the purpose before the granulations began to form, and that these granulations are a consequence of a change then produced upon them."

"Their surfaces are very convex, the reverse of ulcera-

tion, having a great many points, or small eminences, so as to appear rough; and the smaller these points are, the more healthy we find the granulations."

There are few who have seen much practice in the treatment of wounds and ulcers, who have not had occasion to verify these observations of Mr. Hunter. I have often injected the suppurating surfaces of wounds, compound fractures, and ulcers. Though the appearances that are to be observed on these surfaces vary according to the stage of the granulating process, and also according to the manner in which it proceeds, yet they bear a very uniform and striking resemblance to each other. In an early stage, these surfaces are sometimes seen covered with one or more layers of coagulable lymph, into which the matter of injection does not penetrate. On removing this lymph, the vascularity of the subjacent lymph becomes often apparent, and blood-vessels can be seen penetrating it, which are generally in clusters. In some points we can see with a lens, the main branch from which the smaller branches of a cluster of vessels are derived and supplied with blood. Does each cluster of vessels form a distinct granulation? or may the separate and rounded form of granulations be accounted for by supposing that each granulation possesses a distinct central artery? In a still more advanced period, the exterior vessels of these clusters are seen mixing with one another; and, by the time that granulations are formed, the blood-vessels are often so numerous as not to be distinguishable. The parts which surround, or which are subjacent to granulating surfaces, are always much more vascular than similar but more remote parts.

Granulations are, in every instance, the product of a certain degree of inflammation. This is fully proved by the exudation of coagulable lymph, by the increased vascularity of the parts contiguous to the granulating surface, and by the local increase of temperature. I have repeatedly found this temperature in granulating ulcers of the leg, two or three degrees above that of the parts at a little distance from the granulating surface. Is suppuration necessary to the formation of granulations? This is a question to which I do not know if, in the present state of our knowledge respecting this subject, any very definite answer can be given. One instance has been already mentioned in the case of mucous membranes, in which inflammation terminates in suppura-

tion, without granulations being formed. Here the suppuration may go on for weeks, or months, without any appearance of granulation. Granulations indeed, I believe, never form in inflamed mucous membranes, unless when the mucous secreting part of the surface is removed by mortification, by the knife, by caustic, or by the process of ulcerative absorption. But though, as in this instance, suppuration may take place, which is not followed by granulation, still the question recurs, Do we ever see granulations which are not preceded and attended, during their progress to cicatrization, with the formation of pus? I have never seen any thing which I could regard as an example of a granulation, and still less a granulating surface, in which pus was not formed. Yet Mr. Hunter seems to think that granulations may occasionally be formed in circumstances in which suppuration is not produced; and, in support of this opinion, he gives, at page 475, the history of a dissection of a fractured limb. It does not appear to me that the circumstance mentioned by Mr. Hunter, of a substance being found similar to granulation on the ends of the fractured bone, is sufficient to determine the point in question. The blood which had at first been thrown out, seems to have been absorbed, and coagulable lymph deposited in great abundance; but to give to this lymph the form of granulations, besides the presence of the suppurating process, there is generally required also the contact of the external air. There are two facts with regard to this point, which seem curious, and which we are incapable of explaining by any more general facts. The first is, that granulations do not appear on the internal surfaces of abscesses, nor of sinuous ulcers, till they have been opened, and their surfaces exposed to the action of the air. Mr. Hunter very justly observes, with regard to this point, at p. 474, "Few surfaces, in consequence of abscesses, granulate till they are exposed; so that few or no abscesses granulate till they are opened, either of themselves or by art; and, therefore, in an abscess, even of very long standing, we seldom or ever find granulations. In abscesses, after they have been opened, there is generally one surface that is more disposed to granulate than the others, which is the surface next to the centre of the body in which the suppuration took place. The surface next to the skin hardly ever has the disposition to granulate; indeed, before opening, its action was that of

ulceration, the very reverse of the other ; but, even after opening, that side under the skin hardly granulates, or at least not readily. I may farther observe, that exposure is so necessary to granulation, even on such surfaces as arise from a broken continuity of parts, that if the abscess is very deep seated, they will not granulate kindly, without being freely exposed, which alone often becomes a cause why deep seated abscesses do not heal so readily, and often become fistulous." The second fact is, that if the surfaces of abscesses, or the surfaces of wounds and ulcers, which are passing into the state of granulation, be long exposed to the air the granulating appearance of the suppurating surface disappears, the qualities of the puriform discharge are altered, and an ill-conditioned sore or ulcer is produced. A certain degree of exposure to the air then, it would seem, is necessary to the formation of granulations on the surface of an abscess, but this exposure must not be continued too long; for, after the granulating process has once been induced, it goes on the faster, the more carefully the air is excluded ; and much of the beneficial effects resulting from the dressing and bandaging of sores and ulcers, seems to arise from the exclusion of the external air from their suppurating surfaces.

If two surfaces, covered with granulations, be brought into contact, they are observed to unite, and a mutual penetration of blood-vessels is produced, as happens in that mode of union without suppuration, which occurs in the adhesive inflammation. The union without pus, is termed the union by adhesion, or by the first intention; the union by granulation, union by the second intention. Perhaps when these two modes of re-union are minutely investigated, and carefully compared, they will not be found to differ from one another so much as has commonly been imagined. In both, a layer of coagulable or organizable lymph forms, you perceive, the more immediate bond of union; in both, this lymph is penetrated with blood-vessels, nerves, and absorbents; but in one of these modes of re-union, pus is formed, and in the other that fluid does not appear. The production of pus, therefore, and the rounded and granular, or grain-like form which is given to the surface of the coagulable lymph that is effused, seem to be the chief, if not the only circumstances in which these two modes of re-union differ from one another.

The union of granulating surfaces with each other, is necessarily followed by the suppression of suppuration in all the points of these surfaces which adhere; but it often happens that granulating surfaces, when brought into contact, adhere in particular points only, and the intervening spaces form so many foci or points of suppuration, or, in other words, just so many circumscribed abscesses. Hence the frequent necessity, in this mode of re-union, of permitting only the granulations which are at the bottom of a wound or abscess to come into contact, and to form adhesions with one another; for if the granulations in the skin be permitted to unite, while those in the subjacent textures continue to secrete pus, one or more abscesses will be formed, and the process of healing delayed or prevented.

The fifth remarkable change which takes place on suppurating surfaces, whether they have been formed by abscess, by wound, by mortification, or by ulcerative absorption, is the gradual contraction of the granulations, accompanied by the elongation of the old skin round the suppurating and granulating surface. This contraction of the granulations takes place in every point of the granulating surface, and brings gradually the circumference of the sore towards its centre; so that the sore becomes smaller and smaller, even in those cases in which little or no new skin is formed. These two processes, namely, the contraction of the granulations, and the elongation of the old skin, may be very distinctly seen in the healing of wounds, attended with much loss of substance, as in a wound made by the extirpation of a mamma, or of any large tumour, where the edges of the wound inflicted, cannot often at the first dressing be brought within some inches of each other, and in that also formed by the amputation of a limb. The effects of these processes, however, are prevented, or at least retarded, when the granulations form upon surfaces naturally fixed, as upon the bones of the leg, skull, and sternum.

Mr. Hunter's observations upon this subject, p. 484, are so much to my present purpose, that I am convinced I cannot do better than quote them.

"If it is a cavity, or abscess, which is granulating, with only a small opening, as in many that have not been freely opened, the whole circumference contracts, like the bladder of urine, till little or no cavity is left; and if any cavity is remaining, when they cannot contract any further they

unite with the opposite granulations, in the manner above-described.

"This contraction in the granulations continues till the whole is healed, or skinned over; but their greatest power is at the beginning, at least their greatest effect is at the beginning; one cause of which is, that the resistance to their contraction in the surrounding parts is then least.

"The contractile power can be assisted by art, which is a further proof that there is a resistance to be overcome.

"The art generally made use of is that of bandages, which tend to push, draw, or keep the skin near to the sore which is healing; but this assistance need not be given, or is at least not so necessary, till the granulations are formed, and the contractile power has taken place: however, it may not be amiss to practise it from the very beginning, as by bringing the parts near to their natural position the adhesive inflammation will fix them there; they will therefore not recede so much afterwards, and there will be less necessity for the contractile powers of the granulations.

"Besides the contractile powers of the granulations, there is also a similar power in the surrounding edges of the cicatrizing skin, which assists the contraction of the granulations, and is generally more considerable than that of the granulations themselves, drawing the mouth of the wound together like a purse; this is frequently so great, as to occasion the skin to grasp the granulations which rise above the surface, and is very visible in sugar-loaf stumps, where the projection of the sore is to be considered as above the level of the skin.

"This contractile power of the skin is confined principally to the very edge where it is cicatrizing; and, I believe, is in those very granulations which have already cicatrized; for the natural, or original skin surrounding this edge does not contract, or at least not nearly so much, as appears by its being thrown into folds and plats, while the new skin is smooth and shining. This circumstance of the original surrounding skin not having the power of contraction, makes round wounds longer in healing than long ones; for it is much easier for the granulations, and the edge of the skin, to bring the sides of an oblong cavity together, than the sides of a circle; the circumference of a circle not being capable of being brought to a point."

In the union, whether by adhesion or by granulation, the

coagulable lymph, we have said, is penetrated by blood-vessels, and an inosculation of these vessels takes place, by which a free circulation of blood is established between the opposite but now re-united surfaces. There are, however, many points respecting this penetration of the lymph with blood-vessels, and the subsequent inosculations of these vessels with one another, that still remain to be investigated in the way of experiment and of observation. In particular, we are ignorant whether the vessels which penetrate to the effused layer of coagulable lymph be entirely new, or only the prolongation and enlargement of capillary vessels which had previously existed in the divided surfaces. It seems extremely difficult to conceive, how any addition of tube can be made to the extremity of a vessel pouring out coagulable lymph; and it is not easy to perceive by what means the open extremities of capillary vessels, previously existing in the vicinity of an inflamed surface, can be projected into the effused coagulable lymph. That it is a doubling, or fold of the continued canals, not the extremities of the capillaries, that is elongated and projected into the effused coagulable lymph, seems probable from the inspection of transparent membranes affected with inflammation. In these a number of new red vessels are always developed. We cannot suppose these vessels to be generated entirely *de novo*, for we perceive them to be so many continuations of the old vessels, and the shortness of the time in which they have appeared, does not admit of the supposition that they have been all newly formed. In the vessels which have been recently developed, we uniformly perceive each capillary artery has its corresponding vein. The same continuity of canal is to be seen also in injected granulations; but even though the granulations of newly effused coagulable lymph could be proved by experiment to be penetrated by the continued trunks of capillaries previously existing in the original parts, still we should be as much at a loss as ever, to understand in what manner the junction or inosculations of the vessels from the opposite granulating surfaces is effected. The term inosculation would lead us to suppose, that in this union the vessels join by open mouths. But this idea is probably erroneous; we no where find the extremities of the blood-vessels open; and in our most careful examination of inflamed surfaces, and of granulations, we trace only the continuation of canals. Even in recent wounds, where the

extremities of blood-vessels are open for a short time, there the inosculation is prevented by the effusion of coagulable lymph, and by the consequent closure of the open orifices of the vessels.

I have thus stated to you our ignorance of the process of inosculation, and some of the more obvious difficulties that present themselves in reflecting upon this curious and interesting process, because a knowledge of these difficulties seems to be a necessary step to the investigation of this important, though neglected, subject; and I conceive, that in surgery, as well as in other branches of philosophy, it is better candidly to state difficulties as they occur, and to acknowledge our ignorance, than to substitute hypothesis for fact in explaining the phenomena of nature.

From this account of the formation of granulations by the exudation of coagulable lymph, and its subsequent penetration by blood-vessels, it would appear, that whenever any part of the body has been divided by a wound, or destroyed by the progress of a deep-seated abscess to the skin, or by a tumour which has been cut out in such a manner as to leave a cavity or intermediate space, there is always a growth of new flesh in the cavity which is formed. But this growth of new flesh, which seems now so obvious, and which had been admitted by Galen, and by most of those who have written on this subject, was made, about fifty years ago, the subject of much controversy among surgeons, particularly in France.

"One party insisted, that in wounds, abscesses, and ulcers, there is always a growth of flesh of the same nature with that which has been divided or destroyed. If a muscle be cut through, or part of it destroyed, they asserted that the new flesh becomes muscular; if the same injury happens to a gland, the new substance becomes glandular; or if to a tendon, tendinous; and so on of all the different textures of which the body is composed."

"The other party were equally positive, that in wounds, abscesses, or ulcers, there is no growth of new flesh of any kind or quality whatsoever. They insisted that the cavities of wounds and of sores are obliterated, not by any new flesh arising from the bottom to the height of the skin, but by the parietes of the cavities of the wound or abscess shrinking to a level with the bottom, and, notwithstanding that they must often have been obliged in their practice to oppose

the exuberant growth of granulations by bandages and escharotics, yet nothing would compel them to swerve from their opinion, and to trust to the testimony of their senses. They exerted their ingenuity in proportion to the difficulties they had to encounter, and have displayed wonderful subtility in attempting to prove what one can now hardly conceive they believed."

"It would certainly," continues Mr. Moore, in his ingenious Dissertation on the Healing Process, which gained the prize medal of the Lyceum Medicum of London for the year 1789, "it would certainly be very different from the usual processes of nature to remedy the inconveniences resulting from the loss of an ounce of flesh, by causing the neighbouring parts to waste a quarter of a pound; but this is in effect what Messrs. Fabre and Louis have asserted and endeavoured to prove by long dissertations, to be found in the Memoirs of the Academy of Surgery at Paris."

"That there is always a growth of flesh of the same nature with what is destroyed by abscess, or divided in a wound, is certainly erroneous; but that there never is any growth of any kind is equally unfounded."

A very impartial perusal of the papers written in this controversy, has convinced me, 1st. that while Fabre, Pibrac, and Louis have erred in supposing that there is no new growth whatever in wounds and ulcers, yet that this growth of new flesh is far less considerable in quantity than has usually been imagined; 2dly. That the filling up of an abscess, and the process of re-union by the second intention, while they do not necessarily exclude the formation of a small portion of new flesh, are, even in the first instance, chiefly effected by the diminution and falling in of the surrounding parts; and, 3dly. That, even in cases in which a considerable portion of new flesh seems at first to be formed, the greater part of this new flesh, unless when it happens to be stretched over bones, is afterwards removed by the process of interstitial absorption. This is evinced, I conceive, in the contraction of granulations, and in the approximation of the edges of wounds in which there was at first much loss of substance.

The truth probably lies between these two opposite opinions, and it would form a curious and interesting subject of research, to endeavour to ascertain the different effects which follow in different situations, when the different parts or textures of the body are removed or divided; but this is

too extensive a subject, and one which would occupy too much of your time, to allow me to go into it minutely in the way of detail, or to enumerate even a small part of the experiments with which it has been already illustrated. Those who have most successfully prosecuted this branch of experimental inquiry are Murray and Otto Huhn, in prize essays printed at Gottingen in 1787.

The new substance of granulations, it may in general be remarked, is almost always less, though in some rare instances, greater in quantity than what has been destroyed. If, indeed, the opposite sides of the cavity, as in the wound made in the extirpation of a tumour, were to remain at the same distance from each other, that they were before the tumour was removed, then it is probable that the new flesh would cover an equal extent of surface with that which has been removed; but this never happens, for the sides of the cavity collapse, and tend to approach each other, and consequently a less extent of surface in the new parts is wanted to obliterate, or fill up this cavity, than what formerly filled it. The quantity of new matter, or at least the extent of its surface, depends then, in a considerable degree, upon the distance at which the sides of the cavity are kept from each other. If they are brought into close contact, the new parts are in small quantity; but if they are separated considerably, the growth of the new flesh will be proportionably greater; and hence I need scarcely remark to you the propriety, utility, and advantage in the practice of our art, of bringing and retaining parts which have been separated, as nearly as possible in contact.

It has been long known, that there are some parts or textures, in which this new flesh, or the matter of granulations, is more readily and quickly formed than in others. Cellular texture, for example, is a part of the body in which granulations seem to be quickly produced; but though granulations quickly appear in wounds, or abscesses which have their seat in this texture, and though, in the process of healing, these granulations gradually acquire an appearance resembling that of cellular membrane, we have still to learn, in the way of experiment and observation, in what respects the new cellular membrane, if indeed it deserves that name, differs from, and in what it agrees with the old. The new flesh occupying the place of cellular membrane, seems to be of a firmer consistence than ordinary cellular membrane.

Its cells, if indeed it contains any, do not appear to communicate with one another, for the cicatrices of wounds, of old sores, or of abscesses, are not filled with air in emphysema, nor with water in anasarca.

The cellular texture enters so largely into the composition of most of the other textures of the body, that in the divisions, or destruction of these other textures, it becomes a question whether the new flesh, or granulations that are formed, arise solely from the cellular membrane, or partly from that membrane, and partly also from the divided texture into the composition of which it enters. In the division of a muscle, for example, or the destruction of a portion of it by abscess, is the new flesh which is formed a product arising wholly from the cellular texture, which enters so largely into the composition of muscle, or is it in part derived from the muscular fibres which are imbedded in the cellular membrane? This is a question which in this particular instance does not seem to admit of an easy solution. The substance which is formed between the divided extremities of a muscle undoubtedly resembles very accurately that which is formed in divided cellular membrane, but it certainly does not, as Professor Bichat seems inclined to believe, follow from this, that the vessels which supply the muscular matter are incapable in the inflamed state of throwing out coagulable lymph, as well as those vessels which are more immediately destined for the nourishment of the cellular structure of the muscle. The new flesh or granulations formed between the divided extremities of muscle, never puts on the appearance, nor exhibits any of the distinguishing properties of muscular fibre. It serves to connect muscular fibres together, but it never itself seems to acquire irritability.

Cellular texture, or at least a substance very accurately resembling it, enters largely also into the composition of nerves. In the division of a nerve therefore, whether by wound or by abscess, it might in the same manner be asserted, that the new flesh is derived wholly from the cellular texture, and in no part from the vessel supplying the proper nervous matter. There has been much controversy respecting the regeneration of nervous matter, and the possibility of nervous re-union, and many experiments have been made by physiologists with a view to determine these still very obscure points in pathology. By all, it is agreed however, that

the divided extremities of a nerve may be re-united by a substance which has the cord-like appearance of a nerve; but it was not till of late years that it has been so clearly shown, that this substance contained true nervous or medullary matter. It is not sufficient to establish the reality of this regeneration, or rather formation of nervous matter, that the part which had been deprived of its sensibility by the division of the nerve, again recovers this property during or sometime after the complete re-union of the divided nerve, for this sensibility may not depend upon the re-union of the divided medullary nerve, but upon the growth, increase, or developement of other nerves in the neighbourhood of that which had been divided. This unquestionably might be the case, when the sensibility returns, as it sometimes does, even after the removal of a considerable portion of nerve, such a portion as to prevent the extremities from coming into contact.

The growth of nerves and their developement in new-formed flesh or granulations, is a subject of equal curiosity with the growth of blood-vessels in the same structure. Their existence in granulations is proved by the pain which is felt on our pinching, rubbing, or wiping, the surface of a sore. Even the granulations which arise from the surface of bone are sensible, though we are not very well able to prove the sensibility of the larger branches of nerves, from which the newly-formed and sensible nerves and filaments in the granulation are immediately derived. All the difficulties which I formerly mentioned to you, as occurring in the explanation of the manner in which coagulable lymph or granulations are penetrated with blood-vessels, present themselves the moment we begin to reflect on the manner in which the same granulations are provided with nerves, and these difficulties are still increased, when we reflect that the same granulations are in the course of a few hours provided, not only with blood-vessels and nerves, but also with a system of absorbents. The existence of absorbents in granulations, is proved not only by the changes of bulk which we see them daily undergo, becoming gradually in the healthy state smaller, firmer, and more compact, but also by the frequent disappearance, in whole, or in part, of a granulating surface, by the process of ulcerative absorption. I shall have occasion afterwards to mention to you, that not only are old cicatrices more liable to ulcerate

than the surrounding parts, but that newly-formed parts or coagulable lymph just formed into granulations, are exceedingly liable to undergo this process. It is this ulcerative action in the absorbents of newly-formed parts, which often proves the greatest difficulty we have to encounter in effecting the cicatrization of wounds and sores.

In the junction therefore, whether of cellular texture, muscle, or nerve, by adhesion or by granulation, arteries, veins, absorbents, and nerves are uniformly produced; but the production of new nerves, in particular, is no more a proof of the regeneration or nervous junction of the extremities which had been divided, than the penetration of the same lymph by blood-vessels is a proof that the closed extremities of the arteries on the divided surfaces are again opened, and that the circulation is immediately carried on by them, and not by the capillaries which have been formed or prolonged.

Granulations rise very readily from the surfaces of exposed or divided tendons and ligaments, and, in the case of division, often grow strong enough to be able to support the contraction of a muscle, or the motion of a joint, without laceration. When minutely examined, however, the appearance and structure of these regenerated parts in tendons or ligaments, are somewhat different from that of the parts in which they are formed. The fibres of the new parts are not so glistening and silver-coloured, and are not so regular in their direction; instead of the greater number of them running parallel to each other, there is more confusion in their arrangement. The new part is likewise somewhat thicker than the old, so that there appears a kind of knot where the division had existed.

The effect of division with the knife, or of abscess upon absorbent glands, is little known, and we are, if possible, still more ignorant of the effect of abscess or of wounds upon the structure of secreting glands.

Serous membranes which have been destroyed by abscess or by wound, I am inclined to think, may be restored. At least in some experiments in which I removed a portion of the pleura costalis, it appeared to me to be regenerated, as I was unable to distinguish easily the cicatrix from the surrounding parts; but this is a subject which still requires to be illustrated by experiment.

The periosteum, or at least a membrane very accurately

resembling it, is often restored, and the same thing has been asserted of synovial and of mucous membranes; but of the reproduction of these two textures, I confess I am exceedingly doubtful.

I have examined many cases of dislocated joints, in which a ligament resembling imperfectly the capsular or synovial had been formed, but I have no where seen any appearance of synovial membrane in the new joint, unless on the surfaces of the parts which were originally covered with it. Where synovia existed in the new joint, it seemed to me to have been formed by the membrane surrounding the head of the dislocated bone; not from that covering the surface of the new socket.

The examples which are usually given of the destruction and reproduction of mucous membranes, are, in my opinion, equally illusory. Parts of the external surfaces of the urethra, fauces, bronchi, and even intestines, have often been destroyed, and a new membrane, it is said afterwards formed fit for the offices of the old. That a thin portion or layer of the external surface of a mucous membrane may be removed by the knife, or destroyed by ulceration, without the secreting function of the part being destroyed, I will not pretend to deny: but when the wound or ulceration has removed the whole secreting surface and penetrated to the subjacent texture, I doubt much whether the mucous membrane be ever regenerated. Indeed, I am inclined to think that it never is. In this, as in the case of a wound on the surface of the body, the new granulations may diminish and the surrounding mucous membrane elongate, so as to cover the surface which has been abraded; but that the granulations themselves ever acquire on their surface the property of secreting mucus, is a fact so contrary to the usual œconomy of nature with regard to secreting organs, that nothing but the result of the most accurate and well conducted experiments or observations could justify us in believing it.

ULCERS.

In all the various situations and textures in which granulations form, they may have more or less of a healthy or unhealthy appearance. Healthy granulations are small in size, of a firm consistence, and pointed; they are of a florid red colour, are set very close to one another, and are but little disposed to bleed, unless when they are very roughly handled. "The colour," Mr. Hunter remarks, p. 478, "of healthy granulations is of a deep florid red, which would make us suspect that the colour was principally owing to the arterial blood;* but it only shows a brisk circulation in them, the blood not having time to become dark.

"When naturally of a livid red, they are commonly unhealthy, and show a languid circulation; which appearance often comes on in granulations of the limbs, from the position of the body, as is evident from the following case.

"A stout healthy young man had his leg considerably torn, and it formed a broad sore; when healing it was some days of a florid red, and on others of a purple hue; wondering what this could be owing to, he told me when he stood for a few minutes it always changed from the scarlet to the modena. I made him stand up, and found it soon changed. This plainly shows that these new formed vessels were not able to support the increased column of blood and to act upon it; which proves that a stagnation of blood was produced sufficient to allow of the change in the colour, and most probably both in the arteries and veins.

"These sores never heal so fast as the others, whether it is occasioned by the position of the body, or the nature of

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* "I once suspected that the air might have some influence upon the blood when circulating in the vessels, but from its losing that florid colour in sores of the leg by standing erect, I gave up that idea."

the sore itself; but most frequently so in cases of the last-mentioned kind. As the position of the body is capable of producing such an effect, it shows us the reason why sore legs are so backward in healing, when the person is allowed to stand or walk.

"Granulations, when healthy, and on an exposed or flat surface, rise nearly equal with the surface of the surrounding skin, and often a little higher; and in this state they are always of a florid red; but when they exceed this, and take on a growing disposition, they are then unhealthy, become soft and spongy, and without any disposition to skin. Granulations are always of the same disposition with the parts upon which they are formed, and take on the same mode of action. If it is a diseased part, they are diseased; and if the disease is of any specific kind they are also of the same kind, and of course produce matter of the same kind, which I observed when on pus.

"Granulations have the disposition to unite with one another when sound or healthy; the great intention of which is to produce the union of parts, somewhat similar to that by the first intention, or the adhesive inflammation, although possibly not by the same means.

"When the parts are unsound, and of course the granulations formed upon them unsound, we have not this disposition for union, but a smooth surface is formed, somewhat similar to many natural internal surfaces of the body, and such as have no tendency to granulate; which continues to secrete a matter expressive of the sore which it lubricates, and in some measure prevents the union of the granulations. I imagine, for instance, that the internal surface of a fistulous ulcer is in some degree similar to the inner surface of the urethra, when it is forming the discharge commonly called a gleet. Such sores have, therefore, no disposition in their granulations to unite, and nothing can produce an union between them but altering the disposition of these granulations by exciting a considerable inflammation, and probably ulceration, so as to form new granulations, and by these means give them a chance of falling into a sound state.

"Granulations are not endowed with the same powers as parts originally formed. In this respect they are similar to all new-formed parts; and it is from this cause that changes for the worse are so easily effected. They more readily fall

into ulceration and mortification than originally formed parts; and from their readiness to ulcerate, they separate sloughs more quickly.

"The granulations not only show the state of the part in which they are formed, or the state in which they are themselves, but they show how far the constitution is affected by many diseases. The chief of those habits which affect the granulations in consequence of the constitution, are, I believe, the indolent and irritable habits, but principally fevers, and these must be such as produce universal irritation in the constitution.

"The unsound appearances of the granulations show to what a stand the animal powers are put on such occasions, which does not appear so visibly in the originally formed parts; it is therefore evident that the powers of the granulations are much weaker than those of the original parts."

All suppurating and granulating surfaces, whether produced by a wound, by a burn, by an abscess, by mortification, or by ulcerative absorption, in which the granulations formed do not show a disposition to become covered with a new skin, pass into that state which has been denominated an ill-conditioned sore, or ulcer.

The word ulcer, though in common use, is not easily defined. It has sometimes been used in a more extensive, and at other times in a more limited sense; but I do not know of any definition of ulcer that is altogether free from objections. By some it has been defined to be a solution of continuity in the solid parts of the body, accompanied with the discharge of a purulent fluid. According to this definition the term ulcer is synonymous with the words, sore, suppurating wound, and open abscess. But this use of the term ulcer is obviously too general and indefinite. By others the term ulcer has been employed to express only those solutions of continuity from which an ichorous, sanious, or vitiated matter is discharged, attended with a loss of substance in the part. This is perhaps the nearest approximation which has yet been made to a correct definition of an ulcer. Yet, according to this definition, every suppurating wound and abscess become ulcers whenever they begin to give out a vitiated pus; and every ulcer ceases to be one when the discharge from it becomes healthy pus. It is obvious also, that, according to this definition, there can be no such ulcer as that which has usually been described by the name

of the simple, purulent, and healthy ulcer. The addition of the clause "attended with a loss of substance" adds greatly to the correctness of the definition; as we never give the name of ulcer to that inflamed state of mucous membranes in which they yield a purulent, unhealthy, or vitiated discharge, unless there be at the same time a loss of substance from ulceration in these membranes.

The causes of ulcers are extremely various. Some of these causes operate more, others less directly; some are limited in their operation to the parts to which they are immediately applied, while the influence of others extends to the general system: and hence a distinction of ulcers, which is in common use, and which must ever continue to be made of ulcers, into local and constitutional. It is only, however, within certain limits that even this distinction is well founded; for an ulcer, which was at first completely local, may in time affect the system so as to become constitutional; and ulcers, which derived their origin from some general affection of the system, may remain after the constitutional affection has been removed by which they were originally produced.

When an ulcer arises from an internal cause, it is the immediate effect of the process which I have already described to you by the name of ulcerative absorption; but when a wound, a burn, or an abscess, degenerates into the state of an ulcer, it is by no means necessary that the process of ulcerative absorption should in any degree whatever have taken place. A suppurating surface, when it is long in healing, or when it is changed from an healthy to an unhealthy state, may, according to the use that is at present made of the term ulcer, become an ulcer without the process of ulceration having ever been induced. Every suppurating surface, or abscess of long continuance, may, in this extended sense, be regarded as an ulcer; at least the period at which they cease to be wounds or abscesses, and become ulcers, is not very distinctly marked. So true, indeed, is this, that in defining and in classifying ulcers, authors have always found it necessary to set out from a healthy state of the suppurating surface; or, in other words, to begin the consideration of the subject of ulcers, with what they term a healthy or a simple purulent ulcer.

Ulcers have usually been distinguished from each other, as Fallopius very justly remarks in his treatise upon this

subject, by the causes by which they are induced, by the symptoms which they exhibit, and by the parts of the body in which they occur. The want of a disposition to heal in a suppurating surface may depend upon some specific action in the cause from which it proceeds, upon something peculiar in the constitution of the patient in whom it exists, or merely upon an improper mode of management: and hence the distinction that has long been made of ill-conditioned sores or ulcers, into those which are specific in their nature, and into those which are simple.

Specific sores or ulcers may be occasioned by specific poisons, or by particular diatheses. The sores or ulcers which arise from specific poisons, may be either local, that is, confined, like a primary syphilitic ulcer, to one spot; or constitutional, that is, liable to occur in any part, texture, or organ, such as secondary syphilitic ulcers. Of diatheses predisposing to ulcers, we have examples in the scrofulous, scorbutic, and arthritic diatheses, and also in the syphiloid diathesis, or that which arises not unfrequently in those who have had syphilis, from the too free and injudicious use of mercury.

Every ulcer, strictly speaking, is of a local nature; but there are ulcers which, though necessarily local in their appearance, are connected with, or dependent upon, diseases which affect the general system. These ulcers ought to be regarded as modifications of, or forms in which the diseases appear with which they are connected. Considered in this light, it is obvious that specific ulcers can be treated of with propriety only under the head of the diseases to which they respectively belong.

We call those sores or ulcers simple, which do not appear to proceed from any specific disease or morbid diathesis existing in the constitution of those in whom they take place. They are usually solitary occurrences, and the consequences of accidental injuries and improper modes of management. They may occur in every part of the body, but they appear most frequently upon the lower extremities. In saying that they do not appear to proceed from any specific disease, or morbid diathesis, it is not by any means my intention to say that they are not often connected with, or dependent upon, peculiarities of constitution. But these peculiarities must be such, as are neither obvious in their nature, nor capable of being accurately defined; for the mo-

ment they become so, they give a specific character to the ulcers which are formed. Between the simple suppurating surface which has been recently produced in a healthy constitution by a wound or a burn, &c. and which shows a tendency to heal, and those states of suppurating sores which manifest but little, if any, disposition to cicatrization, a great variety of morbid phenomena occur which it is necessary to distinguish from one another, because they often require different, and, in some respects, even opposite modes of treatment.

The appearances which different ulcers exhibit, seem, at first view, to afford an excellent foundation for distinctions among them ; and so they undoubtedly do in many respects. Surgeons have accordingly endeavoured to observe, arrange, and classify the various morbid appearances which occur in ulcers, and to give to these appearances appropriate and peculiar names. It is probable that every morbid affection to which the human body is liable, possesses characters, or exhibits appearances, which are peculiar to itself. To discover these appearances in the symptoms of diseases, and in the various modes of their commencement, progress, and termination, is at all times the great object which the scientific practitioner proposes to himself. It is to be regretted, however, that the characters upon which the distinctions of ulcers, as well as of many other local diseases, are founded, are neither very uniform in their appearance, nor very easily distinguishable from one another. Not only are the local appearances which present themselves in simple ulcers liable to great variations in the different stages of the same individual affection, but they are often apparently the same with, or at least not easily distinguishable from, those which occur in specific diseases, and which require for their cure peculiar modes of treatment. It is this circumstance which renders it so necessary for us, in endeavouring to distinguish and to cure ulcers, to avail ourselves of all the information which we can procure from the history of the ulcer, from the nature of the exciting cause by which it has been induced, and from the effects of the remedies which have been employed, as well as from the particular appearances which the ulcer itself exhibits. But though the distinctions which are taken from the appearances of ulcers, may not at all times enable us to distinguish those which are simple in their nature, from those which

arise from specific causes, they are by no means to be regarded as unimportant or useless; for it will be found, I believe, that similar appearances in ulcers require in general, though not always, the same local applications, and similar modes of management, whether the ulcers be of a simple or specific nature.

The third ground of distinctions among ulcers, is that which is taken from the parts in which they occur. Every texture and organ of the body possesses physical and vital qualities peculiar to itself; and these qualities must necessarily modify the appearances which each texture and organ respectively exhibits in the state of disease. Specific diseases render some parts more liable than others to attacks of ulceration. Thus, secondary syphilis appears most frequently in the throat, scurvy in the gums, cancer in the lower-lip, and lupous and scrofulous ulcerations in the upper-lip or in the nose. Cancer seldom or never appears primarily in the upper-lip; but syphilis, when it attacks this part, puts on many of the appearances of cancer; a fact which I first learned from Mr. Pearson of the Lock Hospital, and which I have since had several opportunities of confirming.

It has been long known, that when a suppurating surface is produced on the lower extremities by wound, burn, frostbite, contusion, ulcerative absorption, abscess, mortification, or by any other cause, that this surface is, *cæteris paribus*, longer in healing than an equal extent of suppurating surface would have been in any other part of the body. This backwardness to heal, therefore, in ulcers of the legs, depends probably upon something in the position or structure of these parts, as well as upon the irritation arising from the use which is made of the limbs, or the position in which they are placed. The blood, in returning from the lower extremities, is obliged to ascend contrary to its own gravity. The effect of this, in filling and distending the veins, can be shown by an easy experiment. Let the arm hang by the side for one minute, and the veins of the hand and wrist will swell out; raise the arm, and this swelling will gradually disappear, till at last, if the arm be brought perpendicular to the body, a degree of hollowness will appear in the site of the larger veins. The same retardation to the return of the serous lymph in the absorbents, which takes place in the return of the blood, must necessarily oc-

cur ; and this is probably the reason, why even the slightest injuries of the lower extremities are accompanied with a considerable degree of œdematous swelling. The vessels in the legs, even of people in health, are fuller in the evening, or after having taken much exercise, than in the morning. If kept long in the same dependent situation, the legs become œdematous ; and this tendency to œdema is, in the course of the limbs, much increased by pressure applied so as to add to the difficulty which the blood and lymph have in returning to the heart. A greater or lesser degree of œdema is an attendant upon almost every inflammatory complaint ; but this is always much increased by a dependent, and may be relieved by a horizontal or ascending posture. The difficulty, therefore, which occurs in healing sores of the lower extremities, probably arises more from their depending situation, than from the actual distance of sores on these parts from the heart.

Mr. Home, in his Practical Observations on the Treatment of Ulcers of the Legs, mentions several facts which seem to prove that ulcers are more common in tall than in short men ; and that ulcers of the legs heal with more or less difficulty according as they are seated nearer to, or more remote from, the feet. But besides the difference with regard to the production of ulcers, depending on the size of the person in whom they occur, there are other causes of difference which, though no less certain in their effects, are not so easily ascertained. In addition to the effects resulting from the manner, in which the ulcerated limb is treated, and the position in which it is placed, a great variety in the appearances of ill-conditioned sores or ulcers will be produced by peculiarities of constitution, some of which may be apparent, though most of them are in general of a nature which is by us quite inappreciable, and of course incapable of being referred to any thing like general disease, diathesis, or temperament. Upon this subject, Mr. Home very justly remarks, that as no two constitutions are exactly alike, so it happens that an ulcer on the leg has not in any two persons exactly the same characters ; for, whatever general resemblance one may have to another, there will be found also some peculiarities by which they may be distinguished.

Besides the dependent position, and the increased resistance to the return of the blood, another circumstance,

which may contribute to the slow healing of ulcers of the legs, is the irritation arising from the motion or use which is made of these parts. But the effect even of this motion is different in different persons, and in different species and varieties of ulcers. If the limb be kept at rest when in the perpendicular position, it is found to swell more in some cases than if within certain limits it had been in motion, the contraction of the muscular fibres appearing to possess a considerable power in propelling forwards the blood and lymph.

Suppurating surfaces, unconnected with any specific disease in the constitution, may occur on the legs as well as other parts of the body, from external or from internal causes. Among the external causes we may rank contusions, wounds, burns, and the application of every substance capable of exciting inflammation. Among the internal causes we ought probably to rank the predisposing causes. Of these we have not only the distance from the heart, and retrograde motion of the blood, but peculiarities of constitution, such as temperaments, diatheses, and idiosyncracies; which often become manifest only from the effects to which they give rise. Thus the slight scratch, or excoriation, which in one person will heal without any trouble, in another, though placed in circumstances precisely alike, becomes a disagreeable and troublesome ulcer. An ulcer, also, which is produced in the leg of a person of a scrofulous diathesis, though the disease may never have appeared in the general system, often discovers a backwardness to heal, and in some instances exhibits symptoms that are peculiar to itself. The age, mode of life, and habits of the patient, are circumstances also which will modify the appearances, and tend to increase the tedious healing and obstinacy of ulcers. Thus, the aged, the sedentary, and the dissipated, are known to be more liable to ulcers of the lower extremities, than the young, active, and sober.

There are no suppurating surfaces upon which we can in general observe, with so much advantage, the phenomena attending the exudation of coagulable lymph, the process of suppuration, the formation of granulations, the processes of sloughing and of ulcerative absorption, and the variations to which, from accidental attacks of inflammation, these processes are subject, as the surfaces of old sores or ulcers of the legs. Instead, therefore, of being passed over with neglect, as they

usually are by young men in their first attendance upon public hospitals, they are, next after the healing of wounds and abscesses, the appearances to which they ought in a particular manner to direct their attention. They are the surfaces in which they can best see the various changes which occur in the general process of healing; and they are the suppurating surfaces also which they will afterwards find in practice to be the most troublesome to heal, and to preserve in a sound state. It is in the management of ill-conditioned sores and ulcers, whether of a simple or specific nature, that the daily and ordinary duties of the surgeon consist, and it is by his success in treating them, that his skill in practice will be judged of by his employers. Out of twenty surgeons who can perform all the operations in surgery with the requisite dexterity, you will not probably find more than one who can treat properly the ill-conditioned sores or ulcers, in which even the wounds necessarily inflicted by operation sometimes terminate.

The two works in the English language, from the perusal of which such of you as have not studied this branch of surgery are likely to derive the most advantage, are, in my opinion, the Treatise on Ulcers by the late Mr. Benjamin Bell, and the Practical Observations on the Treatment of Ulcers of the Legs by Mr. Home. The descriptions, in particular, which Mr. Home has given of the diseased appearances to be obseved on the surfaces of ulcers, are faithful delineations from nature, and cannot fail to be of great use to you in studying and in describing these phenomena. The nomenclature used or the names given to ulcers by Mr. Bell, is that which has been followed by almost every surgeon from the time of Fallopius to that of Mr. Hunter. An entire new nomenclature of ulcers has been proposed by Mr. Home, and has been adopted by several succeeding authors. I confess, however, that I am partial to the old nomenclature, because I am satisfied that in all the general treatises which have hitherto been published upon this subject, you will find merely the same trains of morbid appearances described, the same varieties or species of ulcers. The syphilitic and the syphiloid are the only new species of ulcers with which, in modern times, we have become acquainted; and every practitioner of experience is fully aware of the difficulty which exists in distinguishing them,

merely by the appearances which they exhibit, from simple ulcers.

The ulcers termed simple purulent by Mr. Benjamin Bell, Mr. Home denominates ulcers in parts which have sufficient strength to carry on the actions necessary for their own recovery; or, more shortly, healthy ulcers. In reading the descriptions which have been given of these ulcers, you will perceive that they differ in no respect from healthy suppurating surfaces, unless in having their seat on the lower extremities. Wiseman, in speaking of this species of ulcer, makes the following remark: "Among the various and sundry sorts of ulcers that happen daily under my care, I find it difficult to make out one simple ulcer, as authors have described it to us, without other symptoms or effects joined to it. Every ulcer having somewhat of distemper till it be digested and brought into a healing condition. In which regard we shall call that a simple ulcer which hath fewest accidents attending it."

Mr. Bell calls his second species of ulcers, the simple vitiated. These Mr. Home terms ulcers in parts whose actions are too violent to form healthy granulations, whether this arises from the state of the parts, or of the constitution; more shortly, irritable ulcers. This is probably the first variation from the healthy state of a suppurating surface, to which the name of an ulcer or ill-conditioned sore ought to be given. It is that state, in which the parts surrounding the ulcer, the surface of the ulcer itself, and the discharge which it emits, always differ more or less from those of healthy suppurating surfaces. Mr. Bell characterises this species of ulcer chiefly by the vitiated state of the discharge. Mr. Home, again, ranks all ulcers under the denomination of irritable, which require sedative applications for their cure.

The inflammation which supervenes to a suppurating sore on the leg, or to a simple healthy ulcer, as it is called, may be more acute or chronic in its nature; it may partake more or less of a phlegmonous erysipelatous, or gangrenous character; it may supervene in the recent, or non-recent state of the suppurating surface; and the effects of this inflammation, the phenomena which it exhibits, and the means which will be required for its cure, must vary according to the circumstances which I have enumerated. Other variations in the inflamed state of the suppurating surface

will be induced by the nature of the previous treatment, by peculiarities of constitution, and by the circumstances, more or less healthy, in which the patient is placed. These are all circumstances which must necessarily modify the appearances of the simplest form in which an inflamed suppurating surface, or, as it has been termed, simple vitiated or irritable ulcer, can occur; and circumstances which will demand our attention, whether we attempt to describe or to cure it.

When inflammation supervenes to a recent simple purulent ulcer, this ulcer may return back, after the inflammation has subsided, to its former state, or to one nearly resembling it; but when inflammation has supervened to a non-recent, or to an old ulcer, the removal of the inflammation will not necessarily be followed by the passage, if I may be allowed the expression, of the ulcer to the state of a simple purulent or healthy ulcer; but in some instances it may return to the same, and in others pass to a worse state than that in which it existed previously to the attack of inflammation. Every kind of ulcer on the lower extremities, whether simple or specific, is liable to be attended with more or less inflammation; and when we speak of the treatment of the inflamed or irritable ulcer, we should always remember that the presence of a certain degree of inflammation is the chief, if not the only circumstance, in which vitiated or irritable ulcers may happen to coincide. It is the inflammatory state, therefore, in the treatment of this variety of ulcer, to which our attention ought to be first and chiefly directed, and when this state has been removed by proper remedies, or modes of treatment, we must then vary our treatment of the ulcer, according to the prevailing character, disposition, or appearances of the ulcer which remains.

The state of the discharge is an extremely variable phenomena in ulcers, and one which it is at all times difficult to ascertain and describe. The principal deviations in this discharge, from the state of a healthy purulent fluid, which have been observed by practical authors, you will find expressed by the terms ichor, sanies, and sordes; but you will not find that very accurate or precise ideas have always been annexed by practical authors to the use of these terms. By ichor, however, is usually meant a thin acrimonious discharge; by sanies, a fetid, ichorous, and purulent discharge, mixed with some of the red globules of the blood; and by sordes, a viscid, glutinous kind of matter which fre-

quently covers the surfaces of foul sores. The qualities of the discharge from ulcers, as well as the appearances of the ulcers themselves, are very readily changed by whatever affects the general state of the health. We know at present little or nothing of the chemical composition of these substances. Its investigation has been commenced by the late Dr. Adair Crawford, in the analysis which he made of the matter discharged from cancerous sores.

In some cases, the state of inflammation in the surface of an ulcer is followed by an excess in the growth of granulations; in others by the death or sloughing of the granulations, and of the parts which surround them; and in others, again, portions of the surface and edges of the ulcers are removed by the process of ulcerative absorption. The extremes of these states from sores which are termed fungous, putrid, or sloughing, and ulcerative, or phagedenic ulcers. In most instances, however, the surface of an old sore upon the legs manifests but little disposition, after it has suffered an attack of inflammation, to pass into the states of granulation or of ulceration. It often remains long in a stationary condition, forming what has been termed an indolent or callous ulcer.

When the granulations on the surface of an ulcer, instead of being small, red, and firm, become large, pale, loose, soft, and flabby; and when, instead of rising to, and remaining on a level with, the surface of the skin surrounding them, these granulations rise above that level; the appearance which they exhibit is termed a fungous ulcer, or ulcer with hypersarcosis. This is the ulcer in parts that are too weak to carry on the actions necessary for their recovery of Mr. Home, and the over-acting ulcer of Mr. Burns. I regard the old name, of fungous, as less exceptionable than those which have been substituted in its room. It involves no hypothesis respecting the state or action of the vessels, and merely expresses the fact, that in some suppurating surfaces the granulations are spongy in their consistence, and too luxuriant in their growth.

When the edges of the skin surrounding an ulcer become thick, prominent, smooth, and rounded, and when the bottom of the ulcer is covered with smooth and glossy raw flesh, which can scarcely be said to be raised into granulations, the sore is termed a callous ulcer. This is the ulcer denominated by Mr. Home, ulcer in parts whose ac-

tions are too indolent to form healthy granulations. You will find that, under the name of callous or indolent ulcer, authors have included by far the greater number of the ulcers which affect the lower extremities. This is the ulcer which, of all the varieties to be mentioned, is perhaps that which is most deserving of your attention; for the callous or indolent state, is a state to which almost all ulcers of the lower extremities have a tendency to pass, and in which they often continue stationary, or nearly so, for months, or even for years. Most of the general rules which have been laid down by practical authors, respecting the treatment of ulcers of the legs, and most of the improvements which have of late years been introduced into this branch of surgery, relate chiefly, if not solely, to the treatment of callous or indolent ulcer. The parts surrounding this ulcer may be inflamed or uninflamed. If uninflamed, the ulcer is simply a callous ulcer; but if inflamed, it then becomes a callous ulcer in an inflamed, vitiated, or irritable state. This last is the state, in which most patients affected with ulcers of long standing apply to medical men for advice and assistance. It is the state in which you will almost always find patients affected with this complaint, upon their first admission into our public hospitals.

There are two varieties in callous ulcers to which distinct names have been given. In one of these, the ulcer is connected with one or more apertures leading into hollow suppurating cavities, which forms what has been sometimes termed a fistulous, and at other times a sinuous ulcer. This hollow cavity, fistula, or sinuous ulcer, like the surface of the sore with which it is connected, may exist in different states, varying between the inflamed and the callous. The other variety of callous or indolent ulcer, is that in which the symptoms of this ulcer are connected with a permanently enlarged, or, as it has been termed, varicose state of the veins of the limb, on which the ulcer exists. This, the varicose, is a very obstinate form of ulcer, and baffles often the best directed efforts of our art.

The surface of ill-conditioned suppurating sores and ulcers of the legs is often covered with sloughs. These sloughs are of various kinds, and, in the description which we give of any ulcer, will require to be distinguished as carefully as possible from one another. In some instances they seem to be formed of exudations of coagulable lymph, or of this

lymph, with an admixture of pus, in other instances of newly-formed granulations which have become dead, and in other instances, again, of greater or smaller portions of the surrounding and contiguous parts, which have passed through the states of gangrene and sphacelus. This is a state of suppurating surfaces which exists in scurvy and in malignant ulcer, or, as it has also been termed, hospital gangrene. Ulcers covered with sloughs, have, by the older surgeons, been denominated putrid. Neither Mr. Bell nor Mr. Home have given any distinct name to the ulcers which exhibit this particular appearance. Mr. Home, however, has given the following description of this species of ulcer, which you will find at page 204.

"There are indolent ulcers which occur in patients of debilitated constitutions, that put on a sphacelated appearance (even after they have made some progress towards a cure,) without any apparent cause, and in this way spread to a very large size. This unpleasant change must be the consequence of weakness in the newly-formed parts, and some indisposition of the general system. The varieties of this kind that will be necessarily met with in different patients must be very great; and among them there will be some, which, were they classed according to their appearances, would be generally allowed to belong to the species of irritable ulcers: but as they do not recover under soothing applications, they cannot, according to the principles that have been laid down, be separated from the species of indolent ulcers, of which they appear to be an uncommon variety. They occur in seamen and land-troops which have been long at sea; and, when met with in that class of men, have been called scorbutic ulcers. They are not, however, in any way necessarily connected with the sea-scurvy, being but too frequently met with on shore in patients who have never been affected by that disease.

"They are frequently met with in the West Indies, in soldiers who had lost their health from the effects of climate; they are not uncommonly met with in the London hospitals, in men whose general health has been impaired by the free use of spirituous liquors; and therefore ought to be considered as not belonging to any specific disease, but as common to men whose constitutions are greatly debilitated, whether by salt provisions, the effect of warm climates, or the use of ardent spirits."

There is great reason to believe, that under the term putrid, sloughing, foul, and malignant ulcers, practical authors have included several kinds of ulcers which differ greatly in their nature from one another, and which require, for their cure, very different modes of treatment. To this head have probably been referred all ulcers, whether simple or specific, the surfaces and edges of which have shown a tendency to pass into the states of gangrene and sphacelus. This tendency to gangrenous inflammation may be the effect of peculiarity of constitution; it may arise from unknown states of the atmosphere, which seem in different climates, and in different seasons of the same climate, to give different degrees of gangrenous tendency to external inflammatory affections; or it may be produced by morbid diathesis, or by specific poisons. These are all causes of sloughing in ulcers, which require to be carefully distinguished from one another. Much, however, is still wanting to complete our knowledge of this subject; but you will find a great deal of useful information, with regard to the exciting causes of gangrenous inflammations, in scorbutic and in malignant or contagious ulcers, contained in the writings of Drs. Lind, Blane, and Trotter.

Sloughing in ulcers is often connected with a disposition to ulcerative absorption, and large portions of the surface of an ulcer, as well as of the parts surrounding it, are often removed partly in the way of sloughing, and partly in the way of ulceration. In almost all the varieties of ill conditioned sores or ulcers which I have hitherto mentioned, instead of a loss, there is an addition of substance; but in this variety the absorbents always remove greater or smaller, though distinct portions of the solids. This is the depascent or phagedenic ulcer of many practical authors. It is the ulcer in which ulceration occurs, and which might, on that account, be denominated the ulcerative ulcer. Phagedenic ulcer may occur from irritation, from syphilitic infection, or from the use of mercury. Sloughing and phagedenic ulcers are almost always attended with severe febrile symptoms, and with derangements of the digestive and biliary organs.

The removal by sloughing, or by ulceration, of the soft parts covering the bones, may produce the kind of sore usually denominated a carious ulcer. The effects of the inflammation which occasionally attacks the old ulcers of the legs,

and which is accompanied by an enlargement of these parts, is often communicated to the periosteum and bones, occasioning a deposition of bony matter. I have repeatedly found the fibula, in particular, greatly enlarged in cases where the ulcer had been situated above the external maleolus; and in some instances, where the ulcers have been of large size, and often attacked with inflammation, I have found not only the fibula enlarged, but the greater part of the interosseous ligament converted into bone.

Specific ulcers pass through all the different states or variations which I have described as occurring in simple ulcers. We have frequent opportunities of seeing this in syphilitic ulcers, whether of a primary or secondary nature; and it is this diversity in the appearances of these ulcers which renders it so necessary to vary the external applications that are made to them, according to the prevailing character or appearances of the ulcer, and according to the particular effects which, in individual cases, the external applications produce.

The treatment of simple, purulent, or healthy ulcers of the legs, differs in no respect from that of healthy suppurating surfaces situated on any other part of the body, except in what relates to rest and confinement to the horizontal posture. The simple healthy wound, burn, or sore of the leg, which would have been healed up in the course of a few days, during rest in the horizontal position, is often converted, by exercise, or simply by standing in the erect position, into the inflamed, vitiated, or irritable ulcer: or, by repeated atttacks of inflammation, and imperfect cures, into the callous indolent ulcer. We should, therefore, in the treatment of simple, purulent, or healthy ulcers of the legs, always recommend rest in the horizontal position. In this situation there are three applications under which this ulcer in general heals very readily. These are a common emollient, or suppurating poultice, dry charpee, and adhesive straps.

The poultice is to be preferred to the charpee or straps in those cases in which there is a tendency to cutaneous inflammation. In dressing an ulcer with dry charpee, we cover the edges of the ulcer with slips of linen, spread over with cerate or some mild ointment, before we lay on the charpee, which is applied only to the middle of the suppurating surface. The interposition of the ointment prevents

the dressings from drying and adhering to the edges of the ulcer; and, by allowing them to separate readily, prevents also much of the irritation and pain which these dressings would otherwise occasion. Over the charpee, we lay a pledget of cloth spread with cerate; then compresses of lint; and last of all, we apply the circular roller or bandage. This was the common way of dressing almost all ulcers till within these few years, when the third means to be mentioned, the adhesive straps, began to be employed. These straps have but one inconvenience; they sometimes occasion cutaneous inflammation; and, when this is the case, the common poultice, or dry charpee dressings, are to be preferred.

If the horizontal position be necessary in the cure of simple healthy ulcer of the leg, it is still more so in that of the inflamed, vitiated, or irritable ulcer. When this ulcer is accompanied with a high degree of inflammatory action, cloths dipt in a solution of the acetite of lead, or a poultice made with this solution, often produce great relief from pain. The poultice should be renewed three or four times in the course of the day. Sometimes the cold, and at other times the warm poultice, agrees best with the state of the ulcer and the feelings of the patient. It is in the first and more active stages of the inflammation chiefly, that the cold poultice seems to answer best. The feelings of the patient, however, are often in this, as in many other cases, the best guide which we have in regulating the temperature of external applications.

The decoction of poppy-heads, used in the way of fomentation, the carrot, turnip, and hemlock poultices, all produce excellent effects in many varieties of irritable ulcer. Notwithstanding all that has of late years been said against the use of poultices in the treatment of ulcers, I confess that I am still very partial to their use, in a great proportion of the morbidly inflamed and irritable states into which ulcers are so liable to pass. I have often seen irritable ulcers heal up under their continued application, which had resisted all other means of cure.

It is in the treatment of this ulcer, that practitioners have so often remarked the benefit which arises merely from change in the applications which are made to it. Indeed few ulcers of any kind continue to heal beyond a certain time under the continuance of the same mode of treatment.

I need scarcely remark to you, that blood-letting from

the arm may be required in the treatment of an inflamed and vitiated ulcer, if the patient be young and plethoric, and a high degree of vascular action occur. These ulcers, however, occur most frequently in individuals who, in general, stand more in need of purgatives than they do of blood-letting. The purgative may be of some neutral salt, calomel, jalap, or aloes, according to the state of the inflammation, and according as there is more or less of a bilious tendency in the chylopoietic organs. Have purgatives, by evacuating the fæces, a mechanical effect in taking off resistence to the return of the blood from the lower extremities? Ulcers are said to be more common upon the left than on the right leg. Is this owing to the same cause, or to an original weakness? I have seen the best effects from the use of emetic tartar, in these spontaneous vitiations of ulcers which frequently occur in hospital practice, and which are usually accompanied with, if they be not dependent upon, disorders in the digestive organs. A grain of this salt may be dissolved in twelve ounces of water, and a table-spoonful of the solution given every hour, till it produces purging or vomiting. During the attack of inflammation, an emollient or saturnine poultice forms, in general, the best application to the ulcer. If the inflamed ulcer be of a recent origin, it usually passes, after the inflammation has been subdued, to the state of a simple suppurating surface; but, if it be an ulcer of long standing, or one that has undergone repeated attacks of inflammation, it passes most frequently, after the inflammation has subsided, to the state of a callous or indolent ulcer, the state so well known by the name of old sores of the legs.

The mutual conversion of these ulcers into each other is well expressed in the following paragraph, which you will find at page 186 of Mr. Home's Observations.

"It may, on the first view, appear strange, that the irritable and indolent ulcers, which are so very opposite in their nature, should ever have the slightest resemblance; but when it is considered, that ulcers change their appearances very readily, according to variations in the state of the constitution, or any accidental circumstance which may have affected the parts, it will be readily comprehended. An indolent ulcer, after any violent exertion of the limb, will have more or less of an irritable appearance. If the patient is exposed to cold, and kept without wholesome

food, similar changes will be produced. Under any temporary constitutional indisposition, the ulcer will spread, and be for a time in an irritable state."

The callous or indolent ulcer passes, as I had formerly occasion to remark to you, very readily into the vitiated, irritable, or inflamed; and it is in this state that those affected with callous ulcers usually apply to medical practitioners for relief. In the inflamed state it must be treated as a recent vitiated or irritable ulcer. It is in the callous or indolent state only, that any particular or different plan of treatment seems to be required. In this state, local stimuli of various sorts have been employed, and have frequently been found useful.

Ointments containing resin or oil of turpentine in their composition, to which a small portion of some metallic oxyde or metallic salt has been added, were, till very lately, the most approved applications in the management of callous ulcers. Every variety and form of these stimulating ointments had its partizans and recommenders among practitioners; but the truth is, that this kind of ulcer occasionally got well, under every diversity in the form and composition of the ointments employed. Besides ointments somewhat stimulating in their nature, bandages of different sorts were found useful. The laced stocking was much used, and is particularly recommended by Wiseman. It is, however, in appearance only that this mode of bandaging in the ulcerated or varicose legs has any advantage over that by the common circular roller. The use of the circular bandage, with dressings composed of unguentum resinosum and red oxyde of mercury in different proportions, was some years ago recommended in a particular manner to the attention of the English public, in a very useful Treatise which Dr. Underwood published upon the Treatment of old Ulcers of the Legs. He allowed his patients to go about their ordinary occupations, under this mode of treatment, first, Because it was inconvenient for many of them to be confined; and, secondly, Because it was found that many of those patients whose ulcers were healed up during rest, broke out again as soon as they began to take exercise. Wiseman, who made much use of red precipitate in the cure of ulcers, says it is one of the best anodynes in painful ulcers. It must be acknowledged, that many ulcers do get well under the mode of management recommended by Dr. Under-

wood. To many persons the bandaging, and that degree of cleanliness which is occasioned by the regular dressing of their sores, are of infinite service; but it is a mode of treatment which does not answer in all old and indolent ulcers; for many of them, as I know from experience, become inflamed and irritable under its use. Besides, the recurrence of the ulcers in those who begin to take exercise after being cured, has appeared to me to be often occasioned by their leaving off the bandaging, by their standing or walking too much, and by accidental injuries. The part which has been healed up during rest is weak, and requires support and careful defence; which it very seldom receives from the class of individuals who are most liable to this species of ulcer.

By far the most material improvement which, in our times, has been introduced into the treatment of callous or indolent ulcer, is that for which we are indebted to Mr. Baynton, of Bristol. I shall read the directions which he has given, for the sake of those who may feel inclined to follow them.

" The parts should be first cleared of the hair, sometimes found in considerable quantities upon the legs, by means of a razor, that none of the discharges, by being retained, may become acrid and inflame the skin, and that the dressings may be removed with ease at each time of their renewal; which, in some cases, where the discharges are very profuse, and the ulcers very irritable, may perhaps be necessary twice in the twenty-four hours; but which I have, in every instance, been only under the necessity of performing once in that space of time.

" The plaster should be prepared by slowly melting, in an iron-ladle, a sufficient quantity of litharge-plaster or diachylon, which, if too brittle when cold to adhere, may be rendered adhesive by melting half a drachm of resin with every ounce of the plaster; when melted it should be stirred till it begins to cool, and then spread thinly upon slips of smooth porous calico, of a convenient length and breadth, by sweeping it quickly from the end held by the left hand of the person who spreads it to the other, held firmly by another person, with the common elastic spatula used by apothecaries; the uneven edges must be taken off, and the pieces cut into slips about two inches in breadth, and of a length that will, after being passed round the limb, leave an

end of about four or five inches. The middle of the piece so prepared is to be applied to the sound part of the limb opposite to the inferior part of the ulcer, so that the lower edge of the plaster may be placed about an inch below the lower edge of the sore, and the ends drawn over the ulcer with as much gradual extension as the patient can well bear; other slips are to be secured in the same way, each above and in contact with the other, until the whole surface of the sore, and the limb, are completely covered at least one inch below, and two or three above, the diseased part.

"The whole of the leg should then be equally defended with pieces of soft calico, three or four times doubled, and a bandage of the same about three inches in breadth and four or five yards in length, or rather as much as will be sufficient to support the limb from the toes to the knee should be applied, as smoothly as can be possibly performed by the surgeon, and with as much firmness as can be borne by the patient, being passed first round the leg at the ankle joint, then as many times round the foot as will cover and support every part of it except the toes, and afterwards up the limb till it reaches the knee; observing that each turn of the bandage should have its lower edge so placed as to be about an inch above the lower edge of the fold next below. If the parts be much inflamed, or the discharges very profuse, they should be well moistened and kept cool with cold spring water, poured upon them as often as the heat may indicate to be necessary, or perhaps at least once every hour. The patient may take what exercise he pleases, and it will be always found that an alleviation of his pain, and the promotion of his cure, will follow as its consequence; though, under other modes of treating the disease, it aggravates the pain, and prevents the cure."

To the general utility of this mode of treating old sores or ulcers of the legs, there are few practitioners, that have had much experience in this branch of practice, who will not be ready to give their testimony. Mr. Baynton himself has dispensed with the use of the cold water; and in a considerable number of cases I should be disposed to make a slight alteration on the mode of applying the straps. Instead of carrying them completely round the limb, by which they often act like tight ligatures, or garters, it is in most instances sufficient to make them enclose only about two-

thirds. When properly applied in this way, they act chiefly upon the cutaneous surface, and occasion no retardation to the general venous circulation in the limbs to which they are applied. In practice I have repeatedly found the straps carried completely round the leg injurious, but by no means so always, not perhaps even in a plurality of cases. The straps also have, in some patients, a tendency to excite inflammation of the skin; and in this case, if continued, produce excoriation, and even small ulcers. This state is sometimes prevented by bathing the skin surrounding the ulcer, at the time of dressing, with sugar of lead water. When it occurs, the straps must be given up for a time, and the inflammation removed by poultices. But it is not in old ulcers of the legs only, that the adhesive straps are useful. We have, perhaps, no external curative means in surgery, the emollient poultice not excepted, that is of more universal application in all cases of healthy suppurating wounds and sores. When supported by proper bandaging, these straps bring the edges of wounds and ulcers together; they repress without irritation the excessive growth of granulations; they diminish serous and puriform discharges; and they give a firm support to the parts to which they are immediately applied.

When the surface of the ulcer remains callous, we touch its raw surface every second or third day, at the time of dressing, with a bit of sulphate of copper, or wash it with a diluted solution of nitrate of silver. In the truly callous and indolent states of this ulcer, these applications often promote, in a very remarkable degree, the processes of granulation and cicatrization. Bandaging with the roller, which is begun from the points of the toes, is particularly necessary, and is sometimes useful, in that variety of callous ulcer which is accompanied with the enlargement, or, as it is termed, varicose state of the veins of the leg. Some of the ulcers, however, in this state are found not to heal, be the mode of treatment adopted what it may, unless the varicose state be removed. This, as I shall afterwards have occasion to mention, has of late years been often done by tying the saphena veins, as was first suggested and practised in our times by Mr. Home. I have seen and found this mode of treatment successful in a considerable number of cases; but I think it right to state, that it is an operation not altogether free from dan-

ger, in so far as it is liable, in whatever way it may be performed, to give rise to severe degrees of venous inflammation.

The other variety of callous or indolent ulcer, that in which the ulcer may be said to burrow under the skin, and which is sometimes denominated a sinuous and sometimes a fistulous ulcer, requires, in general, for its cure, to be laid open with the knife, and to be treated afterwards according to its state of irritability or indolence.

With regard to the management of the fungous ulcer, I cannot deny myself the pleasure of quoting to you the excellent observations of Mr. Home upon this subject.

"The first object with respect to the ulcers themselves is to prevent the granulations from rising higher than the edge of the surrounding skin, since it is a fact well established, that, when they are higher than that level, they are not disposed to form skin. This is not sufficiently attended to in common practice; but another mode is adopted which is erroneously supposed to produce the same effect. Escharotic medicines are used to eat down the granulations whenever they are found to be too high; and in this way they are reduced nearly to the proper level. There can be no doubt, that if, by any means, the granulations could be prevented from rising beyond the surface, it would save a great deal of pain to the patient, and be attended with other advantages; and this may be done, as will be explained, by making use of dressings adapted for that purpose.

"It becomes a question, how far escharotics should be employed, even when the granulations, by inattention, have been allowed to become luxuriant; since the very act of destroying the upper part of the granulations seems to increase the growth of the part that remains, so that the disposition for luxuriancy in the new flesh is not corrected but rather increased; and there is a constant necessity for making use of the same harsh means of keeping them within bounds, till they shall be disposed to form skin; a process which would have taken place much sooner under another mode of treatment. If, on the other hand, such medicines are used as have a stimulating power, which is proportioned to the strength of the granulations, the superficial luxuriant parts, to which they are immediately applied, will be absorbed, and those underneath will be checked in their growth. Instead, therefore, of touching the surface of such

ulcers with the lunar caustic, blue vitriol, red precipitate, or any other of the escharotics in use, the same medicines, compounded with other substances which will diminish their activity, and render them only strong stimulants, may be used with advantage.

"To illustrate the difference between the effects of escharotics and of stimulants, in keeping down granulations, I shall mention what happens in the case of warts; which are only a luxuriancy of growth from the cutis, and like granulations; and all other newly formed parts are weaker in their living principle than original parts.

"If warts are touched by escharotics, it is found that their growth is rather increased than stopped by such treatment; and they cannot be removed by these means unless the caustic acts beyond the basis of the wart, and destroys a part of the skin underneath. But if a stimulating application, such as the powder of savin, mixed with œrugo œris, is employed, it excites a degree of action in the wart itself, whose vitals are weak; and in consequence of the degree of action thus produced being greater than the parts are able to sustain, the absorbents take them back into the circulation, and the wart is wholly removed; but if the same application is made to the common skin, it produces no effect at all.

"As the great object in the healing of an ulcer is to have the new flesh by which it is filled up as strong in its living powers as possible, that it may not afterwards break out again, every thing that can conduce to that end is deserving of attention. It is reasonable to conclude, that, in the growth of animal substance, as of vegetables, where there is a rapid increase, the parts growing are weaker than where it is slow; and if the granulations, which are already growing beyond their strength, have this rapidity increased by partial removals, they must in reality be rendered weaker than they were before. If this reasoning be just, which there is reason to believe it is, (since the observations on which it is founded are taken from practice,) the treatment of granulations ought to be regarded in a point of view that has hitherto been little considered. Their growth ought to be kept back, in an early stage of their formation, by such resistance as they are just able to overcome; which will, at the same time, retard their increase, and allow them to acquire strength by their own actions; for new-formed

parts in a living body are strengthened in proportion to the action they are obliged to exert. This, however, is confined within certain limits; for if the actions are increased beyond the real strength of the parts, the absorbents remove them altogether; and an attempt is made to produce a new growth of granulations, strong enough to support the actions required of them. This they are sometimes unable to accomplish, and the ulcer remains nearly stationary, till the stimulating application is removed.

"It is upon this principle that the pressure made by tight bandaging is found so useful in this kind of ulcer; and it is from the same cause that those ulcers which heal while the patient is walking and using exercise, are less liable to break out again, than those which are healed under the circumstances of rest and perfect quietness.

"I have dwelt the longer upon the necessity of attending to the strengthening of granulations at their first formation, from finding that, after they are once formed, they do not appear capable of becoming stronger in the same degree, but give way under the slightest increase of motion in the parts, even after they have been allowed what might be considered a sufficient time to acquire strength, and the ulcer itself has been completely healed. We have daily proofs of this weakness of granulations, in all the stages of their growth, in our public hospitals. When a patient is first received with an ulcer in a very disturbed state, from improper treatment, without any distinct appearance of granulations under the application of a poultice, the surface will frequently become clean, and granulations will rise up in every part: these will increase, and appear to be strong and healthy (when superficially examined) while the patient remains in bed; but as soon as he gets a little better, and walks about, the ulcer spreads; the motion of the limb being greater than the granulations can support; on which account they are absorbed and taken back into the constitution. If the patient be kept in bed, the ulcer will heal; and he may leave the hospital perfectly well; but as soon as he returns to his usual exercise, the granulations, too weak to support themselves, give way, and the ulcer breaks out again, and becomes nearly of the same size as at the first.

"As this is one of the most common species of ulcer to which soldiers are liable, it is of the utmost importance that

military surgeons should be made acquainted with the cause why so many of them are so liable to break out again, that they may avoid this consequence, and, by their mode of treatment, enable their patients to return to their duty as soon as possible after the ulcer shall be healed.

"Ulcers on the leg may be, in the first instance, of the truly healthy kind, but, from their size, the parts towards the centre may be so long kept from skinning, that the granulations may become weak; and, when they have risen to the surface, may remain stationary, without showing any disposition to form skin. When this is the case, they generally, after a day or two, acquire a fresh growth, and become luxuriant.

"In the treatment of such ulcers it is, therefore, proper to attend to this circumstance, and whenever it is seen that the granulations, though come to the proper height, do not form a thin semitransparent pellicle upon their surface, they are to be considered as weak parts, and treated accordingly. The simplest and best mode, where the constitution has no peculiarity which forbids it, is pressure; this may be made by a piece of thin lead over the dressings, and will be assisted by a tight bandage on the limb, which, by compressing the parts, makes the circulation through the veins less tardy, than when the parts are left to themselves."

HOSPITAL GANGRENE, OR MALIGNANT ULCER.

The first distinct account which you will find of the particular ulcer, to which surgeons now give the name of malignant ulcer, or hospital gangrene, is contained in the third volume of the posthumous works of M. Pouteau, who was chief surgeon to the Hotel de Dieu of Lyons. These works were published in 1783. This author's attention was directed, at a very early period of life, to hospital gangrene, from his having been affected with it while employed as a dresser in the hospital, to which he afterwards became surgeon. In 1788, M. Dussassoy, who succeeded Pouteau as chief surgeon to the same hospital, published also an account of this disease, in a pamphlet of about ninety pages. This account is, perhaps, a little more methodical than that of Pouteau, but these authors agree completely in the description which they give of the general features of the disease, particularly with regard to its infectious nature. In 1796, Moreau and Burdin, the former a physician, and the latter a surgeon in the French army, published a small pamphlet upon this disease, but in perusing it I do not find that they have added any new facts to those previously collected by Pouteau and Dussassoy.

The first very accurate account which we have of hospital gangrene, in the English language, is to be found in the sixth volume of the London Medical Journal, published in 1785. The account to which I refer is entitled "Observations on the Putrid Ulcer, by Mr. Leonard Gillespie, surgeon of the Royal Navy." In the edition of Dr. Rollo's work on Diabetes, published in 1797, you will find a section, entitled, "A short Account of a Morbid Poison acting on Sores, and of the method of destroying it." Though the character of the sore described by Dr. Rollo seems to

differ in several particulars from hospital gangrene, yet I cannot help thinking that it agrees with hospital gangrene in a sufficient number of particulars to warrant us in regarding them as one and the same disease, modified, as we know all contagious diseases are, by the circumstances in which they appear. In 1799, Dr. Blane, in the third edition of his judicious work on the diseases of Seamen, gave an account of hospital gangrene under the name of malignant ulcer; and Dr. Trotter, in the 2d volume of his Medicina Nautica, published in the same year, described that affection by the same appellation. In the third volume of his Medicina Nautica, Dr. Trotter has added to his first account several valuable communications relating to this disease, received from the surgeons of the Royal Navy. Mr. John Bell, also, has made hospital gangrene the subject of particular remark, in the first volume of his Principles of Surgery, published in 1801; and two theses have been published in this university, by gentlemen who did me the honour to attend these Lectures, in which you will find a very accurate account of the present state of our knowledge respecting the symptoms and treatment of hospital gangrene. The first thesis, "De Gangrena Contagiosa," was published by Dr. Leslie in 1804, and the second, "De Gangrena Contagiosa Nosocomiale," by Dr. Charles Johnston, in 1805. It must not, however, be supposed that the disease, hospital gangrene, is a disease of late origin, or one the effects of which had altogether escaped the attention of medical men. We have no description of it as a distinct disease, it is true, before the publication of Pouteau's posthumous writings in 1783; but it is mentioned in a very cursory manner by Lamotte, in 1722, as an affection known in the Hotel Dieu of Paris by the name of La Pourriture, and as an affection supervening to the wounds inflicted by operation, and attacking the ulcers and abscesses of those who breathe the corrupted air of that hospital. Army surgeons had often remarked, that in some seasons the wounds of men, who had suffered in battle, or who had had operations performed upon them afterwards in consequence of their wounds, became affected with gangrene; and that these patients, however trifling their wounds at first might be, usually fell victims to the gangrenous affections which supervened. You will find many facts of this kind in the works of Ambrose Paré, of Le Dran, of Ravaton, and, I

believe, I may add, in the writings of almost every army-surgeon of much experience, who has related minutely and accurately the appearances of diseases as they have occurred in his practice. In reading the descriptions which they have left us of these gangrenous affections, we can now have little doubt of the fatality which they mention having, in many instances, been produced by the occurrence of hospital gangrene.

The symptoms by which malignant ulcer, or hospital gangrene, is characterised, are partly of a local and partly of a constitutional nature. These two classes of symptoms are not invariable in the order of their appearance, for sometimes the one and sometimes the other class seems to occur first in the order of succession. According to the result of my own observation, the constitutional symptoms usually precede the local. In the cases in which they have appeared to succeed to the local, may not the constitutional symptoms, though they actually existed, have been so mild as to escape observation? In the progress of the constitutional symptoms, a general uneasiness is felt before any visible change takes place in the wound or sore which is attacked with hospital gangrene; the tongue becomes foul, with a sensation of bitterness in the mouth; the appetite decreases, and the patient begins to loathe his food; the pulse becomes very quick, but is in general rather weak than strong; the skin feels hot; and the patient, in the progress of the disorder, becomes affected with great anxiety and restlessness.

The local appearances of wounds, sores, and ulcers, are soon altered after they begin to suffer an attack of hospital gangrene. Their surfaces become pale; the discharge of pus becomes less copious and less healthy than formerly; their edges swell, inflame, and become exceedingly painful; they are sometimes ragged, at others reverted, and exhibit a soft spongy appearance; a dusky red-coloured circle of inflammation, having more or less of a livid tinge, extends from these edges into the surrounding integuments, and is often the forerunner of gangrene and sphacelus. Inflamed lymphatic absorbent vessels are sometimes to be observed extending from the surfaces affected with hospital gangrene, to the contiguous or communicating cervical, inguinal, or axillary glands.

The local affection in hospital gangrene seldom occupies

at first the whole surface of extensive wounds or sores. It more frequently appears in the form of dirty white ash-coloured sloughs, occupying only one, two, or more small spots, and from these gradually extends itself over the whole of the diseased surface. In some instances hospital gangrene begins in the form of a small inflamed pimple or vesicle, without our being able to perceive any previous injury of the part in which it appears; more frequently, however, it attacks parts which have been scratched, bruised, wounded, or which have had the integuments injured by ulceration, burns, or blisters. Specific sores, or ulcers, seem to be less liable to attacks of hospital gangrene, than those which are of a simple nature. I have seen it, however, repeatedly attack cancerous sores, and venereal ulcers. In some instances it has been said to have produced a cure of these diseases, destroying by mortification the parts on which they were situated. In severe cases of hospital gangrene, the surface of the wound or sore which it attacks is soon changed into sphacelus, and covered with dirty white-coloured sloughs. During the separation of these sloughs, an ill-coloured and sanious discharge, having a peculiar fetid smell takes place from the surface of the wound or sore. This surface is often seen covered with a tenacious viscid pus, which adheres firmly to the surface, from which it is secreted. In mild cases, the destructive effects of hospital gangrene are confined to the skin and subjacent cellular membrane; but it often extends its ravages beyond these textures, destroying tendinous fasciæ, muscles, ligaments, and tendons, together with the nerves and blood-vessels. Artery seems to be the texture which resists most powerfully the destructive action of hospital gangrene, as well as of most other species of mortification. When, in the progress of hospital gangrene, adhesive inflammation does not occur, hemorrhage is liable to take place, and, in some instances, to prove fatal. Even in cases in which distinct hemorrhage does not occur, a thin bloody sanies is often discharged which has a very offensive smell; and the pus, which begins to appear during the separation of the slough or mortified part, often continues for days to be reddened by an admixture of blood.

The severity and progress of the symptoms in hospital gangrene, as well as the duration of the disease, are extremely different in different individuals. In some, the fe-

ver continues with unabated violence for a period of one or two weeks. After suffering an abatement, it is liable to recur; and the patient sometimes sinks under a second or third attack. When the affection has been very severe, has continued long, or has returned frequently, the patient becomes at last generally affected with hectic fever and obstinate diarrhœa. This is a state from which, if patients recover, it is always in a very slow and tedious manner.

I shall, perhaps, add considerably to the accuracy and importance of the account which I have given you of hospital gangrene, by quoting to you a few extracts from those practical authors, who have described this disease from their own observation, as it has occurred in different regions of the globe. In speaking of this affection, as it occurred in our West India settlements, Mr. Gillespie observes, "The putrid or scorbutic ulcer proved to be one of the most troublesome, inveterate, and dangerous diseases, which afflicted the British seamen employed in the Leeward islands during the late war.

"I prefer the name of putrid ulcer to any other, because the marks of putrescency always were evident to the senses, although those of scurvy were not. It in general did not attack the ships' crews until they had been at least a year in the West Indies; and it often seemed to rage epidemically on board certain ships, whilst others remained in a great measure free from it: Thus his Majesty's ships Ajax, Montagu, Russel, and Triumph, in the beginning of 1781, landed a great number of men on Pigeon Island, St. Lucia, with ulcers of the most malignant nature, whilst several ships in the fleet, which had been employed the same length of time, in the same climate, and on the same service, remained, in a great measure, free from such complaints. It often affected those who began to recover from fever or dysentery, and those who had other symptoms of scurvy; but it often occurred to those who had been healthy during their continuance in the West Indies, and most generally after having received a wound or contusion, however slight, particularly of the lower extremities.

"The wounds of seamen, received in the different general actions, were generally affected with this putrid exulceration; and horrid were the devastations made by it. Those who had been formerly affected with ulcers of the legs, sel-

dom escaped a return of their complaint, after having been some time in the country.

" The bites of moschitoes often gave occasion to this disease; and sometimes, without any evident exciting cause, a small pimple made its appearance on the leg or foot, which, on being scratched, oozed out a small quantity of serum; an inflammation of a livid reddish colour, and diffused appearance, generally succeeded; and when in this state, warm fomentations and poultices were applied with a view of discussing the inflammation, the ulcer soon began to spread; a fœtid, corrosive ichor was discharged, which soon acted on the surrounding parts, and, in the space of a few days, produced a foul, sloughy, gangrenous ulcer. A considerable degree of fever generally accompanied these external appearances, with great thirst and restlessness. It generally happened when the complaint affected the extremities, particularly the lower ones, that the lymphatic vessels and glands of the part were more or less affected with swelling and pain.

" When the disease attacked the leg, it seldom confined itself to the soft parts. The sloughy gangrenous disposition frequently affected the periosteum of the tibia, and was accompanied with the most excessive pain; large and profound sloughs were formed, the limb became œdematous, and hæmorrhagies often occurred.

" In the autumnal months of the year 1780, I had an opportunity of seeing about two hundred cases of scorbutic ulcers in the naval hospital at New York, some of which belonged to the ships of the West India squadron, which was then at that place, in order to avoid the hurricanes; others belonged to the American squadron. The hospital was well provided with every thing necessary, as well of diet as medicine. Every attention was bestowed, in order to keep the sores clean; bark and wine were liberally dispensed, and opium was not sparingly administered; but in vain were cataplasms, fomentations, and warm dressings applied, as they seemed evidently to hasten the rapid progress of the disease. Precipitate powder, which was proposed and tried as a detergent, produced still worse effects, and simple dressings of dry lint were very far from putting a stop to the rapid putrefaction. A number of men were rendered unfit for service. Amputation was had recourse to in some instances, but with very indifferent success, as the sloughy

disposition generally made its appearance on the stump; and a great many men lost their lives by this dreadful disease, in which they might literally be said to die by inches.

"Finding the inefficacy of simple dressings, and the very bad effects attending the use of warm poultices and fomentations, the powder and decoction of bark were tried, but not with any very obvious benefit. Vinegar and water answered much better: but what answered the best of any was a solution of the gummi kino in equal quantities of claret and red port; by the use of this, the large, fœtid, bloody discharge was diminished and corrected, and a stop was put to the exulceration.

"In the beginning of 1781, a naval hospital was established on Pigeon Island, St. Lucia, which was soon crowded with patients affected with the most dreadful ulcers. The progress of the disease, as might naturally be expected, was much more rapid in the hotter climate of St. Lucia, than at New York; and what tended much to increase the malignity of those complaints was the excessive scarcity of all vegetable productions, the hurricane which happened in October the preceding year having destroyed them.

"The same plan of treatment was followed here as at New York. Bark, wine, and opium, were administered internally in as large quantities as they, perhaps, ever have been administered. A solution of essence of malt was allowed as common drink; but I could not then, nor have I ever observed, any considerable effects from that substance, which was furnished to the ships in the West Indies, during the war, at such considerable expense. This I am confident of, that had one half of the money been laid out even on sugar canes, or their juice, they would have been found a much more serviceable anti-scorbutic.

"The external applications were either warm poultices, or cold fermented ones; lint, dry, or wetted in vegeto-mineral water; pledgets of cerate, &c. We pursued this mode of treatment for some time, and were inclined to attribute the bad success of it to the want of fruit and vegetables; but when we found these were not sufficient to check the rapid progress of the disease, we gladly pursued a different course.

"We lost a very considerable number of men by this disease during the first five months, after the establishment of the hospital. When the complaint affected the leg, its

general progress was from a trifling sore, often proceeding from a hurt, till it became surrounded with an erysipelatous inflammation, discharging an ichorous matter which darkened the lint applied to it, and afforded the most fœtid smell; blood was often discharged in a thin dissolved state, sometimes by an oozing from the entire surface of the ulcer, and at other times from small vessels, the mouths of which, though visible, were with great difficulty closed, owing to the great degree of putrefaction. There was generally some pain and tension of the inguinal glands; a considerable degree of fever attended the first stage of the complaint, with great thirst; the belly was inclined to be bound at first, but, as the disease advanced in its progress, a dysentery or diarrhœa generally made their appearance, and in the end carried off the patient. The disease was sometimes more rapid in its progress, and in the course of a few days, seized on and denuded the tibia, whilst large pieces of integuments and cellular membrane were found to be entirely mortified."

Mr. M'Dowal has given an excellent account of the destructive effects which hospital gangrene produced among the men on board of the Prince of Wales, during a voyage which that vessel made from the West Indies to England. "On the 11th of April, 1800, we received on board his Majesty's ship Prince of Wales a number of bad cases of ulcer from Martinique hospital, where many were labouring under that complaint in the worst stages.

"From this period, to us unfortunate, as it was peculiarly distressing to the miserable sufferers, every, even the slightest scratch or hurt, in whatever manner inflicted, degenerated into a bad ulcer. The soldiers of the 43d, who came on board at that time, were not exempt; and so alarming was its progress, that on our arrival in the Downs fifty-six were on the list of ulcer: mostly bad cases.

"That it was highly infectious appears pretty clearly proved from the following circumstances:—of the fifty-six who were attacked, forty-five were sent to the Royal Hospital, Deal, the others remained on board; and the temporary sick-bay, in which they had been heretofore, being pulled down, they were put into the old bay on the opposite side; which was previously well washed, sprinkled with vinegar, and every mode of purification usually adopted was employed; but, above all, cleanliness was particularly at-

tended to. The dressings were frequently and speedily removed. The bandages, trowsers, &c. which had the least chance of retaining the noxious miasma, were either destroyed or well washed and aired. The consequence was, that the *few* cases that remained on board soon got well, by the same treatment and regimen (water only excepted, of which we got a fresh supply); and, what is still more remarkable, several of these were toe-nail cases, which we always found more obstinate. And I here beg leave to remark, that the ceruss. acetat. sprinkled over the ulcerated toe, was very rarely found to fail of success. What still more confirms the opinion of its being infectious, several people who had cuts and scalds, on applying, had cerate and lint given them to dress them below; and *all* those healed in the usual manner.

"The infectious ulcer assumed various appearances in the different stages of the complaint; but, in general, after a slight hurt, scratch, or wound, an erysipelatous kind of inflammation surrounded the injured part; and, in the course of a few hours, a small vesicle, containing a brownish-coloured fluid was observed; on this being evacuated, a brown puncture appeared nearly on the centre of the above mentioned vesicle, which discharged a thin acrimonious serum. This morbid point spread rapidly; febrile symptoms generally accompanied this stage: frequently delirium. The edges were reverted and painful; the sore of a brown colour, and covered with a deep, tough, fibrous slough; the discharge thin and acrimonious, sometimes destroying the surrounding cuticle. In a few days the depascent stage seemed stationary; and a healthy action was just perceptible, by the slough becoming detached from the edges of the sore. In two or more days the slough was commonly cast off, leaving the sore perfectly clean, with a fine healthy granulating appearance. Things proceeded in this manner for some time, in some instances till the sore was half or more healed up; tantalizing us with the hopes of a speedy cure, when a small part of the granulating surface, mostly near the cicatrice, put on a crimson redness, in the centre of which a dark-coloured speck made its appearance; and spreading rapidly as before, over the whole formerly ulcerated surface, and often twice as much of the surrounding sound parts became a prey to its devouring influence.

"In the course of this stage of the disease, its appearance was singularly striking. The destroying power of the infection spread regularly from one side of the sore to the other, in a uniform and well-defined line.

"Hæmorrhage, in the more advanced stages of the disease, was a very frequent and troublesome symptom; and, as far as I could observe, best relieved by the application of cold water over a simple dressing.

"The fœtor was peculiar, and extremely offensive; to correct which the air was kept highly charged with nitrous gas, especially during the time of dressing. The only effect I ever could observe from the exposure of the ulcers to this gas, was a slight additional degree of pain, probably from the precipitation of its chemical combination with atmospheric air.

"In several cases the denuded muscles were amazingly enlarged and diseased throughout their whole extent, resembling an oblong bladder, the outer membrane being of a pale white colour, and full of a thin whey-coloured liquid, which issued out in considerable quantity on its being punctured or cut into.

"In one instance, in which the sore was induced, by a drop of boiling pitch falling on the anterior and lower part of the leg, it degenerated into a foul extensive ulcer, in the manner aforesaid, in spite of the unremitting attention of Mr. Chivers, the surgeon, in assiduously administering the remedies usually employed, viz. cinchona, lime-juice, wine, and a light nutritious vegetable diet; slight evacuations, with emollient poultices and fomentations, in the first stage; and spirituous embrocations were employed latterly, with a full allowance of nutritious regimen, and an increased proportion of sound port-wine at intervals through the day. The sore, by repeated depascent stages, occupied one-third the extent of the tibia, and more than one-half the circumference of the leg. The tibialis anticus muscle appeared in the middle of the sore, in the form already mentioned, entirely detached, only at the superior and inferior edges of the sore; where it stretched toward its origin above, and insertion below. A probe being passed under it, and gently raised up, the entire remains of the muscle from its origin to its insertion, came away without pain, the patient feeling, according to his own expression, only a creeping sensation along the bone. The muscle appeared in

a dissolved state, and consisted chiefly of longitudinal fibres, loosely connected by a vascular substance, full of a whey-coloured fluid."

Dr. Blane, in treating of malignant ulcer, remarks, page 509, that "ulcers of the same kind prevailed to the most dreadful degree in the ships serving at the Cape of Good Hope, and the naval hospital there, in the years 1796 and 1797, producing the most severe and protracted sufferings, terminating frequently in the loss of limbs or life, or both. Nor were they confined to the lower extremities, so that the *ossa ilium*, the *scapula* and *cranium*, would sometimes become carious. Their description is the same as has already been given; but, in addition to the symptoms already enumerated, the lymphatic glands in the ham and groin sometimes swelled; the buboes in the latter suppurated, and they not only healed kindly, but the ulcers of the legs looked better while this suppuration continued. These ulcers were much more prevalent in some ships than in others; and they did not arise in any of them on their first arrival, at a time when the men were most highly scorbutic, but some weeks afterwards, though they had the advantage of the refreshments of the country: and they could, in some instances, be traced from the intercourse of one ship with another. I was informed by the surgeon of one of the ships of the line on that station, that some men, having been sent from thence to the hospital for the cure of other complaints, they were seized with malignant ulcers, originating from scratches or slight sores; although no ulcers of that description prevailed on board of the ship at that time, and although the men had the advantage of fresh and vegetable diet at the hospital. These circumstances are all in favour of their proceeding from infection, and not from climate, nor any thing peculiar in the circumstances of the service on that station."

In describing the appearances and effects of this sore, which he had occasion to observe in the English Channel, Dr. Trotter remarks, "that in blistered parts which assumed the characteristic appearance of this prevailing malady, there were particular spots that inflamed, became dark-coloured and sloughy, which spread in all directions, till the whole extent of the blister was ulcerated. Numerous little vesicles appeared on the margin to a considerable distance, with inflamed edges: these quickly broke, turning of

a dark-red colour, in some places they united with the large sore; and gave the whole an indented appearance, somewhat resembling peninsulas in a sea-chart. The vesicles appeared to be lymphatics inflamed by the absorption of the cantharides, which instantly partook of the general disposition to gangrene. During the whole of this process, an acute and violent degree of fever raged, with unusual pain of the affected part, which continued till the inflammation on the margin of the ulcer subsided, and the sloughs fell away. This commonly happened in four or five days; but in some cases the inflamed portion turned black, and mortified, with a fetid discharge, in less than forty-eight hours.

"Contused spots, even where the cuticle was not broken, were not exempted from this general tendency to ulcer. But parts that had been scalded or burnt, above all other accidents, most quickly assumed the nature of this horrid sore, spread and inflamed more rapidly, and in the end put on the most formidable appearance: deeper and larger sloughs were the consequence, and symptomatic fever violent in proportion. This was a general remark in every ship.

"Even in the early stage, and sometimes before the cuticle had burst, so as to expose the naked surface, buboes appeared in the groin and axilla, not to be touched without much pain, and always attended with fever. These, however, seldom suppurated; but, when they did, they constantly exhibited the complexion of the parent sore. In the Terrible, the glands of the groin were more liable to be affected than was observed in the other ships: and in the Triumph only I have heard of them suppurating.

"Although for the most part these ulcers sprung from some external injury, yet we have met with a number of cases, where neither wound, puncture, scab, or contusion, could be said to have first taken place. A small circumscribed red spot would be first perceived, scarcely to be felt; but in a few hours rising to a pimple, becoming black in the centre, and inflamed round the edges, till it increased in size, swelled, and assumed every characteristic symptom, with concomitant fever and subsequent ulceration, sloughs, and fetid discharge." To this account, he adds, "The striking peculiarities of this ulcer are,

1st. "Its rapid progress, by which, in the space of a

few days it passes through the various stages of inflammation, gangrene, and sphacelus, when the injured parts slough away, which puts an end to an acute concomitant fever.

2dly. "It has been observed to prevail more in ships in port than at sea, or very shortly after leaving the harbour.

3dly. "It has never assumed the complexion of a scorbutic ulcer, which is distinguished by the dark-coloured fungous mass laying over its surface, that on being removed is quickly regenerated, and is commonly attended with some symptoms of scurvy, such as soft swellings of the legs, spongy gums, and sallow looks: on the contrary, in this ulcer, when the putrid parts separate, the surface is of a light florid colour. The scorbutic sore is seldom painful; our ulcer is attended at times with exquisite torment.

4thly. "It has not been relieved by large quantities of lemon-juice, even to a bottle *per diem*: nay, we have thought that, in some cases, much harm was done by this practice in the first stage.

5thly. "We have not been able to distinguish particular constitutions more liable to be affected with it than others, except the strong and robust, nor have seamen been more exempt from it than landmen.

6thly. "It has occurred in ships where every attention is paid to exact discipline, cleanliness, ventilation, and every circumstance connected with preserving health. It has also been treated by some of the most experienced and able surgeons in the navy: and there is nothing peculiar to the soil surrounding the ports of the Channel where it has appeared."

The following account given by Dr. Rollo of the peculiar modification of hospital gangrene, as it occurred in the Royal Artillery Hospital of Woolwich, is so accurate and complete, as not readily to admit of improvement of any sort.

"After the formation of the brigade of Royal Horse Artillery, many accidents occurred, especially in kicks in the legs of the men by the horses' feet; and being generally on the shin, very unpleasant sores were produced. The wound was sometimes small and punctured, having arisen from the turned-up part of the horse's shoe, as formerly prac-

tised. The bone was often laid bare. We seldom had less than forty cases of sores at that time in the hospital.

"When this sore engaged our particular attention, and, from the rapidity of its progress and effects, very watchful examination was bestowed, it was found that a sore of any extent (some were very considerable, as 3 or 4 by 5 or 6 inches, and others small), in the promising state of healthy cicatrization, was liable to have a solitary ulceration on its edge, of unequal dimensions, the size varying, being smaller or larger than a pea. This distinct little ulcer was of a darkish colour, its edges jagged, its bottom unequal and ragged, and discharged a thin matter, having a peculiar smell. Such was the earliest state in which it was perceived; but probably it might have been distinguishable sooner. The disappearance of the sore in the hospital deprived us of a more minute and early inquiry.

"The day after the little ulcer had been discovered, it had acquired the size of a sixpence or a shilling, extending itself every way, even on the shin as well as on the surface of the former sore: the discharge was now changed, having become thickish, of a whitish colour, intermixed with dark shades, and adhering strongly to the surface of the part; the peculiarity of the smell continued, and was become more offensive.

"In another day the ulcer had spread farther: and on other parts of the former sore might probably be perceived small ulcerations of the same appearance and kind as those of the first discovery, and which went on extending until they united.

"Five or six days from the appearance of the small ulcer or ulceration, when it had extended (or by its union with other ulceration) over one-third of the former sore, with pain and redness in the course of the lymphatics, and the glands through which they led, with enlargement of them, general indisposition became evident. This consisted in nausea, loss of appetite, heat of skin, a very small and quick pulse, extreme irritability, a whitish tongue, and thirst. When these symptoms took place, the ulceration rapidly went on, extending beyond the limits of the former sore, and destroying the adjacent parts. In this state of the sore, the parts were puffed and bloody, accompanied with much uneasiness, having a burning and lancinating sensation; and the action frequently terminated in apparent

gangrene. Sometimes, however, the ulcerating part remained covered with the thick adhesive matter, and gradually without any other apparent change, assumed the healing state.

"The operation of the poison in slowness or rapidity probably depended on some constitutional circumstance, as it was not in all of equal degrees of facility. These sores, which spread rapidly and extensively to sloughing, and even to gangrene, from one, two, or more small ulcerations, very likely happened in those who might be said to have a constitutional susceptibility; while, on the contrary, in those where the ulcerations continued distinct, and remained covered with a thick, whitish, and adhesive matter, without acquiring the sloughing and gangrenous states, their constitutions had no favourable tendency to the operation of the poison.

"The first favourable change was in the appearance on the edges of the sore, with a separation of dead parts, which went on until the whole were thrown off; and then healthy granulation and cicatrization took place.

"The most singular phenomena in the progress of this sore consisted in the various actions which were not unfrequently perceived in it at the same time, and which seemed to depend on constitutional differences. We have seen the ulcerating, suppurating, and cicatrizing states, going on at the same time in one sore. It was not unusual for the ulcerating process to be checked before it had extended over the whole sore, when the former cicatrizing parts went on without interruption; and the ulcerating part, having assumed the disposition to healthy action, arrived at the cicatrizing point, and then proceeded with the others to skinning.

"The smallness of the ulcer, the appearance of its edge and base, its ulcerative tendency, the absorption of its matter affecting the lymphatic glands and vessels, and then the whole system, pointed out the operation of *a morbid poison.*

"The action of this poison seemed to be limited and confined to specific effects; the first were local, producing only general affection by a more extensive operation on the sore, and which in a certain time terminated in the healthful separation of parts, granulation and cicatrization, and a state of constitutional convalescence.

"Sores having specific actions, as the venereal, scrofulous, and variolous, resisted this poison, and in the hospital were not affected, though such patients were in the same wards."

"Some men in quarters, one with a blistered part, another with a cut on the outer-ear, and another with a sore on the leg, besides several others, were affected with this poison. The men in the same wards were not generally affected with it; those with specific sores, or with sores of small extent, and having little discharge, though laying within two feet of the men under the action of the poison, escaped.

"From the very serious ravages of this poison, we were induced to make the most particular inquiries. Being fully persuaded it was neither the sore acted upon by erysipelas, nor the sore described as peculiar to hospitals, we found ourselves involved in considerable difficulties. We consulted every thing that had been written by the ancients or moderns within our reach, and we found nothing resembling our sore. We saw, however, similitudes, in some of its stages, to phagedæna, especially as it is described by Mr. Adams in his account of morbid poisons. But the local attack of this sore, its progress, and the consequent general indisposition, and changes on the sore, remained new, and to us unnoticed and unexplained.

"Impressed strongly with the notion that a morbid poison was applied locally to a part of the sore, which, like the venereal poison, had the power of assimilation, and thus augmenting its power; as also of being absorbed, producing general effects on the system, and a re-action on the sore; we were determined to adopt local means of treatment, consisting in the chemical destruction of the poison, and in parts under its direct action, and in exciting a new action.

"We were led to propose an early and vigorous treatment of the local operation, from observing that when the constitutional effect took place, any plan of cure was inadequate, the disease then going on, and apparently ceasing of itself; but not until very extensive destruction of parts had been accomplished.

"The oxygenated muriatic acid, and the nitrates of silver and mercury, were the applications employed; and latterly, the oxygenated muriatic acid gas.

"When either of these were applied four or five times, the little ulcer soon put on the suppurating state, and granulated. They did not give pain in any degree, and it was of short continuance. While the ulcer was directly touched with the nitrated silver, the whole sore was moistened with a dilute solution of nitrated mercury, or a mixture of the oxygenated muriatic acid in distilled water; after which the whole was covered with lint that had been previously moistened by æther, or the oxygenated muriatic gas applied to the ulcer, and over the sore the dilute solution of nitrated mercury in distilled water.

"By these means, diligently persevered in, the poison and ulcer were destroyed, and the sore went on cicatrizing. The only failures were in those cases where the ulceration had so extended, that the nitrated silver, or oxygenated muriatic acid gas, could not be completely employed. It is necessary to mention, that washing the sore with warm water was always previously performed.

"The success of this treatment afforded additional strength to the opinion we had formed of the existence of a poison, its locality, and that it possessed, like other poisons, the property of assimilation, or producing matter similar to itself.

"Having gained this much, we were prepared to make some inquiry into its origin.

"From the local commencement of the poison, and the power we had of destroying its peculiar nature, and consequent action, by a direct application, and at the same time considering the circumstances of the sore previous to its appearance, we entertained the notion that the poison was formed on the surface or edges of the sore.

"In all these sores on which the poison showed itself, both in and out of the hospital, the discharge from them was considerable; they were most generally dressed with an ointment of wax and oil spread over coarse linen, and, when dressed, the matter was seldom cleaned off; by which it formed incrustations about the edge, or at a little distance from the sore. This arose from the opinion of some, that the washing of sores, if it did no harm, was at least superfluous, and from the great number of sores at that time to be daily dressed, by which less attention was probably given than might have been otherwise required and bestowed.

"We suspected, however, in a few cases, that the poison was propagated from one sore to another by means of the sponge employed in the occasional wiping or washing, the same sponge having been unguardedly used for different sores.

"The discharge of a sore remaining confined, or some of it suffered to adhere long on the edge of the sore, may undergo such changes as to produce a matter possessing new properties of an apparently poisonous nature and effect. On several sores, but one in particular, where a considerable quantity of finely-powdered nitrated mercury had been sprinkled, in twelve hours, the time of the next dressing, the mercury formed a shining crust, was firm, and appeared as if a portion of the mercury had been revived. This might be owing to hepatic gas on the surface of the sore."

To this account of hospital gangrene, I shall add only two more short extracts. They describe the appearances which it was observed to exhibit in two different parts of the Mediterranean. Mr. Brigges, surgeon of the Ajax, in a letter to Dr. Trotter, observes, "These were ulcers of a most inveterate nature, which from the slightest wound often extended itself in a few days to the bone.

"In many instances, their first appearance was made by a small pustule containing a limpid fluid, in others, by pain, hardness of the limb or part affected, and inflammation. These I treated for a long time simply as scorbutic ulcers; but am now of opinion they proceed from other causes, for persons afflicted with them seldom had attacks of any other disease; which induces me to think that they originate rather from an effort of nature to throw off some noxious matter lurking in the system, than merely what is called scorbutic habit.

"Another circumstance which confirms me more in this idea is, that most of those ulcers commencing with a small pustule, and the fluid contained therein being of a yellow tinge, always undergo a sensible change on the administration of emetics; for, in most of these cases, the stomach has been very foul, the patient always discharging a great deal of bilious matter.

"Emetics I have always found more effectual than any other evacuants in these cases, and generally observed, that the wounds sooner exhibited a healthy appearance, and the

discharge assumed a better colour than from the operation of cathartics; whereas, on the contrary, if omitted, the patient often loses his strength and appetite; he becomes emaciated; his skin partakes of a yellowish tinge, the wound grows worse every day; violent pain and inflammation succeed, extending itself with incredible rapidity, which soon terminates the life of the patient; for in cases of these very extensive sores of this nature that may ultimately terminate so as to admit of amputation, debility is so very considerable, that the patient, in all probability, never can recover.

"But it often happens, that neither medicine nor topical applications seem to have any influence in stopping the progress of these sores for the first five or six days. Discutient washes, and cataplasms, repeated blood-lettings, evacuations by cathartics and emetics, a plentiful use of vegetable acids, with nothing but a farinaceous and vegetable diet, do, in some cases, appear to me to mitigate their violence before the fifth, sixth, or seventh days. While many of those which I left almost to nature, with the assistance only of keeping the bowels in a laxative state, preceded in general by an emetic, as before mentioned; emollient cataplasms, prohibiting the use of wine or spirituous liquors, and substituting vegetable acidulated drinks, were often sooner restored than those subjected to a more rigid discipline. Though the inflammation extended, in some instances, beyond the limits expected; for, in the first mode of treatment, the debility occasioned by it impeded the cure, while, in the other, the granulations were more luxuriant, discharge in general better, and cicatrization rapid.

"Immediately on the appearance of these or any other sores, I restricted the patient to farinaceous and vegetable diet, allowing no kind of animal food, and wine only in particular circumstances, substituting vegetable acids, sugar, &c.

"In the convalescent state I have usually allowed such proportions of fresh provisions as the situation would admit of, with a liberal use of bark in the vegetable acids, with sugar, wine, opium, &c.; which plan, considering the great number I have had committed to my care, the many privations they suffered, and in a climate by no means

favourable to their recovery, I have pursued with much success."

Mr. Jarvis, surgeon of the Indefatigable, in a letter addressed also to Dr. Trotter, says, "That after the celebrated battle of the Nile, several malignant ulcers made their appearance in the Culloden, of which ship he was then surgeon, that generally arose from very slight scratches, scalds, or wounds, and some from boils or small pimples, all of which resisted every method of treatment that he put in practice. If the pimple or boil were seated on the lower extremity, it was very inert and slow in suppurating, although cataplasms, &c. were applied; and after the dead cellular substance or core appeared through the cuticle, several days elapsed before the slough was separated. When the slough was thrown off, the edges in some became ragged, in others quite callous and horny; and when this last separated, the ulcer was much extended in size. Absorption took place from several of the ulcers, and produced considerable turgescency of the lymphatic vessels. In some cases, when the ulcer began to heal, another boil appeared in its vicinity, which sometimes suppurated and formed a second ulcer more malignant than the first; but the boil more frequently disappeared, the original ulcer began to discharge again, and pass through all its stages with symptoms of augmented virulence. Escharotics and stimulating ointments were made use of when the ulcers first appeared; but as it was supposed that they increased the susceptibility for absorption, dressings of a milder nature were afterwards used." He says, "it appeared to him that the system was struggling to be freed from something highly noxious and hostile to its healthy action, and that he at last left the treatment to nature.

"When the ulcers attacked the knee or other parts thinly covered with cellular substance, the slough was generally so deep as to destroy part of a tendon or muscle, and to injure their motion. One patient had an ulcer seated between the tendons of the ham, which was at length healed; but the tendons were contracted, and the motion of the joint entirely lost. Another had a similar ulcer, which was so irritable and painful that he could not suffer it to be dressed; he became dyspeptic, his stomach rejected every thing he took; and after lingering a month in the utmost agony he

died. Another patient was attacked with inflammation on his shin, which proceeded to suppuration in spite of leeches, cathartics, &c. When the abscess was opened the tibia and fibula were found to be carious; and in a few days the man became weak and much emaciated. Soon afterwards a large abscess formed above the knee; and it is extraordinary that no previous pain was felt, nor inflammation observed in the part. It had been hinted to him a few days before, that it would probably be necessary to resort to amputation, which he was unwilling to comply with; but when he saw the abscess he solicited to have the operation performed;—a circumstance that created some embarrassment in Mr. Jarvis, for the abscess ran so far up the thigh, that the stump must necessarily be very short. As his strength was however rapidly declining, the operation was resolved on and performed above the seat of the abscess. The muscles were found to be so flaccid as scarcely to resist the knife. The stump was healing, and the patient recovering his strength and spirits, when he was sent to the naval hospital at Port Mahon, where he was soon cured."

It is obvious, from the extracts which I have read to you, that there are two points respecting hospital gangrene which require to be more accurately investigated than they appear hitherto to have been done. The first of these points relates to the diagnosis between hospital gangrene and scorbutic ulcer; the second to the contagious nature of hospital gangrene.

The chief difficulty in distinguishing between hospital gangrene and scorbutic ulcer, seems to have arisen from the similarity in some of the appearances of the ulcers which occur in these two diseases. The best description of scorbutic ulcer, with which I am acquainted, is that which Dr. Lind has given in his valuable Treatise on the Scurvy. Yet, in perusing it, you cannot fail to perceive that it is drawn up in a manner so general, as to include several particulars which occur in malignant as well as in scorbutic ulcer. "The distinguishing characteristics," the Doctor observes, "of scorbutic ulcers, are as follow. They do not afford a good digestion, but a thin fœtid matter, mixed with blood; which at length has the true appearance of coagulated blood, lying caked on the surface of the ulcer, and is with great difficulty wiped off, or separated from the parts below. The flesh underneath these sloughs feels to the

probe soft and spongy. No irritating applications are here of any service: for though such sloughs be with great pains taken away, they are found again at next dressing, where the same bloody appearance always presents itself. Their edges are generally of a livid colour, and puffed up with excrescences of luxuriant flesh arising under the skin. When too tight a compression is made, in order to keep those excrescences from arising, they are apt to have a gangrenous disposition; and the member never fails to become swelled, painful, and for the most part spotted. As the disease increases, they come at length to shoot out a soft bloody *fungus*, which the sailors express by the name of *bullock's liver:* and indeed it has a near resemblance, in consistence and colour, to that substance when boiled. It often rises in a night's time to a monstrous size; and although destroyed by caustics, or the knife, (in which last case a plentiful bleeding generally ensues,) is found at next dressing as large as ever. They continue, however, in this condition a considerable time without tainting the bone.

"The slightest bruises and wounds of scorbutic persons degenerate sometimes into such ulcers. Their appearance, on whatever part of the body, is singular and uniform; and they are easily distinguished from all others, by being so remarkably offensive, bloody, and fungous, that we cannot here but take notice of the impropriety of referring many inveterate and obstinate ulcers on the legs, with very different appearances, to the scurvy; which are generally best cured by giving mercurial medicines: whereas that medicine, in a truly scorbutic ulcer, is the most dangerous and pernicious that can be administered."

But notwithstanding the similarity which has been observed in several of the local appearances of hospital gangrene and scurvy, we shall be in little danger, I conceive, of confounding the symptoms of these two diseases together, if we attend carefully to the peculiar circumstances in which they respectively occur, to the general state or diathesis of the body, and to the constitutional symptoms which accompany the local. Malignant ulcers are not affected in any degree like scorbutic ulcers, by the use of vegetable diet and lemon-juice; and they occur among men who are fed upon fresh meat, and upon vegetables, as readily as they do in those who have been fed upon salt provisions only.

"The scurvy," Dr. Blane very justly remarks, "generally begins to show itself between the sixth and seventh week after men have been at sea victualling. The first visible symptom is generally sore gums, which are affected with a spongy swelling, and bleed upon the least touch. The next most obvious symptom is livid blotches or wheals on the fleshy parts of the legs, under which hard caky substances are felt. This hardness increases, and extends to other parts, as the disease advances, and is considered as a mortal symptom when it reaches the trunk of the body. The face has a livid bloated appearance, and the legs near the ankles become somewhat œdematous.

"The most remarkable symptom next to these is a lassitude and depression of spirits; a small degree of exercise produces laborious breathing.

"Debility and lassitude increase as the disease advances; and these, together with pains of the limbs, and contractions of the hams, confine the diseased person to bed; and any rough motion, or an attempt to raise himself to the erect posture, is apt to bring on syncope.

"In the most advanced stages of the disease, the patients frequently expire on occasions of this kind, or in the act of carrying them on shore for cure, after their arrival in port.

"When a part is bruised in any stage of this disease, there follows a tumour, which is found to be filled with liquid blood; and any wound, however small, especially in the lower extremities, is apt to fall into a foul ulcer very difficult of cure. There is a great tendency to hæmorrhage, either spontaneous, or upon the smallest injury."

Hospital gangrene is almost always accompanied by a high degree of constitutional or febrile symptoms; but "as to fevers," says Dr. Lind, p. 106, "it may indeed be doubted, whether there be any such as are purely and truly scorbutic. The disease is altogether of a chronic nature; and fevers may be justly reckoned amongst its adventitious symptoms. I have been told by a very skilful surgeon, who has had opportunity of seeing some hundred scorbutical cases, and those of the worst kind, that he remarked very few of them to be attended with fevers; which, to the best of his remembrance, always proved fatal."

Whether hospital gangrene ever does or does not supervene to scurvy, I cannot take upon me to determine.

There are certain climates and situations in which they may occur together; but whether they are ever combined in the same person, and what the changes are in the appearances of these diseases which are produced by this combination, are points which I must leave to your own investigation.

The next point of much practical importance, respecting hospital gangrene, is that which relates to its contagious nature. This had been very generally admitted by those who had occasion to observe and to describe that disease, till it was denied by Dr. Trotter, upon grounds no where very explicitly stated in his writings. The contagious nature of hospital gangrene appears to me to be sufficiently proved, 1st, By the fact, that it may be communicated by sponges, charpee, bandages, and clothing, to persons at a distance from those infected with it. 2dly, By its having been observed to attack the slight wounds of surgeons or their mates, who were employed in dressing infected persons; and that even in circumstances where the medical men so employed did not live in the same apartment with the infected. 3dly, By our being able often to trace its progress distinctly from a single individual through a succession of patients. 4thly, By its attacking recent wounds as well as old sores, and that in a short time after they are brought near to a patient affected with the disease. 5thly, By our being able to prevent the progress of the disease in particular situations, by removing the infected person before the contagion which his sores emit has had time to operate. 6thly, by its continuing long in one particular ward of an hospital, or in one particular ship, without appearing in other wards or ships, if pains be taken to prevent intercourse between the infected and uninfected. I have seen hospital gangrene introduced into an hospital by a single individual; and, when proper precautions were not taken, spread extensively among the other patients, but chiefly among those who lay nearest in the ward to the person originally affected, or among those who had had most frequent intercourse with him. I have also known patients attacked in succession with hospital gangrene, who had used the same bedding, or who, without using the same bedding had occupied in quick succession the same small apartment.

We know as yet, it is true, but little of the laws by which

this contagion is communicated, or the distance to which it extends from the focus of infection. It would seem, however, to be capable of being communicated through the medium of the air; for it passes along the wards of an hospital, and attacks patients placed at some distance from one another. Nor is the time at which the disease begins to show itself, after the infection has been received, better ascertained. I think I have repeatedly seen it attack patients in less than three days after they have been exposed to its influence; but of this I would not be very positive.

We are also ignorant whether this poison can act immediately on the sores which it attacks, without being absorbed; or whether, like most other poisons, it must first be absorbed, and produce its effects afterwards, only through the medium of the general constitution.

There are probably certain states of the atmosphere more favourable to the production of this disease than others; but these it may not be easy to ascertain. It has been observed by some authors to occur more frequently in spring and autumn than in the other two seasons of the year. I have seen it make its first appearance, so far as it could be traced, during the middle of winter. I have repeatedly seen this species of sore occur in persons who had not obviously been exposed to the contagion of other sores, and in whom of course it appeared to have been generated for the first time. But this is a point which, in the present state of our knowledge, must be regarded as extremely doubtful. Indeed the subject of human contagion, whether we regard the causes which produce, or the means or laws by which different contagions are communicated, is one of the most difficult to investigate of any which relates to disease; but while it is difficult, it is at the same time also one of the most important that can be suggested to human curiosity.

Scabies, syphilis, sibbens, the plague, and cow-pox, are communicated only by the actual contact of infectious matter in a liquid or solid form. But typhous fever, small-pox, measles, hooping-cough, scarlatina, and hospital gangrene are communicated, not only by actual contact, but also by the transmission of an effluvium from the fomes or original source of infection through the medium of the air. Some infectious diseases, again, as the small-pox and measles, seem

to be capable of being communicated both by contact and by transmission through the air.

Some of these diseases, as syphilis, small-pox, the vaccine, and measles, are never generated *de novo*, but appear to be always propagated by infectious matter, which has been transmitted in succession from one person to another. Other infectious diseases, again, as typhous fever, and probably hospital gangrene, seem capable of being produced in certain circumstances where the individuals affected by them have not been obviously exposed to infection. But we are ignorant, it must be confessed, how long these and other contagions may remain fixed in clothes, utensils, and apartments; and, till this is ascertained, we can never distinctly, in particular instances, say whether typhous fever or hospital gangrene has been generated anew, or only communicated.

The means of preventing and of exterminating this malady resolve themselves into a few particulars, which can at all times be more easily enumerated and recommended than they can be readily enforced, or generally practised. They are, however, the more deserving of your attention, that they are the means which experience has found to be best adapted for preventing and for exterminating, not only hospital gangrene, but every other species of infectious disease.

The first of these means that is usually mentioned, is a free ventilation of air. This is a point in practice upon which I conceive it is quite unnecessary for me to insist; for there is now no fact better established in medicine, than that the virulence of contagious effluvia, and of course the danger of infection, is in proportion to the degree of their concentration; or, in other words, to the smallness of the quantity of air with which they are mixed, or in which they are dissolved. As, on the one hand, the air may be so loaded with contagion as to render infection inevitable, so, on the other, the contagious matter may be so widely disseminated in, or so largely diluted with air, as to render it incapable of producing its specific effect.

A second means, equally obvious and equally essential to the prevention of contagious diseases, is a strict and rigid attention to cleanliness; and this attention, I need scarcely remark to you, must extend to the body-clothes, bed-clothes, and apartments of the infected. These two means, ventila-

tion and cleanliness, I regard as the most powerful we yet possess against the production and propagation of every species of contagion. If, therefore, in the treatment of a contagious disease, we be remiss or negligent in employing these means, we may be assured that all others we can employ must prove ineffectual.

A third means of prevention is, to separate, where this is possible, those affected with any contagious disease from those who are, or who appear to be, uninfected. The utility, as well as necessity, of this measure must be so obvious, that I need not spend any part of your time in attempting to prove it. Not only should the infected be separated from the sound, but the more you can separate the infected from one another, the greater must be the chance of exterminating the contagion.

As an auxiliary, but as an auxiliary only to ventilation, cleanliness, and separation, perhaps we may add, as means of prevention, the practice of acid fumigations. The vapours of acids have a powerful effect in destroying fetid and putrid smells; but whether they be capable of combining with, or of decomposing contagious effluvia, are points which have never been, and perhaps may never be, fully ascertained. The fumes of burning sulphur, and the vapour of boiling vinegar, have long been regarded as powerful means of resisting and of destroying contagions; but the former are of so suffocating a nature, that they cannot be used unless in the fumigation of apartments which are uninhabited. An atmosphere loaded with the vapours of vinegar may be breathed with impunity. These vapours have some, though not a very powerful effect, in destroying fetid exhalations; and they are in general agreeable to the sick and their attendants. Of late years the vapours of the muriatic, nitrous, and oxygenated muriatic acids, have been preferred to those of sulphuric acid and vinegar, partly on account of their superior efficacy in destroying fetid smells, and partly also on account of their greater diffusibility in the atmosphere. The late Dr. James Johnstone of Worcester seems to have been the first who employed the vapours of the muriatic acid with a view to destroy contagion. He did this during the existence of a malignant epidemical fever, which prevailed at Kidderminster in the year 1756. But it does not appear that this mode of practice was generally known, before the experiments performed by

Morveau, in the year 1773, in the church and prisons of Dijon. From the account which that celebrated chemist has given, in his Treatise on the Means of Purifying Infected Air, &c., it appears that, in the winter of the year 1773, the air in one of the principal churches of Dijon was so much contaminated by the putrid effluvia emitted from dead bodies, lodged during an intense frost in its sepulchral vaults, that it became necessary to shut up the church. Various unsuccessful attempts were made to purify the air by the detonation of nitre, by fumigations with vinegar, by burning in it perfumes, and other odoriferous substances. It was at this period that Morveau was consulted, and first carried into execution his process for purifying air, impregnated with putrid effluvia, by the vapours of the muriatic acid. The doors and windows of the church being carefully shut up, the vapours of this acid were disengaged from common salt by pouring on it a quantity of sulphuric acid. The experiment succeeded completely; for the day after the fumigation not the slightest vestige of any offensive odour could be perceived.

Towards the end of the same year, an infectious fever had appeared in the prisons of Dijon, and had proved fatal to upwards of thirty persons, when Morveau was again requested to superintend the execution of a similar process, which was accordingly performed with the greatest apparent success. Morveau, in these fumigations, was led to employ the muriatic acid from his knowledge of the tendency which it has to unite with and to neutralize ammonia, a substance which is generated during the putrefaction of animal matters, and which he, without any satisfactory proofs, regarded as the vehicle of contagion.

It is obvious, from the account which Dr. Carmichael Smyth has given of the jail distemper, which prevailed among the Spanish prisoners at Winchester, in 1780, that it was his intention to have employed the vapours of the nitrous acid for purifying the air of the hospital wards; but the mistake he committed, in supposing that these vapours were to be disengaged by the deflagration of nitre, proves incontestibly, that the nitrous acid had no share in the very beneficial effects which his zeal and benevolent exertions had produced, by means of ventilation, ablution, and separation. Had Dr. Smyth been acquainted with the account of Morveau's process, given in the Journal de Physique, it

would have been impossible for him to have committed that mistake; since he must have known that the nitrous acid is decomposed during the deflagration of nitre; and that, in purifying the air of the hospital, the process which he employed could produce no other than a mechanical effect. I am the more confirmed in this opinion, from observing that Dr. Smyth does not appear to have known that Morveau had expressly mentioned the nitrous acid, in his account, as a substance which, had it been used, must have produced effects more powerful than those of vinegar.

An extensive series of experiments with the vapours of the nitrous acid were, however, made, under the particular direction of Dr. Smyth, by Mr. Menzies, on board of the Union, hospital-ship, at Sheerness, in 1795; and this mode of fumigating has since been much followed both in the navy and the hospital practice of this country. There can be no doubts of the efficacy of these vapours in destroying the offensive smells which occur in sick-wards, and of consequence in rendering the air of these rooms more agreeable and healthful to patients and their attendants. But whether the vapours of nitrous acid, or indeed of any of the acids, actually possess anti-contagious powers, is a point which appears to me to have been assumed, rather than proved by any experiments which are yet before the public. Acid vapours may act upon the atmosphere surrounding the infected, but they are not applied to the bodies of the infected, nor to the bed-clothes in which they lie; though these are usually, and I believe justly, regarded as the great fomites of infection. They may be useful, however, in the apartments of the sick, not only by sweetening the air of these apartments, but also by inspiring the attendants with confidence, and by directing their attention in a particular manner to the other means of prevention. It appears from the foreign journals, that the practice of acid fumigation is still continued in putrid and contagious diseases in many of the hospitals in France, Italy, Spain, and Germany; but the fumes of the oxygenated muriatic acid gas are now generally preferred to those of the other acids. This preference seems to be founded partly on the great expansibility of the fumes of that gas, and partly on its well-known powerful agency in decomposing animal substances. Upon the whole, it seems now to be generally admitted by medical men, that the body-clothes, bed-clothes,

utensils, and apartments of those who have been infected with contagious diseases, should never be used till they have been properly fumigated with the vapours of the oxygenated muriatic acid gas, washed with boiling water, and duly ventilated.

In the treatment of a patient affected with hospital gangrene, our first object should be, as has been already mentioned, to remove him from the place of infection; but where, from particular circumstances, this is impossible, or where, after being removed, the disease continues, we must then have recourse to those remedies, general and local, which experience has shown to be best adapted for the cure of hospital gangrene.

In the commencement of the constitutional attack, Pouteau and Dussassois recommend the use of emetics; and the same mode of practice seems to have been followed with advantage by several surgeons in the British navy. Mr. Briggs says, "I have always found emetics more effectual than any other evacuants. It often happens," he adds, "that neither internal medicines nor external applications have any influence in stopping the progress of these sores for the first five or six days. I have often seen emetics administered at the commencement of the disease; and, when used sufficiently early, always, as I conceived, with advantage." They unload the stomach of matter which might be long in being digested; or which, as it happened to partake of a vegetable or animal nature, might be disposed to become acescent or putrid. By unloading the stomach, they diminish the sickness with which the febrile attack of this gangrene is often ushered in; and they tend powerfully to promote perspiration. I do not remember ever to have seen an emetic given in this disease occasion any mischief: so that, judging from the benefit which I have seen emetics produce, I am inclined to think that they ought never to be omitted in the commencement of the disease.

The cold affusion has not yet, so far as I know, been tried in hospital gangrene; but from its now well-ascertained beneficial effects in eruptive typhoid fevers, with which, it deserves to be remarked, that the symptomatic affection in hospital gangrene seems, in many respects, to have a considerable affinity, I should, in the progress of this disease, be inclined to expect from the affusion of cold, tepid, and warm water, the most agreeable results.

Purgatives and laxatives, also, may be necessary in every state of hospital gangrene; but, from their effect in diminishing fever, they are particularly useful in the commencement of the attack. Of these there is, indeed, a very great number which have been recommended by different surgeons. If, from the state of the tongue, or from the prevalence of other complaints, there should be any reason to suspect the presence of bile in the intestinal canal, calomel is the purgative which ought to be employed. Dussassois thought that he obtained in his practice great advantages from the use of cream of tartar, given at first to act as a purgative, and afterwards as a diuretic. It was useful, probably, from its cooling as well as laxative quality. In this, as in most other diseases, the kind of purgative may be left to the discretion of the practitioner, or to the inclination of the patient. The principal object proposed by administering it is to remove from the intestinal canal whatever matter might prove a source of irritation, or hinder the digestion of the food.

Blood-letting is admissible in but few instances: not merely because the orifice made by the lancet is apt to become gangrenous, but because the fever which accompanies this gangrene is usually of the typhoid or asthenic character; and, still more, because in many instances patients affected with hospital gangrene have been observed to sink rapidly after this evacuation had been employed. In young, strong, and otherwise healthy people, who, in consequence of slight hurts, and of exposure afterwards to the infection of this poison, are attacked with hospital gangrene, one or two blood-lettings at first may perhaps be of service in weakening the violence of the febrile reaction. I have seen it employed, and I think with advantage, in one or two cases of this kind. You will find that blood-letting was, in some situations, pretty freely had recourse to by some of the navy surgeons who have corresponded with Dr. Trotter. It was employed by Mr. Moffat with much advantage. He tried fumigations without benefit, and returned to the use of the antiphlogistic treatment. The disease, as described by those surgeons who employed blood-letting, seems to have partaken a good deal of a phlegmonous inflammatory disposition. This, however, is not its most usual form; and even where the inflammatory diathesis seems at first to prevail, it is com-

monly but of short duration. Blood-letting, therefore, in hospital gangrene, must always be used with much caution. Though I would not in every case forbid its use, I am of opinion that it will seldom or ever be necessary to repeat it. What renders it at all times unpleasant to have recourse to blood-letting, is the fact, that men, who are bled for other inflammatory affections during the prevalence of hospital gangrene, are liable to be attacked with it in the orifices of the wounds made by the lancet. Instead of healing, these become painful, somewhat swelled, hard, and of a livid red colour.

The effects of spontaneous hemorrhagies upon the febrile symptoms accompanying hospital gangrene, have either not been accurately observed, or at least not fully recorded, though they might be a guide of great importance in practice.

That part of the antiphlogistic plan which relates to abstinence from animal food, ought, in the first attack of hospital gangrene, to be strictly observed, and in its place diluting acid drinks employed. Lemonade, spruce beer, and acid fruits, are generally very agreeable to the patient.

In severe cases, however, attended with quick and feeble pulse, with depression, restlessness, and anxiety, an opiate becomes necessary. So long as we wish to excite a degree of moisture on the skin, Dover's powder, or laudanum with some antimonial wine, form in general the best opiates. They heat the body less than the pure opium or laudanum. Such of you as may not have seen opium given to allay the pain attendant upon hospital gangrene, will be surprised to observe how little relief it usually brings in the commencement of this disease. Given in a very early stage in hospital gangrene, I think I have, as in typhous fever, repeatedly seen it do harm. Several of the navy surgeons were convinced, from their own experience, that it added to the violence of the fever. When the violence of the febrile reaction, however, has a little subsided, opium is the internal remedy, from the judicious use of which you will obtain the most sensible relief, and the most permanent advantage.

The use of wine, in the early stage of hospital gangrene, is liable to still stronger objections than opium; for it adds to the violence of the fever simply, without having, like opium, a tendency to soothe or to diminish the local pain.

In administering this remedy, therefore, we must wait for an abatement of the fever. We must give it at first in small quantities, to be increased gradually, according to the effects which it seems to produce; and we must be careful to discontinue it immediately, wherever we can perceive from it any aggravation of the general or local symptoms of the disease. The wine may be changed for ale, porter, or even spirits, according to the wishes of the patient, or according to the circumstances in which this malady first appears.

Camphor, Pouteau regarded as a medicine peculiarly useful in putting a stop to the progress of the gangrene. I have not myself had any experience of its effects.

All authors, who have written upon the subject of hospital gangrene, agree in reprobating the internal use of bark at an early period. I have often seen it administered in hospital gangrene; but I cannot say I have ever seen it prove beneficial. In more cases than one have I seen it prove highly injurious, by loading the stomach, and by exciting diarrhœa.

The diet, which at first should consist of light, easily digested, farinaceous substances, may, in the progress of the disease, be made more nourishing, by an admixture of animal food. But it is needless for me to attempt to be minute on points in which your own good sense must direct you, better than any rules I can prescribe.

The local treatment of hospital gangrene has been more diversified than the general. Scarcely any two practitioners agree in recommending the same application. In general, however, practitioners agree in reprobating the use of watery applications, such as fomentations and poultices. In the reports of the navy surgeons, these applications are said, and the remark agrees with my own observation, to have accelerated the progress of the disease. Exceptions, however, ought perhaps to be made in favour of the fermenting poultice, which seems to answer very well in mild cases of hospital gangrene. It never appeared to me, however, to answer so well in this disease as in gangrene from pressure. Mr. Hammick, of Plymouth Hospital, conceives that he obtained much advantage from the use of poultices and fomentations, to which hops were added; but whether the addition of hops to the poultice was merely following up the idea of improving the fermenting poultice, as we im-

prove beer by their addition, or whether hops of themselves really possess salutary virtues, I am unable to say. One surgeon also, Mr. Stokoe, made use of a poultice composed of oat-meal and sea water; but this application did not seem to answer well with some of the other surgeons who tried it.

Solutions of sugar of lead have been strongly recommended. In some instances they seemed to retard the progress of the gangrene; but in producing this effect they always rendered the separation of the sphacelated parts more tedious. From the well-known sedative effects of lead, locally applied, I am disposed to believe that its use in hospital gangrene will, in the greater number of instances, be injurious; but this is a point concerning which we require more accurate observations than any I have been able to find upon record.

Dr. Trotter recommends local as well as general bloodletting in the treatment of hospital gangrene. None of the navy surgeons seem to have followed this advice; or, if they did, they have not chosen to communicate the result of their experience. Every wound made by a lancet, or by a leech, in the neighbourhood of the sphacelus, must have become the centre of a new ulcer; and the practice must have been inwardly reprobated by all who had had the temerity to try it.

Cloths dipt in vinegar, or in diluted muriatic acid, have appeared to stop the progress of this gangrene. They undoubtedly correct the fetor. Vinegar, either alone or mixed with spirits, I regard as a good application. In some cases in which I saw it used, it occasioned a good deal of pain. I cannot, however, say whether this effect be very general. Lemon-juice also has been tried, and, it is said, with advantage. Dr. Gillespie applied thin slices of lemons to the sores in this gangrene. They were repeated two or three times in the course of the day, and seemed to prove highly useful. This is the common application which the negroes make to all foul sores in the West Indies. Moreau and Burdin, in mild and incipient cases, apply citric and acetic acids.

The vapours of the nitric, muriatic, and oxygenated muriatic acids, have often been applied to sores affected with hospital gangrene. The first report of their applica-

tion was very flattering; but it was soon found, that though they corrected the fetor, and seemed for a time to give a favourable appearance to the sore, yet that this appearance was not lasting. But though fumigation with acids may not produce any beneficial effects on the surface of the sores, it may, however, be of considerable use, by destroying the bad smell which these sores emit during dressing. Patients in general complain much of the pain which acid vapours occasion: and what, in my opinion, should tend to weaken our belief in chemical explanations of the action of medicines, by chemists who are no physicians, or by physicians who are but indifferent chemists, is the well-ascertained fact, that hospital gangrene has repeatedly become worse in situations where acid fumigations were practised. I am far, however, from thinking, that the increased malignity of the disease was to be ascribed to the acid fumigations. We are justly entitled to infer that they were inefficacious, not that they were injurious.

Cold applications, in some instances, give relief, particularly in phlegmonous gangrene, and in the commencement of the disorder. Very frequent dressings are in general necessary on account of the quantity, acrimony, and fetid smell of the discharge.

Dr. Harness is said to have employed with much success the gastric liquor of the bullock's stomach, in ulcers affected with mortification.

Spirits of wine, either alone, or holding in solution some of the warm gums, such as myrrh, aloes, and camphor, form in many cases very good applications in hospital gangrene. They stimulate parts in the state of gangrene to the production of healthy granulations; while they correct powerfully, also, the fetid smell of those which are sphacelated.

Oil of turpentine, either alone or mixed with equal parts of unguentum resinosum, is the local application on which, from the practice of the French surgeons, as well as from the effects which I have seen follow from its use in a very considerable number of cases, I should be most disposed to rely.

Dussassois used to cover the surface of the sores with successive layers of the powder of bark, which were afterwards moistened with oil of turpentine. I very much doubt whether the bark served any other purpose than

to detain the oil on the sore, and to exclude the air. Charcoal, as well as bark, has been supposed to possess strong antiseptic qualities. I believe that these substances are chiefly useful by absorbing the discharge, which is fetid and acrimonious, and which would otherwise excoriate the parts in a state of gangrene. The oil of turpentine was probably weakened by the addition of the powder of bark. The two used together formed a hardened cake, which required to be changed every twenty-four hours. This application, Dussassois says, changes the character of the inflammation from that of œdematous and gangrenous to phlegmonous, alleviates pain, and occasions the growth of healthy granulations. But it usually requires from seven to nine days to produce these effects. If intermitted, the gangrene returns, the relapse proves dangerous, and requires the application of the cautery.

Solutions of sal ammoniac in water and vinegar have often been used, but I cannot, from my own observations, say much of their effects in hospital gangrene, though I am inclined to believe they will be found to be useful. Dussassois sometimes added, particularly in very malignant cases, about one-fifth of powdered sal ammoniac to the bark with which he covered the ulcers.

Escharotics also have been used. Several of the navy surgeons sprinkled the red oxyde of mercury upon the sores, in order to promote the separation of the sloughs. It is only where the sloughs are very thin that the precipitate can produce this effect. I have never seen it used, nor should I be much inclined to give it a trial.

Mr. Cruikshanks used a diluted solution of the nitrates of mercury and silver in the sore which Dr. Rollo describes, and, as he conceived, with great advantage.

Pouteau goes even so far as to recommend, what he seems to have practised, the actual cautery; and, where this was not permitted, the application of boiling oils. Dussassois, who must have followed the same practice, states expressly, that the patients usually felt great relief from the application of the cautery. It should be applied, he says, to the surface of the sore only, not to its edges; and if the first application does not allay the pain, another should be made within forty-eight hours from the first. He regards the boiling oils as less useful applications than the cautery.

The fermenting poultice, spirits, and turpentine, are certainly much milder applications, and will, I am convinced, when judiciously used, be found to be much more efficacious in effecting a cure. If attention to cleanliness, in the dressing of sores and ulcers, be at all times required, it is needless for me to remark to you, how much more imperiously it must be required in hospital gangrene, where the discharge from the sores, and probably the effluvia from the body of the patient, are of a contagious nature.

MORTIFICATION.

The human body is but a temporary fabric, which carries in its composition and structure the principles of dissolution and decay; and this is true not only of the machine, considered as an organized whole, but also of the several parts, textures, and organs, of which it is composed. Accordingly every part of the body, possessing a vital power, or exerting a vital action, may be deprived of these faculties, and reduced, by the operation of a variety of causes, to the state of inert or dead matter.* When this deprivation of the vital powers extends to the whole machine, death ensues; but when it is confined to some particular part, that local affection is produced which we are next to consider, and which has been technically denominated a mortification.

The phenomena which attend partial death, or the mortification of the different parts of the body, are exceedingly numerous, and, in some respects, very dissimilar; and there is but too much reason to suspect, that, under the general term mortification, a great number of morbid phenomena have been comprehended, which, notwithstanding the present improved state of medical science, have never been carefully examined, nor of course accurately distinguished from one another. Attempts have, indeed, been made to subdivide the phenomena of mortification, and to arrange them under distinct heads or classes, each class, or head, possessing some common character, and distinguished by an appropriate name. Hence, probably, the origin of the terms gangrene and sphacelus, terms which are to be

* See Pearson's Principles of Surgery, p. cxc.

found in almost every medical work, but to which very precise or definite ideas do not appear to have at all times been annexed. Accordingly, by some authors, the terms mortification, gangrene, and sphacelus have, in their description of diseased appearances, been used indiscriminately as being of the same, or very nearly of similar import; while, by other authors, they have been used to denote different states or stages of the same morbid affection.

The various modes in which parts die, the diversity of causes from which their death proceeds, and the dissimilar, or even opposite modes of treatment which those affections, in different stages and in different circumstances, seem to require, render a careful investigation, and accurate arrangement of this subject a most important object in the practice of surgery. In looking, however, into the different books of surgery and physic, which treat of mortification, you will soon be convinced that the subject has not yet received that attention which its importance demands. By an indiscriminate use of vague terms, and by a careless arrangement of the phenomena of mortification, practical authors have scarcely left us an opportunity to profit by the facts, observations, and cases which they have put upon record. The work of M. Quesnai, entitled, "Traité de la Gangrene," published at Paris in the year 1749, is by far the most valuable publication which we yet possess upon this subject. Indeed every page of this work is distinguished by the same talent for accurate observation and perspicuous arrangement, which are so remarkable in all the other writings of that celebrated author. That I shall be able, by the views which I am going to present to you, to remove any part of the obscurity which prevails with regard to the nature and progress of mortification, is what I dare not presume to hope; but I shall obtain a great part of the object which I have in view, if I can impress you with a conviction of the importance of this subject; and if, in studying the phenomena of mortification, I shall be able to prevent you from confounding together things which are really and essentially, though perhaps not very obviously, distinct.

In attending to the progress of different local inflammatory diseases, we observe that some of them, instead of terminating in resolution, or of producing in the inflamed parts the phenomena of adhesion or of suppuration, manifest a dispo-

sition to terminate, and often do actually terminate, in the death or mortification of a greater or less portion of the parts which are the seat of the inflammation. It is this disposition that constitutes the peculiar character, or generic essence, of these diseases, and therefore it requires to be distinguished by an appropriate appellation. The disposition in inflamed parts to terminate in mortification manifests itself in many inflammatory affections produced by external injury, and in constitutional diseases in which peculiar states or diseases of the system seem to exist. Besides occurring in these circumstances, mortification appears not unfrequently as an original idiopathic disease, and in other instances as a local affection, occasioned by the internal use or external application of substances which produce mortification as a specific effect.

In treating of this subject, I shall retain the term mortification as a generic term, comprehending under it the whole series of phenomena which occur in any inflamed part, texture, or organ, from the first apparent diminution of its vital powers, to their total and complete extinction. But between the state of apparent diminution of the vital powers of any inflamed part, and the complete extinction of these powers in mortification, a considerable interval of time often elapses, and many morbid events occur, sometimes in quicker, at other times in slower succession, which require to be separately observed and carefully distinguished. These events are the more deserving of our attention, that they form the local and constitutional symptoms by which the different stages of the state or process of mortification are characterised. I shall employ the term gangrene to express that stage of mortification in inflamed parts which precedes the death of the part; a stage in which there is a diminution, but not a total destruction of the powers of life; in which the blood appears to circulate through the larger vessels; in which the nerves retain a portion of their sensibility; and in which, perhaps, the part affected may still be supposed to be capable of recovery. The word sphacelus I shall use to denote the complete death or mortification of a part; that state in which the powers of life have become extinct; in which the blood ceases to circulate; and in which the sensibility of the nerves is lost, whether the dead or mortified part has or has not become actually putrid, or shown any tendency to separate and fall away from the

living and sound parts. Putrefaction, or the spontaneous process by which animal bodies are decomposed, is an accidental, and not a necessary effect of the state of mortification. It takes place at very different periods after the death of particular parts ; and these periods, it may be remarked, are always regulated, not only by external circumstances, such as the humidity and temperature of the atmosphere, but also by the peculiar structure and morbid conditions of the animal texture or organ in which the putrefaction occurs. The term sphacelus has, I know, been employed to express that a part is not only completely dead or mortified, but also that that part has become putrid, and is in a state of separation from the surrounding and living parts. But as putrefaction is not a necessary or immediate consequence of mortification, or partial death in animal bodies, this use of the term sphacelus is obviously improper. Even in cases of sphacelus, in which putrefaction actually occurs, we cannot always very accurately determine, whether this process be going on in the solids, or only in the fluids of the part that is mortified. The smell affords but a fallacious test; and, besides, we shall find that, in some species of mortification, the solid parts affected with that disease, so far from having their natural proneness to decomposition increased by it, are rendered even less susceptible of putrefaction than similar parts which had not been mortified before death. Gangrene, therefore, according to the definition which I have given of it, is the first step, the incipient stage of mortification; sphacelus, the last stage and full completion of that state: or, in the language of Galen, gangrene is a mortification which, strictly speaking, is not actually formed, but forming, being the intermediate stage betwixt the height of inflammation and the state of sphacelus. Among the practical authors who have adopted these definitions of Galen, no one appears to me to have understood them better, or to have adhered to them more closely in his writings, than Fabricius Hildanus has done in his "Tractatus Methodicus de Gangrena et Sphacelo," a work which, at the period in which it was written, and for a long time after, contained by far the best account of mortification that is to be found in the records of medicine.

Gangrene may arise from a great variety of causes; but the form of this disease, to which I would, in the first place, wish to direct your attention, is the gangrene which obvi-

ously arises from inflammation, or which at least succeeds immediately to that state, whether it be of a local or of a constitutional, of a common or of a specific kind. The succession of gangrene to inflammation is indeed so very common an occurrence, that gangrene has usually been considered as one of the modes in which inflammation terminates. That it should not have been so considered by Mr. Hunter, appears to me to be matter of equal surprise and regret: For that great pathologist could not have failed to have rendered his account of the gangrenous inflammation as instructive and interesting, as he has made those of the adhesive, suppurative and ulcerative.

In cases in which gangrene immediately succeeds to inflammation, these two morbid states may, in some measure, be regarded as stages or periods of the same disease. They pass insensibly into one another; nor is it possible to say precisely, where the one state ends and the other commences. The symptoms of inflammation in these cases do not disappear before those of gangrene come on, but seem rather to undergo a gradual and almost imperceptible change or conversion into one another. The redness acquires a deeper tinge, and spreads farther than formerly; the swelling increases, and becomes more doughy: and in this incipient stage, the gangrene, particularly when it attacks cutaneous texture, often resembles the disease, afterwards to be described under the name of erysipelas, so completely as to render it impossible, but by the history of the complaint, to distinguish these two affections from each other.

The progress of the local symptoms from inflammation to gangrene, and from gangrene to sphacelus, varies always according to the structure of the part in which they appear, according to the age, constitution, and habits of the patient, and according to the nature and degree of the remote cause by which the affection has been induced. When the progress of the disease is rapid, we may term it an acute, when slow, a chronic mortification. German medical authors usually express this difference by the terms of hot and cold, the French by those of humid and dry gangrenes.

When, in any case, the local symptoms of inflammation, instead of being resolved, or of passing into the state of adhesion and of suppuration, continue, and become attended with a sense of burning in the inflamed part, by a purple,

bluish, or livid appearance of the skin, and by a kind of flaccidity or softness in the part, notwithstanding the increase of the swelling, we can have no difficulty in saying that the disease has passed from the state of acute or active inflammation to that of gangrene.

The part of the body which becomes affected with gangrene does not immediately lose its sensibility, for the pain, on the contrary, is often very much aggravated by the approach of this state. The blood also still continues to circulate at least in the larger vessels of the part, but perhaps with less force ; and from the resistance which it meets with in passing through the capillaries, in less quantity than formerly. The serous effusion into the cellular membrane continuing to increase, and the action of the absorbent and sanguiferous vessels to diminish, the part becomes at length incapable of being restored to its former office in the animal œconomy. It is therefore in its earlier stages only, that gangrene is to be considered as an affection admitting of cure; for there are limits beyond which, if it pass, recovery becomes impossible. These limits it may not, in every instance, be easy to define; but they form the boundaries between incipient gangrene and the ultimate termination of that state in sphacelus. Whether retarded circulation, or stagnation of the blood in the capillaries, always precedes the state of gangrene, and how long stagnation may remain without gangrene being induced, are points concerning which at present we have little, if any, correct information.

It has been objected to the usual mode of considering gangrene as a consequence or termination of inflammation, that it often occurs without being preceded by inflammation. That a mortification in the form of sphacelus may come on which had not been preceded by acute inflammation, is a fact established by daily experience; but that a state, similar to that which I have described by the term sphacelus, ever appears spontaneously, without being preceded or attended by a certain degree of inflammation, is a point which I am very much disposed to doubt. I shall not attempt to deny that a gangrene may arise spontaneously in the body, or may be produced by the operation of causes, in some instances obvious, in others concealed, which in the order of its symptoms was not preceded by inflammation of a more active kind. Something like this state seems to occur in some cases of erysipelas and of carbuncle, in some

cases of burns and frostbite, and perhaps, too, in malignant cases of whitloe.

But though a gangrene may arise spontaneously, or may be produced by external causes, which, in the order of its appearance, was not preceded by inflammation of a more active kind, still I am of opinion that gangrene is a state which approaches, in its nature, to that of inflammation; and that if, on the one hand, we find inflammation terminating in gangrene, so, on the other, we find gangrene terminating in inflammation, particularly of the adhesive kind. Thus we often see parts affected with gangrene, which seem as if they were about to pass to the state of sphacelus, enter into that of adhesive inflammation. Indeed it is by this process only, that parts in the neighbourhood of a sphacelus can ever be rescued from the destruction with which they are threatened.

It may be objected to the use which I have made of the term gangrene, that it is impossible to say precisely in what the state, which I include under that appellation, differs from inflammation. I admit readily the truth of the objection. I have said, that when gangrene succeeds immediately to inflammation, it is impossible to determine where the state of inflammation ends, and that of gangrene begins. In both states there is redness, pain, and swelling; and these symptoms are, in general, more considerable in gangrene than inflammation. I am doubtful, however, if the same remark should be made with regard to the temperature. In inflammation this is almost always some degrees higher than in the corresponding part of the body which remains uninflamed. In gangrene, from the diminished force of circulation, and from the increased resistance to the influx of blood into the vessels of the part, I am inclined to believe that the temperature will be found, even in its commencement, lower than in active inflammation. This, however, I give you merely as a conjecture, as a point which you may ascertain by observation. No very accurate experiments have, so far as I know, been made with a view to ascertain the temperature of parts in the earlier stages of gangrene. If retarded or obstructed circulation in the capillary vessels be necessary to the state of gangrene, we should, *a priori*, expect a proportional diminution of temperature. But in ascertaining the temperature of a gangrenous part, we must be careful to distinguish the heat which it receives

by communication, from that which is evolved in it by the circulation of the blood.

The constitutional symptoms which appear in gangrene, whether succeeding immediately to active inflammation, or occurring as an original idiopathic disease, are not very different in their appearance from those which accompany the different kinds of inflammation. They form fevers which partake, in individual cases, more or less of an inflammatory, typhoid, or bilious character. But the degree of these fevers varies, in every particular case, from their almost total absence to the highest degree of intensity. The skin is usually hot and dry at the commencement of the attack, the tongue is without moisture, brown and hard, the pulse is quicker and less full and strong than in inflammation; and this state of the pulse is often attended by fluttering, intermissions, and a considerable degree of subsultus tendinum. The fever has, in general, more of the asthenic than of the sthenic character; or it is more of the typhoid than of the inflammatory type; a circumstance of great importance in the constitutional treatment of mortification. The fever in gangrenous affections is often accompanied with great uneasiness and restlessness, dejection of spirits, wildness of the looks; and, in severe cases, with almost always less or more of delirium. In the progress of the disease, cold sweats, palpitations, and convulsions, sometimes occur; a hiccup, accompanied with nausea, often comes on, and proves a most distressing symptom to the patient; frequently this hiccup is the forerunner of death. Some patients die comatose, others after suffering severe pains, spasms, and delirium. But in some a slow, in others a sudden abatement of the constitutional symptoms takes place, accompanied also by the amelioration of the local affection. The gangrenous inflammation stops, and a red line is formed by adhesive inflammation in the extreme verge of the living parts, the dead part separates, and granulations form; and, when the constitution has strength to sustain the injury it has received, recovery takes place. The symptoms, however, both constitutional and local, which accompany gangrene, vary exceedingly according to the seat of this disease, the degree of its progress, and also according to peculiarities of constitution in the individuals affected by it.

In many instances gangrene and sphacelus are confined to a particular texture or organ, in others these affections

attack several textures or organs at the same instant or at successive instants of time.

Cutaneous texture is that in which we have the best opportunity of observing the phenomena and progress of gangrene. In this texture it may occur as an original idiopathic disease; but more frequently we observe it occurring as a consequence either of specific inflammation, or of that which is excited by the application of external causes. When it occurs as a consequence of some preceding inflammation, the colour of the skin, as has been already remarked, changes from the florid red to a darker shade; and in the progress of the disease it acquires a livid hue. The cuticle often separates in some points from the skin, and the vesications termed phlyctenæ are formed, which contain usually a bloody-coloured serum. Gangrened skin in this state has a strong resemblance to that affected with ecchymosis, and sometimes exhibits a similar variety of colours. Indeed it is often difficult in cases of ecchymosis, produced by external injury, to distinguish that state from gangrene. In passing into the state of sphacelus, the livid hue, in some instances, disappears, and an ash-coloured slough is formed; in others the part sphacelating acquires and preserves a black colour. The ash-coloured slough seems to occur most frequently in skin which is moister, the black-coloured in skin which is dryer than common. The portion of the skin which becomes sphacelated may (and this is most frequently the case) occupy only a small portion of the space existing in a state of gangrene, or it may occupy the whole of the gangrened space. In the former case we have an example of a mortification which spreads slowly, and which attacks successively the gangrenous skin; in the other, a sphacelus, which is stopped by the healthy integuments. In some instances, the gangrene and sphacelus seem limited to the cutaneous texture. In most instances, however, they extend to the subjacent textures, and frequently affect the whole depth of an extremity. It is not always easy to judge of the extent of mortification from the appearance of the skin, for this disease, when it attacks the subjacent cellular membrane, may occupy a greater extent of surface internally than it does externally. In a spreading gangrene, the red colour of the gangrened skin is lost insensibly in the surrounding integuments; but when gangrene, followed by sphacelus, stops, a red line,

of a colour more lively than that of gangrene, is usually to be perceived between the living and dead parts. When this red line, the breadth of which varies in every particular instance, acquires the livid or gangrenous hue, we have reason to fear that the part is about to pass into the state of sphacelus. It is in the inner edge of this inflamed line that we usually see that ulcerating process begin, by which the separation of dead from living parts is effected, a process the phenomena of which I took occasion to detail to you at great length when treating of ulceration. In the natural progress of aneurisms, and other large tumours, from the internal to the external parts of the body, greater or less portions of the cutaneous texture which covers them, not unfrequently become red and gangrenous before they pass into the state of sphacelus; in other instances, the parts covering these tumours pass into the state of ulceration unaccompanied by sphacelus.

Mortification seems to occur frequently in cellular texture; but we seldom, if ever, have an opportunity of observing the progress of the disease in this texture before it has passed into the state of sphacelus. The portion of skin which covers dead cellular texture has generally a gangrenous appearance, and passes sometimes into sphacelus, and in other instances into the state of ulceration. In some cases the portion of sphacelated cellular texture is of a small, and in others of a large size. We have an example of the former in malignant boil, and of the latter in common and in pestilential carbuncle. It not unfrequently happens, in cases of erysipelas phlegmonoides, that the cellular texture which enters between, and connects together different parts, such as muscles, tendons, nerves, blood-vessels, &c. becomes dead, by which the continuity of these parts is destroyed. In these cases, extensive portions of the skin are usually removed, partly by gangrene and partly by ulceration; and we see muscle, tendon, blood-vessel, and nerve, denuded of their proper coverings, and existing in different states of disease.

Artery is the texture which nature seems to have endowed with the greatest power of resisting its own destruction by mortification. I have, in various instances of erysipelas phlegmonoides, seen several inches of the femoral artery laid completely bare by the gangrene, ulceration, and sphacelus of the parts covering it, without its giving way before

death. The arteries in these, and other similar instances in which I have seen them laid bare in the neck and arm, by abscess terminating in mortification, had the appearance of raw flesh, and were obviously thicker and more vascular than natural. The blood circulated through them, and assisted in supplying with nourishment the parts upon which they were distributed.

The colour of fascia, ligament and tendon, is often but little altered on the first attack of sphacelus. When the skin and cellular texture which cover them have been removed, and these parts themselves exposed, few marks of gangrenous inflammation are to be perceived in them, nor can we in general say how much of these textures has become dead, till we perceive an increased vascularity or redness beginning to appear in the living parts contiguous to the dead. Mortification goes on with very different degrees of rapidity in these textures. In slow mortification, the fibres lose their glistening appearance, and become, particularly in fasciæ or fibrous membranes, of an ash-colour, softer in their texture, and admit of being easily torn or separated from each other. The extension of the mortification in these textures is often made known to us only by the gangrenous inflammation, swelling, and tension of the parts covering them, and by the increased severity of the constitutional symptoms by which mortification in these textures is usually accompanied.

The progress of the phenomena of mortification in muscular texture has not been observed, and of course not described.

Mortification occurs very readily in mucous membrane. The most frequent example which we have of this is in the gangrenous affection of the throat which accompanies scarlatina. The redness in this membrane is more intense than in cutaneous texture. Most frequently the inflammation of the fauces in scarlatina terminates in ulceration, but occasionally in sphacelus; and in these instances the disease proves almost always fatal. The white sloughs which are formed in the fauces by exudation are often mistaken for ulcers; and, when surrounded by erythematous inflammation, not unfrequently for the effects of sphacelus.

Aphthous excoriations of the fauces and inside of the lips and of the tongue sometimes pass into the state of mortification, though these parts are much more frequently the seat

of ulceration, and of an ulceration which is but seldom very destructive in its effects. These excoriations have also their seat upon the gums; but sphacelation of this texture occurs more frequently from scurvy than it does from aphthæ.

The inflammation which attacks lymphatic absorbent glands terminates sometimes in mortification. In many instances of this, however, it is the skin and cellular membrane which cover these glands, rather than the glands themselves, which pass into the states of gangrene and sphacelus. The most frequent examples of gangrenous bubo are those which occur in the venereal disease, and which are usually produced by the irritation of mechanical or chemical means, by a regimen too stimulating, or by perseverance in the use of mercury after it has begun to act as a poison upon the system. Very often in gangrenous bubo, the glands are exposed, by sphacelus and ulceration, and in this exposed state, appear as so many pieces of raw flesh, which in some instances slough and come away of themselves; in other instances require to be removed by caustic or ligature; and in others, again, admit of being covered over by a new skin forming upon the surrounding granulations.

There are few, if any parts of the body, which are not liable to an attack of gangrenous inflammation; but in many parts general death seems to be produced by the inflammatory or gangrenous affection, before it passes to the state of sphacelus.

Even portions of the brain itself, or of the membranes covering it, have often been observed to be destroyed by mortification, and this sometimes long before general death took place. The mortification in this case is, however, in general, the effect of the contusion produced by external injury. At present it seems doubtful, whether, in spontaneous inflammations of the brain, mortification of that organ ever passes into the state of sphacelus. The fetid smell and soft state of the brain are very uncertain criteria of this, since these occur in many cases in which the inflammation terminates by suppuration.

Senac, Lieutaud, Portal and Corvisart, mention cases in which gangrenous spots were supposed to be seen after death in the pericardium and in the heart; but the descriptions which have been given of these appearances are too

vague, to allow us to place much reliance upon them. Inflammations of these parts are exceedingly common occurrences; but if inflammation ever passes in them into the states of gangrene and sphacelus, it must do so very seldom, since no cases of this kind have yet been accurately described.

Practical authors also mention appearances which they have supposed to proceed from mortification in the lungs and pleura. The inflammation of these parts has often a very dark livid colour; but I have not seen myself, nor have I, after some research, been able to find any cases upon record, in which unequivocal marks of sphacelus were observable in the chests of those who had died of pleuritic inflammation. Sphacelus of the lungs, in the instances yet recorded of it, has been always produced by strangulation in the protrusions of portions of these viscera, through punctured wounds in the parietes of the chest.

The different parts of the alimentary canal may become affected with gangrene and sphacelus; but the accounts which have been given of these affections, as occurring in the œsophagus and stomach during life, are extremely imperfect, if not in some respects erroneous. These organs are liable to attacks of inflammation, and inflammation so severe as in many instances to be attended with extravasation of blood, and a livid colour of the parts more immediately affected; but ulceration is a much more common effect of inflammation in the œsophagus and stomach than the state which has been denominated sphacelus. The sphacelus of the stomach, which occurs during life, is that only, I believe, which is produced by the direct effect of caustic poisons.

Inflammation of the intestinal canal passes readily into the states of gangrene and sphacelus. It is but seldom, indeed, that we have an opportunity of seeing the last of these states produced in cases of simple enteritis, because the patient generally dies before the state of sphacelus has actually commenced; but this is a state which we sometimes see in dysentery, and which we often see occur both in intussusceptio and hernia. In intussusceptio, from one or two inches of intestine to several feet, have often mortified and come away by stool, without the inflammation by which this was effected proving fatal. More frequently, however

the patient dies before the strangulated portion of gut passes into the state of sphacelus. This is true also of hernia; though in this affection not only the intestine, but the peritoneum in which it is included, and the parts which cover them when protruded, may all pass, in particular individuals, into the state of sphacelus, without death being the immediate consequence. The omentum and mesentery, like the intestinal canal, may be attacked with gangrene and sphacelus; but they are more frequently so in hernia, than as a consequence of spontaneous inflammation. What the circumstances in inflammations of the abdominal viscera are, which occasion death, in some instances, during the period of active inflammation, in others during gangrene, and in others not till the state of sphacelus has not only begun, but has continued for a considerable length of time, is a point concerning which we have no knowledge whatever. We only know the fact, and this is all which we shall probably ever know of the matter.

The inflammation which accompanies swellings of the salivary glands, is, as has been remarked by Sir John Pringle and others, frequently of a gangrenous kind. In the suppurations of these glands, the skin and cellular membrane covering them pass sometimes into the state of sphacelus; but I do not know of any cases in which the salivary glands themselves have been observed to come away by sloughing.

Morgagni, Lieutaud and Portal, speak of gangrene and sphacelus of the liver, pancreas and spleen, as affections which had repeatedly occurred to their observation. Some of the descriptions which they have given of these affections appear to be from recollection, and others are probably inaccurate. That these organs should be liable to gangrenous inflammation seems highly probable, since the continued inflammation of every texture and organ of the body may be supposed to have always a greater or less tendency to terminate in gangrene. The marks, however, of this state, occurring in the internal viscera, are of a very equivocal and uncertain nature. The part affected with gangrene is said to be of a livid colour, to emit a disagreeable smell, and to be so very soft as to be easily torn or ruptured. This is a state of parts which occurs in the neighbourhood of those which are sphacelated, and which, wherever it does so, may be regarded as the forerunner of sphacelus; but in numerous dissections of the inflamed abdomen, I have

never seen any thing like sphacelus of the liver, pancreas, or spleen.

Gangrene and mortification are frequent occurrences in the urinary and genital organs of both sexes. It seems doubtful, from the cases upon record, whether sphacelus has ever actually been observed in the kidneys; for in almost all the instances recorded, in which these organs have shown a tendency to mortification, it does not appear from the descriptions given that the disease had passed beyond the state of gangrene.

Mortification of the urinary bladder, passing through the state of gangrenous inflammation into that of sphacelus, occurs not unfrequently in the male sex, from distention of that viscus produced by obstructions in the urethra; and in the female during tedious parturition, from the pressure of the bladder between the head of the child and the bones of the pubes. Mortification of the bladder proves fatal in every instance in which the urine escapes into the cavity of the abdomen. That which occurs in parturition gives rise to a distressing, and in almost every instance, incurable stillicidium of urine.

The whole, or a part only of the penis, may be destroyed by mortification, in the form of sphacelus. This succeeds to attacks of gangrenous inflammation, occasioned by inflammation at the root of the penis, by strangulation of the prepuce, as in paraphymosis, by external violence, particularly during a state of intemperance, by the neglect of the inflammation attendant upon venereal ulcers, and, still more frequently, by the injudicious use of mercury.

Inflammation also sometimes terminates in mortification of the parenchymatous, or tubular part of the testicle. The tunica albuginea gives way, and the tubuli protrude through the opening in the form of a white slough, which admits of being pulled away, like small and long threads, without giving much pain to the patient.

The uterus, both in the impregnated and in the unimpregnated state, is said to be liable to attacks of gangrene and sphacelus. In those cases in which a laceration of the fundus of the uterus has taken place during parturition, has the occurrence been owing to a state of mortification?

Mortification of the external parts of generation occur in the female from high degrees of inflammation, and in infants not unfrequently from an inflammation of the erysi-

pelatous kind, which, in particular situations and seasons, appears like an epidemical distemper, and always proves fatal.

In the progress of almost all the occurrences of mortification which I have enumerated, that state, whether in the stages of gangrene or sphacelus, is usually sooner or later accompanied with the process of ulceration. Indeed in many instances of mortification, it is difficult to say whether most destruction or loss of parts is produced, by the process of ulceration, or by the state of sphacelus.

Gangrene, gangrenous inflammation, or inflammation which shows a tendency to terminate in sphacelus, (for I use these terms as synonymous,) seems to depend for its production partly upon the nature and action of the exciting causes by which it is induced; but still more, perhaps, upon the state of the body or system to which these exciting causes are applied. Accordingly we observe, that although gangrenous inflammation is the usual effect of certain exciting causes in almost all the individuals to whom they are applied, yet that there are individuals in whom these causes fail to produce their specific effects, and others in whom the slightest degree of external injury, such a degree as seems scarcely sufficient to excite inflammation of any kind, produces, nevertheless, extensive, dangerous, and even fatal degrees of gangrene.

The gangrene which supervenes to inflammation may be induced by the operation of a great variety of causes; indeed by every power in nature capable of exciting the state of inflammation, that state to which, as I have already remarked, gangrene appears to succeed, or rather, perhaps, more strictly speaking, of which it is the continuation. Gangrenous inflammation is a state in which there is always more or less of a predisposition or tendency to sphacelus. Lightning, cannon-balls, or concentrated acids, may all severally produce the immediate death of the part to which they are applied, without any previous inflammation occurring, or they may produce the death of these parts in a more slow and gradual manner, through the medium of gangrenous inflammation. It is the latter mode only of producing death which ought to be termed a mortification.

Gangrene is often observed to succeed, and that sometimes very suddenly, to the inflammation which is produced by severely contused, lacerated, or punctured wounds. But

the same degree of external injury inflicted in any of these three ways, produces very dissimilar effects, both local and constitutional, in different textures, organs, and regions of the body, in patients of different ages and constitutions, of different habits, and in different conditions of life, living in different climates, or even in the same person living in the same climate in the different seasons of the year, and in the healthy or more unhealthy states of the atmosphere. The influence of these causes, which are perpetually acting, and of many other circumstances which might be mentioned in modifying the effects of external injury, are such as to render it impossible for us to foresee the precise effects that will result from it in any particular instance. We often do not apprehend the occurrence of gangrene, till the symptoms that indicate the existence of this state occur, which they sometimes do in cases in which we had expected, or even predicted, very different results.

But though the influence of these causes, in modifying the effects of external injury, is undoubted, it is equally certain that a gangrenous state is often induced by severe contusions and lacerations, contusions and lacerations which, in a slighter degree, might have induced only an active and more healthy species of inflammation. In some of these injuries, when severe, the different states of inflammation, gangrene, and sphacelus are often very suddenly, and, as it were, simultaneously produced. Thus, in contusions, for example, which are so severe as to destroy completely the life of some portion of the body, the parts which immediately surround that portion, the life of which has been destroyed, shall put on an appearance of gangrene, while they again are in their turn surrounded by parts in a state of more active inflammation. We see examples of this every day, in wounds made by cannon-balls, and in cases of compound fractures.

Not only are the severer kinds of contusions and lacerations more liable to be followed by gangrene, than those which are slighter, but the contusions and lacerations of particular parts of the body, such as tendinous fasciæ, ligaments and synovial membranes, are more liable to be followed by gangrene, than the contusions and lacerations of many other parts. We have very frequently, and sometimes most remarkable instances of this, in the effects which occasionally succeed to contusions, punctures, and lacerations

of the extremities, and to the wounds and compound dislocations of even the lesser joints of the body.

Injuries of the thumb and finger, in particular, are often followed with considerable degrees of acute inflammation, terminating in gangrene, and in some instances even in sphacelus. The degree of the gangrenous inflammation, and the distance to which it extends from the point of injury, differs in every particular case. In some the œdematous swelling, tension, and gangrenous inflammation, are confined chiefly to the hand, in others they extend to the fore-arm, and in others pass along the arm to the shoulder, and from thence to the neck or side of the body. In the progress of the gangrene, red lines or streaks of inflammation can frequently be observed, extending from it up along the fore-arm, or arm, towards the axilla, which indicate the course of inflamed absorbents; but these lines are often soon lost in the general gangrenous redness and swelling which supervene. The colour of the gangrenous inflammation in young subjects is of a red resembling that of the peach blossom; in elderly people it has usually a yellowish tinge, and in both it becomes livid before passing into the state of sphacelus. These affections are from the first usually accompanied with great pain, and sense of tightness extending up in the course of the arm, and depriving the patient altogether of rest. If vesications occur in the earlier stage of the affection, they are generally numerous, small, and filled with a yellowish fluid resembling those which are produced by a blister. The vesications which occur in the later stages of gangrenous inflammation are in general of a larger size, and often filled with a bloody-coloured serum. The constitutional symptoms which accompany gangrenous inflammation, extending up the arm to the trunk of the body, almost always prove fatal before the disease has had time to pass into the state of sphacelus. I have repeatedly known this inflammatory, or acute kind of gangrene, prove fatal by the fourth day from the commencement of the attack; in other instances, not till a much later period.

Appearances, precisely similar to those which I have described as arising from external injury, sometimes occur spontaneously in malignant cases of paronychia or whitloe. This is an affection which seems to be peculiar to the thumb and fingers; at least I do not recollect having seen, or heard of an instance of this disease attacking the toes.

This peculiarity seems surprising, as from the structure of the fingers and toes we should, *a priori*, imagine that these two parts would be subject to the same diseases.

In the lower extremities, gangrene not unfrequently succeeds to inflammation produced by external injury; contusions of the toes and feet, compound luxations of the great toe, lacerations of the ankle-joint, severe simple or compound fractures of the legs, may all severally be followed by gangrene. The local appearances of this affection, when it succeeds to high degrees of inflammation in the lower extremities, differ in no respect from those which occur in the same state in the upper. In some cases the patient dies before the gangrene reaches the trunk of the body; in others it extends from the point of injury to the trunk of the body, and spreads extensively over the fore and lateral parts of the abdomen. The gangrenous affection in these cases generally occupies the whole surface of the leg and thigh; but in some instances I have seen detached portions of the skin remain unaffected. When the gangrene arrives at the upper and inner part of the thigh, a remarkable swelling of the scrotum takes place, which seems to arise from the extravasation of serum into its cellular texture. The colour of this swelling is sometimes of a bright red, but oftener of a livid hue. I have seen this swelling of the scrotum from the infiltration of serum, take place also in inflammations which had their original seat in the groins or perineum.

In a case of acute spreading gangrene, which succeeded, in a strong and healthy young man, to luxation of the ankle joint, a severe symptomatic fever occurred in about sixteen hours after he met with the accident. This fever was accompanied with great swelling, tension, redness and pain of the parts more immediately surrounding the injury. The gangrene gradually extended up the leg and thigh till it reached the abdomen. In most of its course it had a dark red livid colour, except where it appeared to terminate in the sound skin. Here it had a more lively bright red colour. In various places of the leg and thigh a separation of the cuticle took place, and vesications were formed which contained considerable quantities of a bloody-coloured serum. The formation of these phlyctenæ, or blisters, is a process which goes on during the state of gangrene, and before that of sphacelus commences; it is a process which goes on in the part while it is alive, and while there is a certain degree of

circulation in its blood-vessels. The symptomatic fever proved fatal before the end of the fourth day. In the dissection of the limb after death I found the cellular membrane filled, or injected as it were, with a bloody serum; the large artery, as well as the veins, were filled with blood; and this blood, instead of being coagulated, was of a fluid consistence, and very black colour. This fulness of the arteries, and uncoagulated state of the blood, are appearances which have presented themselves to me in the dissection of the limbs of several patients who had died of acute gangrene; but, whether they be common, or occasional appearances only, I am unable to say.

In the progress of gangrene to sphacelus, an elastic fluid is sometimes evolved in the cellular texture subjacent to the skin. The presence of air in this texture constitutes the state well known by the name of emphysema, and usually occasions a crackling noise to be heard when pressure is made on the part which contains it. We are ignorant what share the chemical changes going on in the serous fluid, extravasated into the cellular membrane, may have in accelerating the progress of gangrene, and in producing the state of sphacelus. Hydrogen gas, holding greater or less portions of carbon, sulphur, and phosphorus in solution, we have reason to believe is evolved during the decomposition of animal substances; but the nature of the gas which is evolved during the state of gangrene, is wholly unknown to us. In various instances of gangrene and sphacelus, I have seen this air evolved into the cellular texture of parts apparently sound, which were contiguous to the diseased or dead. Here it adds greatly to the swelling, gives an elastic undulatory sensation to the fingers, and is liable to be mistaken for a collection of matter. The air rushes out when an incision is made into the sound structure containing it; and where an extension of the gangrene does not afterwards take place, the incision heals readily. But whether air, which is the product of putrefaction, could be evolved, and remain for days in cellular texture, without inducing the death of that structure (which the air evolved in the cases to which I allude assuredly did not,) is a point which I must leave to your own investigation. Does the death of the solids in mortification precede the chemical decomposition of the extravasated fluids; or do the extravasated fluids undergo chemical changes, before the vitality of the

solids is extinguished? Is there, in mortification, ever a loss of vitality without any apparent change in the sensible properties, or visible organization of the part? Such cases have been mentioned but I have never seen any of them. Serum or blood, which have been extravasated into living cavities, or pus which has been formed in these, seldom, if ever, undergo chemical decomposition. Would not these fluids, if extravasated into dead cavities, putrefy quickly, and promote the decomposition of the solid parts?

Gangrene sometimes arises from punctures, or, in other words, from very small or slight wounds. Of this, innumerable examples are to be found in the records of surgery. In most instances of this kind there is, however, reason to believe, that some peculiarity of constitution exists, or that the disposition to gangrene is given by the kind of wound, by the nature of the part injured, by the climate, or by the particular state of the atmosphere. The use of very high-seasoned food, and an excessive indulgence in spirituous liquors, have been mentioned as circumstances which operate powerfully in producing this disposition. I am unable to say how far this opinion is well founded; but gangrene, when induced in persons of these habits, is certainly more rapid in its progress, and less easily stopped by the ordinary remedies, than in persons who live in habits of temperance. Gangrene from puncture, as I shall have occasion afterwards more fully to relate, arises in several ways, and seems to be attended in different instances with somewhat different local effects. In some instances the gangrene spreads gradually from the puncture into the surrounding parts. The skin and subjacent cellular membrane are simultaneously affected; but the local symptoms do not extend far from the original point of injury. At other times the gangrenous inflammation seems to be communicated along the absorbents, to veins at a great distance from the part originally affected. When the inflammation extends along the absorbents, red lines, or streaks of a florid red colour, can in general be observed running from the wound or puncture, affected with gangrene, in the course of these absorbents. These red lines are very painful when touched, and their appearance is sometimes attended, though not always, with an inflammatory swelling of the glands into which the absorbents enter. Effects similar to those which have been described as occurring in punctured ab-

sorbents, have long been supposed to be common attendants on, or consequences of, punctured wounds in the nerves or tendons. That gangrenous inflammation may, in cases of punctured wounds, run along the cellular membrane, or sheath covering a punctured nerve, seems highly probable; but it is to be regretted that the cases of this kind which have been recorded are but very inaccurately described. Indeed there is great reason to suspect, that some, if not most, of the cases of gangrene, recorded as arising from this cause, were in reality cases of gangrene succeeding to an inflamed state of the absorbents or veins.

Gangrene may be produced by the application of a variety of stimulating, acrid, or poisonous substances, to the surface of the body. Thus gangrene may be produced by the application of strong spirit of wine, oil of turpentine, soap, ammonia, or cantharides, to parts in a state of acute inflammation. The production of gangrene, from the application of cantharides, is an event which, in general, takes place only in particular constitutions, in parts which have been inflamed before the blister is applied to them, or in persons who have been previously much reduced or weakened by disease.

Some poisons, as the stronger vegetable poisons, seem to produce death without occasioning any sensible local irritation; whereas, in producing death, most animal poisons give rise to the production of gangrene. We have examples of this in the effects produced by the bites of the *cobra de capello*, the rattlesnake, and the viper. The poison of the viper is that with the effects of which we are best acquainted in this country. It very soon produces a livid spot in the part of the body into which it is introduced, attended by great swelling and pain. The swelling arises from the cellular membrane being filled with a serous fluid, bloody in severe cases; and, in particular habits, this effusion is followed by the usual symptoms of gangrene. Though these are the effects which follow the bite of this animal, the poison seldom proves fatal, unless to very small animals. The injection of the cellular membrane with serum, is a never failing attendant upon the bite of this and other poisonous serpents. It occurs also in the stings of bees and of wasps; and, in some particular constitutions, from the bite of the common bug. I have repeatedly seen the whole side of the face, neck, and arm, swollen, and highly œdematous, from the

bite of this animal. In the bite of the common bug, the redness, heat, and pain, bear little or no proportion to the degree of swelling which is produced.

Gangrene, or rather gangrenous inflammation, arises very frequently from the extremes of temperature; but the effects of heat and of cold, when applied to the human body, will form separate subjects of consideration. At present it is only necessary to observe, that the effects of these extremes vary exceedingly, according to the manner and degree in which they are applied to the body. A violent degree of heat, for example, may produce the immediate death of a part; while the application of a lesser degree is followed by the production of inflammation or of gangrene.

Gangrene may arise from the application of a ligature to a part so tight as to obstruct the free return of the blood towards the heart. We have examples of this daily in the gangrene attendant upon, or rather necessarily produced by, the stricture in cases of strangulated herniæ. I have repeatedly seen it induced by the too long continued application of the tourniquet, employed with a view to repress a hemorrhagy, that would have been more securely stopt by the application of a ligature to the vessel from which it proceeded. Gangrene is, also, but too often occasioned, in the present practice of surgery, by the use of tight bandaging in the earlier stages of fracture.

Gangrene may arise from the over-distention of the solid parts of the body, occasioned by the infiltration of serous fluids. We have examples of this in the gangrene attacking the limbs of those who are affected with anasarca or general dropsy. In some constitutions the punctures which are made in the limbs for the evacuation of the water in anasarca, are very liable to occasion gangrene, and that in cases in which no previous symptom of the affection had appeared. The infiltration or injection of stimulating fluids into the cellular membrane, is frequently followed by gangrene. Of this we have an example in the gangrene which attacks the scrotum, in consequence of a rupture of the urethra, and the infiltration of the urine into the interstices of the cellular membrane; but in this case the distension of the parts may partly contribute to the production of the gangrene, arising from the acrimony of the urine. Simple water, if injected into cellular membrane, would, perhaps,

in few cases induce gangrene; urine, if in any considerable quantity, never fails to do it. Gangrene of the scrotum is also an occasional occurrence, from the escape into its cellular texture of the wine and water which are used for the cure of hydrocele.

Gangrene not unfrequently arises from pressure. This is an event which is very liable to occur, when pressure is made for any length of time on a part already inflamed, as on a part affected with erysipelas, or on parts in which inflammation has been excited by external injury. To the same head, I conceive, I ought to refer a species of gangrene which very frequently occurs in persons, who, after being reduced by typhous or hectic fever, are long fixed down to their beds in one particular posture. The gangrene, in these instances, is seldom preceded by any very active inflammation; and it sometimes even occurs in parts upon which no very evident pressure has been made.

Many other external causes of gangrene might be enumerated; but those already mentioned will be sufficient to convince you, that it must be a disease of frequent occurrence; and one which, from the rapidity of its progress, and the violence of its effects, may in practice require the adoption of prompt and very decisive methods of treatment.

In all the various cases which I have enumerated of gangrene, arising from external or internal causes, that affection always partakes more or less of the nature of inflammation; or, in other words, redness, swelling, pain, and, in its first stages, probably also an increase of heat, appear to be its distinguishing local characteristics. Gangrene, therefore, such as I have described it, is to be regarded as a species, mode, consequent, or termination of inflammation. To distinguish this affection from every other, I should be inclined to give to it the name of gangrenous inflammation. It exhibits characters no less distinct than those which are to be found in the adhesive, suppurative, or ulcerative inflammations of Mr. Hunter; and though, in the progress of the gangrene, these characters may be variable, and sometimes but of short duration, yet, upon a careful inquiry, we shall find, I believe, that gangrenous inflammation, in the diseases and cases which I have enumerated, usually precedes the state of sphacelus.

The gangrenous affection occurring in, or supervening to

inflammation, may terminate in one of four ways. 1st. Where it is slight, by resolution. Here the process of nature, in the production of a cure, seems to be the same, or very nearly so, with that of resolution in every other species of inflammation. 2dly. It may terminate in adhesive inflammation. This is seen in the red line so often formed in the line of contact between the dead and sound living parts; and is a process of nature, the phenomena and effects of which have been already sufficiently described. 3dly. In ulceration, as in gangrene from pressure. And lastly, Gangrenous inflammation may, and most frequently does, terminate in sphacelus, or in the complete death or mortification of the part in which it occurs.

In inflammatory, humid, or acute gangrene, the patient but too frequently dies before the state of sphacelus commences; so that we have seldom an opportunity of tracing the changes which take place; but in cases where the reaction of the system, or, in other words, the febrile or constitutional symptoms are moderate, and particularly in cases of idiopathic, dry, or chronic gangrene, general death seldom takes place till the local death, or sphacelus, has subsisted for a longer or shorter period of time.

The approach of sphacelation in a part is indicated by the red colour of the part changing to a bluish or livid colour; by the part becoming usually flaccid; by a total cessation of pain in the diseased part; in some instances, by a sense of weight in the part; by the part losing its natural heat; and sometimes, also, by the occurrence of an emphysema. We are certain that sphacelus has actually taken place, when the cuticle separates readily from the skin, and when the part begins to emit a cadaverous smell. But the two last-mentioned circumstances indicate not only that sphacelus exists, but also that the parts in which it exists have already begun to undergo the putrefactive process.

The progress of this process, the putrefactive, in the different textures, and parts which have been killed by gangrene, is very various. In those textures or parts which abound in fluids, and which are kept in a heat nearly equal to that of the standard heat of the body, this process goes on most rapidly; because these are circumstances which we know to be favourable to the decomposition of animal matter. In the same texture, the rapidity of decomposition will be found to be nearly in proportion to the

degree of moisture, and to the warmth in which it is kept. The decomposition goes on more quickly in summer than in winter; in warm climates than in cold; and in parts that are near to, sooner than in those remote from, the source of circulation.

As almost all the textures of the body, with the exception of the bones, are composed of nearly the same ultimate elementary particles, though combined in different states, and in different proportions, the phenomena which putrefaction exhibits, and the products to which it gives rise in these textures, is wonderfully uniform during the time they remain attached to the living body; at least so we presume from the general appearances which present themselves; for the minute chemical changes are still to be ascertained by the way of experiment. We know that animal matter, consisting of hydrogen, carbon, azote, and oxygen, to which a small portion of sulphur and phosphorus are added, gives rise, during its putrefaction, to a variety of new combinations, some of which only have as yet been ascertained by chemical investigation: to the formation, for instance, of carbonic acid, ammonia, hydrogen gas holding a portion of carbon, sulphur, or phosphorus in solution, and probably, also, to the formation of a small quantity of water. But for more minute information on the subject of putrefaction, I must refer you to the latest works upon chemistry. It is with the appearances exhibited by the living, and not with the dead processes, going on in animal bodies during sphacelus, that we are more immediately concerned.

Does the state of sphacelus ever occur in any part of the body without being preceded, in the order of its appearance, by the state of gangrenous inflammation? This is a question to which, in the present imperfect state of our knowledge respecting gangrene and sphacelus, it would perhaps be rash to attempt to give any thing like a decided answer. I am, however, inclined to believe, that the state of gangrene is a necessary prelude to that of sphacelus; but instead of being dogmatical with regard to this, I would beg leave to suggest it as a subject for your future investigation: Meanwhile I shall proceed to give you a slight account of the circumstances which have led me to be of this opinion.

Besides occurring as a consequence of a more active inflammation, gangrene occurs not unfrequently as an original idiopathic disease. In this form it exhibits appearances in some respects different from the gangrene which is the consequence of acute inflammation, but yet appearances sufficiently similar to justify us, I conceive, in giving to them the same general appellation. Authors have endeavoured to express the differences to which I allude by terms, some of which appear to be well, others but ill enough chosen. The cases of gangrene which I have enumerated as succeeding to inflammation, M. Quesnai, from the extravasation which accompanies these cases, denominates humid gangrenes; and on account of the absence of this extravasation in cases of original idiopathic gangrene, he makes a separate division, to which he gives the name of dry gangrenes. The term dry, when applied to gangrene, is not meant to imply that the parts in which this affection occurs are actually without moisture, or that they have become hard, but merely that there does not occur in this, as in the gangrene succeeding to inflammation, that superabundance of extravasated fluids which renders the mortified part so liable to undergo the putrefactive process. In the dry, chronic, or idiopathic gangrene, as contradistinguished from humid, acute, or inflammatory gangrene, little or no serum is effused into the cellular substance. The skin, subjacent cellular membrane, and muscles, instead of passing quickly into the state of putrefaction, become firmer and more difficult to cut than even the living solids; and they remain long moist without showing any tendency to putrefaction.

The idiopathic, chronic, or dry gangrene, has not at all times been carefully distinguished from the state of sphacelus; a circumstance which has given rise to much inaccuracy in the descriptions which authors have given of mortification. This inaccuracy has, I believe, arisen in some measure from the rapidity with which idiopathic gangrene passes in many instances, into sphacelus; and from the state of sphacelus having often actually commenced before the patient affected with it becomes aware of his situation, or any application is made by him to medical men for relief. Accordingly we find that both Mr. O'Hallaron and Dr. Kirkland, the two authors who have given us the fullest accounts which are yet to be found in the English language

of mortification, have, in general, given to idiopathic gangrene, from its first commencement to its final termination, the appropriate appellation of sphacelus.

M. Quesnai has given the most correct account of the symptoms of dry, idiopathic, or chronic gangrene, and of the order in which these symptoms appear, of any practical author to whose works I can refer you. The changes, indeed, which, since his time, have taken place in physiology, pathology, and chemistry, have rendered the language of this author in many places obscure and almost unintelligible; and sometimes his explanation of facts, otherwise valuable in themselves, exceedingly erroneous. Yet, with all these imperfections, I doubt if you will readily find, in the works of any other author, so good an account of the symptoms and progress of idiopathic, dry, or chronic gangrene, as that which is contained from the 324th to the 353d page of his Treatise.* In perusing that account, you will not fail to recognize a very full description of the disease of which Mr. Pott has left us the following account.

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* "Il y a cependant quelque gangrene séche qui commence par une espece d'inflammation extérieure et superficielle qui ne forme point de tumeur. La gangrene qui naît de cette sorte d'inflammation est aussi accompagnée dans son progrès d'une inflammation semblable, qui toujours précede et annonce le progrès de la gangrene. Cette inflammation s'éteint à mesure, et se termine si promptement par la gangrene, qu'elle est entierement insuffisante pour produire aucune suppuration purulente, qui seule peut marquer des bornes à la mortification, et nous assurer d'une action suffisante dans les arteres, pour satisfaire à la vie et aux fonctions de ce genre de vaisseaux. Cette espece d'inflammation peut être comparée à celle qu'excite une pierre à cautere, dans le moment de son action, et qui n'est point proportionée à la violence avec laquelle cette pierre opére sur nos parties; aussi l'action de cette piere a-t'elle beaucoup de rapport avec l'action de la plûpart des causes de la gangrene séche, et l'état, dans lequel l'une et l'autre action réduisent nos chairs, est à peu près le même.

"La gangrene seche est précédée et suivie de changemens considerables dans la couleur de la partie. Ordinairement l'endroit qui est menacé de mortification, devient rouge et comme un peu inflammé; sans qu'il y ait ni tumeur, ni tension, ni chaleur remarquable, la peau et les chairs sont souvent même compactes et comme un peu pâteuses dans cet endroit même, dont la rougeur est semblable à celle d'une légere inflammation érésipélateuse. La vivacité de cette rougeur s'obscurcit bientôt et dégénere en lividité et ensuite en noirceur. Quand le gangrene s'étend, elle est dévancé par ce cercle de couleur rouge dont nous venous de parler, et on regarde ce cercle même comme l'avantcoureur de la mortification: Ainsi, à mesure qu'il chemine, on prévoit le progrès du mal, et on juge de son état par les changemens qui arrivent à cette rougeur."—*Traité de la Gangrene*, par M. Quesnai. Paris, 1749.

"It is very unlike to the mortification from inflammation, to that from external cold, from ligature or bandage, or to that which proceeds from any known or visible cause, and this as well in its attack as in its progress. In some few instances it makes its appearance with little or no pain; but in by much the majority of these cases the patients feel great uneasiness through the whole foot and joint of the ankle, particularly in the night, even before these parts show any mark of distemper, or before there is any other than a small discoloured spot on the end of one of the little toes.

"It generally makes its first appearance on the inside, or at the extremity, of one of the smaller toes, by a small black or bluish spot: From this spot the cuticle is always found to be detached, and the skin under it to be of a dark red colour.

"If the patient has lately cut his nails, or corn, it is most frequently, though very unjustly, set to the account of such operation.

"Its progress in different subjects, and under different circumstances, is different; in some it is slow and long in passing from toe to toe, and from thence to the foot and ankle; in others its progress is rapid, and horridly painful. It generally begins on the inside of each small toe, before it is visible either on its under or upper part; and when it makes its attack on the foot, the upper part of it first shows its distempered state by tumefaction, change of colour, and sometimes by vesication; but wherever it is, one of the first marks of it is a separation or detachment of the cuticle.

"Each sex is liable to it; but for one female in whom I have met with it, I think I may say that I have seen it in at least twenty males. I think also that I have much more often found it in the rich and voluptuous, than in the labouring poor; more often in great eaters than free drinkers. It frequently happens to persons advanced in life; but is by no means peculiar to old age. It is not, in general, preceded or accompanied by apparent distemperature either of the part or of the habit. I do not know any particular kind of constitution which is more liable to it than another; but, as far as my observation goes, I think that I have most frequently observed it to attack those who have been subject to flying, uncertain pains, in their feet, which they have called gouty; and but seldom in those who have been accustomed

to have the gout regularly and fairly. It has by some been supposed to arise from an ossification of vessels; but for this opinion I never could find any foundation but mere conjecture."

Mr. Cowper was one of the first anatomists who had observed an ossification of the arteries of the legs, in those who died of mortification of the feet and toes. He gave an account of a case of this kind, which you will find in the 280th Number of the Philosophical Transactions. A similar case occurred to Mr. Beckett, of which he has given an account in his Chirurgical Observations. I have myself seen one example of the coincidence of a very complete ossification of the arteries of the leg, with mortification of the feet and toes. How far the mortification depended upon the ossification, in the instances to which I have alluded, (and many more might be found, I doubt not, in the records of surgery,) I cannot pretend to say; but, if not related as cause and effect, their coincidence at least must be allowed to be curious.

Even in the cases in which I have seen sphacelus suceeed to the obstruction, by ligature of the principal artery of a limb, there something like gangrenous inflammation occurred; the part became red, painful, and swollen, and did not lose its heat suddenly, but gradually; and this state continued for some days before that of sphacelus supervened. The redness and heat in a limb, where the principal artery is tied, must depend, it is obvious, on the circulation of the blood which is conveyed into it by the smaller communicating arterial branches. Mortification of the extremities is not by any means so frequent an occurrence, from the obstruction by ligature of the larger arteries, as was at one time imagined; but there are constitutions and cases in which this mortification supervenes to the application of a ligature to the main artery of a limb, without any fault being attributable to the operator.

Fabricius Hildanus mentions a case of mortification of the feet and legs, which proved fatal to a man in the vigour of life, and of an apparently sound constitution, in whom, after death, a scirrhous tumour was found surrounding and compressing the inferior cava and aorta, just where they are about to divide, to form the iliac vessels; and which, by its pressure, had prevented the free passage of the blood to and from the lower extremities.

Mortification of the extremities sometimes occurs from deficient circulation in the progress of diseases of the heart; and if observation shall show that a preternatural heat, as well as redness, takes place in this affection, I shall then believe myself justified in concluding, that a state resembling inflammation always precedes the occurrence of sphacelus; and to this state, however short in its duration, or however slight in its attack, whether it terminates in resolution, adhesive inflammation, ulceration, or sphacelus, I shall feel inclined to give the name of gangrenous inflammation.

Bayle, it is true, has lately described a species of malignant pustule, as appearing in some provinces of France, in which he says, neither pain nor local redness occur. Yet this pustule, by his own account, was surrounded by a considerable degree of an elastic swelling, and supported upon a brown, bluish, or livid base, which always sunk more or less deeply into the texture of the skin. The fluid which was discharged from this pustule coagulated upon exposure to the air, and became like the yolk of an egg dried in the sun.

Besides occurring as an original idiopathic disease, and from obstruction of arteries, chronic or dry gangrene may be induced by the action of substances taken into the stomach, which seem to produce it as a specific effect in parts remote from the source of circulation. The most singular example which we have of this, is in the gangrene produced by the eating of a particular kind of unsound or diseased rye. This is a species of mortification which has not been observed in this country; but it is well known, and has been frequently observed, in different parts of the continent of Europe, particularly in France, where it has been repeatedly known to prevail in some districts, as an endemial disease. Indeed most of the knowledge which we at present possess, respecting chronic or dry gangrene, has been obtained from watching the progress of the disease produced by eating unsound rye. This disease has been observed to occur in those districts in which rye forms the principal food of the inhabitants. It occurs only, however, in those districts after very rainy and moist seasons; seasons in which that grain is liable to be affected with a particular disease, well known in France by the name of the *Ergot*, or the cockspur in rye. In this disease the grains of rye grow to a large size, acquire a black colour, and have a compact horny consistence. Few sea-

sons pass without the rye containing more or less of this vitiated grain; but it is produced chiefly in rainy and moist seasons, and in those years it is produced in such quantities, as to form sometimes nearly one-fourth of the whole produce of rye. It is in those seasons only in which the ergot or cockspur is very abundant, that the mortification I am going to describe makes its appearance; and it has, from this circumstance, been very naturally inferred, that this spur or disease in the rye was the cause of the mortification.

The attention of the public was first called to this disease in a particular manner by M. Dodard, by a letter inserted into the Journal des Savans for the year 1676. In this letter M. Dodard mentions, that it had been long known that those who made use of rye-bread containing much of this corrupted grain or spur, were liable to be affected in their extremities by a gangrene attended usually with but little fever, inflammation, or pain, but during which the use of the limb affected was destroyed, or the limb itself became dead and separated from the body.

The part affected became at first insensible and cold, and, in the progress of the disorder, dry, hard, and withered. In very malignant cases, M. Dodard mentions, that this mortification was attended with a greater or less degree of delirium. The account which this author gives of the symptoms and progress of this disease is evidently very imperfect; and the only fact stated in his relation, which seemed to prove decidedly that the mortification was owing to the use of corrupted rye, was, that that grain proves fatal to fowls that are fed with it. M. Saviard mentions having seen this distemper, in the year 1694, at the Hotel Dieu of Orleans, where he had been commanded to perform some chirurgical operations. He contents himself with observing, that it is very frequent in Sologne; attacks those who eat rye affected with the cockspur; and that the upper and lower extremities of the patients, whom he saw, grew, during the progress of this affection, as dry as touchwood, and as emaciated as Egyptian mummies.

In the year 1710, several accounts of this disease were transmitted to the Royal Academy of Sciences at Paris by gentlemen practising physic and surgery in the districts in which it was known that season to have prevailed. In particular, M. Noel, surgeon to the Hotel Dieu of Orleans, men-

tioned to the secretary of the academy, that about fifty people, men and children, affected with a dry, black, and livid gangrene, had come that season into his hospital: That this affection always began in the toes, and extended itself gradually along the foot and leg, till it sometimes rose to the upper part of the thigh; and, what is a singular enough observation, and one peculiar to himself, that he had not seen any of the female sex afflicted with this distemper, and had only in one instance seen it affect the upper extremities. In some patients the gangrened part came away of its own accord; in others it became necessary to use scarifications, and other topical remedies. In four or five instances death succeeded to amputation, because, notwithstanding the performance of that operation, the disease continued to extend to the trunk of the body. The history of one case was communicated to the Academy, in which the lower extremities were separated from the body in the articulation of the heads of the thigh-bones with the acetabula; the first example of this separation, I believe, upon record. It was the occurrence of this, and of similar cases, in which these cavities were, in the process of the cure, filled up with new and sound flesh or granulations, that probably first suggested the operation of amputation at the hip-joint.

It is particularly mentioned in this report, that this gangrene attacks only the poor and ill-fed of the districts in which it occurs. The rye of Sologne, in the year 1709, contained, according to the relation of M. Noel, fully one-fourth of the cockspur; and the poor had taken no pains to separate it from the good grain with which it was mixed. The same M. Noel, in a letter which many years afterwards he addressed to M. Quesnai, who had applied to him for information with regard to this singular disease, seems to be of opinion that the cockspur-rye lost its malignant quality after a certain time; this period he limited to two or three months; but this opinion does not seem to have been confirmed by subsequent observation. During the thirty-three years in which M. Noel had been surgeon to the Hotel Dieu of Orleans, that distemper had appeared three or four times, and always in those rainy and moist seasons in which the rye contained a large proportion of the cockspur. The disease in his patients had always existed for some time before these patients applied at the hospital for relief; so that M. Noel could not give any

very accurate information, from his own observation, of the symptoms which first manifested themselves; but he adds, that these unfortunate patients had often told him, that the disease generally began in one or both feet, with pain, redness, and a sensation of heat as burning as the fire; and that at the end of some days these symptoms ceased as quickly as they had come on, when the extreme sensation of heat which they formerly felt was changed into cold. The part affected, adds M. Noel, was black like a piece of charcoal, and as dry as if it had passed through the fire. After some time, a line of separation was formed between the dead and living parts, like that which appears in the separation of a slough which has been produced by the application of the cautery, and the complete separation of the limb, was, in many cases, effected by nature alone; in others he was obliged to have recourse to amputation, which he found to prove sufficiently successful, unless in those patients who were very much worn out with the disease, or who had naturally very bad constitutions.

This disease appeared in Switzerland in the years 1709 and 1716; and a very accurate description of its symptoms and progress in that country has been given by Langius, a native of Lucern, in a dissertation, entitled, "Descriptio Morborum ex esu Clavorum Secalinorum."

M. Gassoud, physician in Dauphiny, where this disease had appeared also in 1709, in a description which he has given of it, says, that many of the patients were affected with swellings of the feet and legs, and of the hands and arms, which degenerated into a gangrene that penetrated to the bone, and produced a separation of the affected limb; and which often required no assistance on the part of the surgeon, except to correct the deformity which it sometimes left behind it. This gangrene was, M. Gassoud observes, attended with different symptoms in different individuals, some suffered very violent pain, accompanied with an insufferable sensation of heat, although the part affected often felt cold to the touch. In other patients, redness with much swelling, supervened, attended by fever and delirium. Other patients, again, were without any fever or delirium, though they seemed to suffer equally from pain. In some patients the parts affected became withered, dry, and black like charcoal. The separation of the dead parts from the living took place with the most excruciating pain, and a sensation re-

sembling that produced by the direct application of fire to the body. This sensation was sometimes intermittent; and in other instances it was succeeded by an equally harassing sensation of cold.

M. Bossau, surgeon to the hospital of St. Antoine, in Dauphiny, has remarked some peculiarities in the history of this disease which are worthy of your notice. This author says, that the gangrene which he had an opportunity of observing was not in every instance of the dry kind, but that the limb attacked with it sometimes becoming putrid, worms or maggots were generated, and a most insupportable stench exhaled; that the symptoms were not the same in every patient, but that they had this in common, that heat and cold were equally insupportable; that the disease was not communicable by infection; that it attacked indiscriminately men, women, and children; that there were about four hundred parishes attacked with this disease, each of which contained six or seven patients; and that between thirty and forty came to the hospital of St. Antoine, upon whom it was judged necessary to perform amputation of the arms or legs.

The degree of fatality attending the progress of this mortification in different districts appears to have been very various. M. Du Hamel mentions, in the Memoirs of the Royal Academy for the year 1748, that of 120 persons attacked with that complaint, of whom he had heard, scarcely four or five had escaped with their lives. Langius mentions that it was equally fatal in Switzerland.

A calamity like that which I have mentioned, recurring so often, and producing such deplorable distress, could not fail to attract the attention, and stimulate the curiosity, of medical men; and accordingly we find, that in France many attempts were made to discover the true source from which it proceeded. In attending to this subject it was soon observed, that animals of every kind, except man, refused to eat rye affected with the cockspur; and that many of them would rather starve, than taste bread or food of any kind, into which a portion of this substance had, for the sake of experiment, been introduced. Animals that were forced to swallow it were observed to die of a gangrene, which, in different animals, attacked different parts of their bodies. The observation of these facts, and the results of several trials made with rye corrupted with the cockspur,

seemed to leave no room for doubt with regard to the true origin of this disorder; but in the discussion of many of the questions relative to this disease, doubts began to be entertained with regard to the real origin of the disease; and experiments were made by a number of individuals, to prove that this disease had its origin in other causes than the corruption of the rye by the cockspur.

M. Model, a Russian apothecary, from some experiments, which you will find in the 13th vol. of Bomare's "Dictionnaire de Histoire Naturelle," was led to conclude, that rye vitiated with the cockspur does not possess the quality of exciting gangrene in animals. He fed for some time several animals, such as hens, pigeons, and dogs, with food containing a portion of corrupted rye, without observing any injurious effects to result from its use; and this emboldened him to try the use of it on his own person. But the quantity of this substance which M. Model administered in his experiments upon animals, or which he took himself, was greatly inferior to what the people inhabiting the countries where the disease prevails consume of corrupted rye in ordinary years, without being at all injured by it. His opinion, however, having been eagerly adopted by some men of great reputation in France, such as Parmentier, Schlegel and Tillet, it became necessary to bring its truth to the test of a fair trial, and to make such experiments upon this subject as should leave no farther room for doubt or uncertainty of any kind. The Royal Society of Medicine in Paris employed M. Tessier to go into the countries where this gangrene prevailed, to collect a sufficient quantity of the cockspur rye, and to institute such experiments as seemed to him best calculated to determine a point of so much importance to society. The result of M. Tessier's observations and experiments are to be found in two Memoires, inserted into the two first volumes of the Memoires of the Society by which he was deputed. The first memoir contains an account of all the facts which he could learn respecting the production of the cockspur in rye; and the second, an account of the results which he obtained by feeding a number of animals with that substance. Some of those results are sufficiently curious to be deserving of particular attention. M. Tessier had learned in Sologne, and in the other districts of France where this species of gangrene appears, that the inhabitants often eat rye with impunity for three or four

months together, one-fourth part of which consists of cockspur; and this fact served him as a guide, in judging of the quantity that it would be necessary to mix with the food of the animals, which he had chosen for the subjects of his experiments.

His first experiment was made upon two wild ducks, one male the other female. He fed them with food containing one-seventeenth part of corrupted rye, and increased the corrupted rye till it formed one-ninth. At the end of the fifth day, drops of a very black-coloured fluid were seen to ooze from the nostrils of the duck. By this time she had taken about an ounce and two drachms of cockspur rye. Her tongue had become yellow, swollen, and flabby. The beak became first brown, and then black, particularly towards the root. The skin covering it swelled, and became cold, as well as the tongue, the point of which became also pale and sphacelated. The parts affected began to emit a bad smell, and the bird died between the 9th and 10th day of the experiment. During that period it had taken an ounce and seven drachms of cockspur rye.

The drake was not sensibly affected before the 8th day, nor till he had taken an ounce and three drachms of the poison. In this bird the tongue did not sphacelate, but the other symptoms were nearly the same as in the duck. Death took place on the 14th day, after two ounces and six drachms of cockspur rye had been consumed. On dissection no mark of gangrene or inflammation could be perceived in the course of the alimentary canal. The disease was confined to the beak, which was sphacelated, and had a most completely fetid smell.

The third experiment was made in the same manner upon a Turkey hen. She was seized with vertigo. Her head began to assume a violet colour, and the nostrils to emit a reddish-coloured liquor. A diarrhœa came on, and she died on the 22d day of the experiment, after having consumed eight ounces and four drachms of cockspur rye. Marks of inflammation and of gangrene could be seen in different parts of the alimentary canal. The pituitary membrane was in a state of sphacelus, and one of the pectoral muscles was inflamed. In this bird the gangrene had attacked different parts of the body.

In a fourth experiment, a pig, six weeks old, was fed with food containing an admixture of cockspur rye. On the 12th

day, after this animal had taken about four ounces and a half of the rye, the extremities of the ears and the feet began to assume a red colour. By the 18th day, the ears began to droop, and the tail to become red also. The belly became swollen, tense and painful, by the 22d day; the ears and tail became cold, and the animal died on the 23d, after having had some convulsive fits, and after having consumed a pound and twelve ounces of cockspur. Several inflamed spots were perceptible in the lungs, stomach, small and large intestines. The inside of the throat was inflamed; and the gangrene had made a considerable progress in the ears, tail, and extremities.

The subject of the fifth experiment was a pig stronger than the preceding. On the fifth day after beginning the use of the cockspur rye, the eyes became inflamed. This inflammation went off and returned several times during the course of the experiment. The animal lived till the 69th day, having consumed twenty-two pounds and six ounces of cockspur rye. The ears, tail, and legs, during the use of this substance became swollen and livid; that part of the stomach which is next to the pylorus, was, on dissection, found to be inflamed and gangrenous in several places; as were also the small intestines.

These experiments appearing to be sufficient to establish the injurious effects of cockspur rye, when used as an article of food, M. Tessier made a number of curious experiments to ascertain the degrees of aversion which animals show for this substance either alone or mixed with the substances with which they are usually fed. In all his trials he found it extremely difficult to disguise the rye so as to induce the animal to swallow voluntarily any portion of food, into the composition of which he had introduced rye affected with cockspur. These experiments of M. Tessier's in confirming the opinions of those, who believed that the use of this substance was the cause of those gangrenous diseases, which had repeatedly appeared as epidemical in various districts of France, afforded also a simple explanation of the fact, that persons might live for a considerable time upon rye affected with the cockspur, without suffering any sensible injury from its use; since, in all the animals upon which it was tried experimentally, a given quantity was required to produce the specific effect; and they suggested the only measure, that of separating the diseased from the sound rye,

which could prevent so great a national calamity as that which had been so often produced by its use.

The cockspur occurs occasionally in the rye of this country, but in exceedingly small quantity; never, I believe, in a quantity sufficient to produce, in those who consume it, its deleterious and specific effects.

Nothing similar to the disease of which I have just given you a slight account, has ever been observed, so far as I know, in this country, unless we were to regard as such the history of some cases of mortification of the limbs, which are recorded by Dr. Charlton Woolaston, in the Philosophical Transactions for the year 1762. The following is a copy of Dr. Woolaston's account: "John Downing, a poor labouring man, who lives at Wattisham, a small village about sixteen miles from Bury, in January last had a wife and six children; the eldest a girl, about fifteen years of age, the youngest about four months. They were also at that time very healthy, as the man himself and his neighbours assured me.

"On Sunday, the tenth of January, the eldest girl complained in the morning of a pain in her left leg, particularly the calf of the leg. Towards evening the pain grew exceedingly violent. The same evening another girl, about ten years old, complained of the same violent pain in the leg. On the Monday, the mother and another child, and, on the Tuesday, all the rest of the family, except the father, were affected in the same manner. The pain was exceedingly violent; in so much that the whole neighbourhood was alarmed with the loudness of their shrieks. The left leg of most of them was only affected; but in some both legs. The little child was taken from its mother's breast as soon as she was taken ill, and lived a few weeks. The nurse told me it seemed to be in violent pain, and that its legs were black before death.

"I was exact in my inquiries about each particular person. By what I could learn from them, in about four, five, or six days, the diseased leg began to grow less painful, and to turn black gradually; appearing at first covered with spots, as if it had been bruised. The other leg began to be affected at that time with the same excruciating pain; and in a few days that also began to mortify. In a very little time both legs were sphacelated. The mortified parts separated, without assistance, from the sound parts, and the

surgeon, had in most of the cases, no other trouble than to cut through the bone, with little or no pain to the patient. The separation was, in most of them, about two inches below the knee, in some rather lower; and to one child the feet separated at the ankle, without any assistance from the surgeon. In some the separation was not quite so perfect. The eldest girl has had one leg taken off, and the other is perfectly sphacelated; but the surgeon has not thought proper to cut it off yet, as the thigh is much swelled, and there is a large abscess under the ham. The mother has the right foot off at the ankle; the other leg is a mere bone, quite black and exceedingly fetid, with some little remains of putrid almost dry flesh in some parts. One child only has one leg saved, with the loss of two toes of that leg. Three of the children have lost both legs, and the other child both feet. This is the present state of their legs, viz.

"Mary, the mother, ætat. 40. The right foot off at the ankle: the left leg mortified, a mere bone; but not off.

"Mary, ætat. 15. One leg off below the knee: the other perfectly sphacelated, but not yet off.

"Elizabeth, ætat. 13. Both legs off below the knee.

"Sarah, ætat. 10. One foot off at the ankle.

"Robert, ætat. 8. Both legs off below the knees.

"Edward, ætat. 4. Both feet off at the ankles.

"An infant, four months old, dead.

"The father was attacked about a fortnight after the rest of the family, and in a slighter degree, the pain being confined to two fingers of his right hand, which turned blackish, and were withered for some time; but are now better, and he has in some degree recovered the use of them.

"It is remarkable, that, during all the time of this calamity, the whole family are said to have appeared in other respects well. They eat heartily, and slept well, when the pain began to abate. When I saw them they all seemed free from fever, except the girl, who has an abscess in her thigh. The mother looks emaciated, and has very little use of her hands. The rest of the family seemed well. One poor boy, in particular, looked as healthy and florid as possible; and was sitting on the bed, quite jolly, drumming with his stumps.

"I made what inquiry I could into the manner of their life and food before this misfortune befel them; but I cannot discover any thing to which I can in the least attribute

this very surprising attack. They lived, as the country people here do, on dried peas, pickled pork, bread and cheese, milk and small-beer. The man was a day-labourer, and the woman and children spun ; and, by their industry and sobriety, maintained themselves very well. There is no reason to apprehend that these poor people had suffered by being exposed to severe cold, as the beginning of January was remarkably mild. It is not very uncommon for one limb to be lost by a sphacelus attended with the same symptoms as in these cases, but it is very extraordinary that a disorder of this kind should run through a whole family with such amazing violence and rapidity.

"A nurse who has lived with them from the beginning of their illness, has not been affected. She did not live in the house with them before; but used to be with them frequently."

If, in the very singular cases of which I have read you the history given by Dr. Woolaston, the mortification was induced by the food used, it would seem that damaged wheat, not rye was the cause of the gangrenous appearances ; for the Rev. Mr. Bowes, clergyman of the parish in which these cases occurred, in answer to so some queries respecting this family, which had been proposed to him by Dr. Baker, makes the following reply: "We have no rye. This family have been used to buy two bushels of clog-wheat, or rivets or bearded wheat, (as it is variously called in this country,) every fortnight. Of this they have made their household bread. This wheat they have bought of the farmer whom I lodge with, who tells me that last year he had some wheat laid, which he gathered and threshed separately, lest it should spoil his samples. Not that it was mildewed or grown, but only discoloured, and smaller than the other. This damaged wheat he threshed last Christmas; and then this poor family used no bread but what was made of it, as likewise did the farmer's own family, and some others in the neighbourhood. We observed that it made bad bread, and worse puddings ; but I do not find that it disagreed with any body. A labouring man of the parish, who had used this bread, was affected with a numbness in both his hands, for about four weeks from the 9th of January. His hands were continually cold, and his finger ends peeled. One thumb, he says, still remains without any sensation."

After the account which I have given you of the appearances and progress of gangrene, acute and chronic, and of its termination in sphacelus, we should next proceed to inquire, What are the means by which nature puts a stop to the progress of sphacelus, and by which parts affected with sphacelus are separated from the living and sound parts?

When sphacelus appears in any part of the body, the surrounding contiguous skin, I have already remarked to you, is always affected with gangrenous inflammation. The redness which accompanies the state of gangrenous inflammation, is insensibly lost in the parts which surround the gangrene; nor is the termination of this redness any where very abrupt or distinct. The part which appears gangrenous to-day often becomes sphacelated on the morrow; and the spreading goes on either until the patient dies, or till a new order of appearances presents itself in the part attacked with gangrene. In the order of appearances to which I allude, the redness surrounding the sphacelus acquires a more florid and healthy colour, and begins to terminate more abruptly in the surrounding skin. It is the occurrence of this more healthy inflammation which produces the red line that you will find so often mentioned in the history of those cases in which a temporary or permanent stop had taken place in the progress of spreading gangrenes and sphaceli. The gangrenous inflammation is usually the forerunner of death in a part affected with mortification; but this red line of a more lively hue seems, on the contrary, to present a barrier to the progress of the gangrene, and of course to secure the part against an attack of sphacelus. This barrier is formed, and the red line produced, by the occurrence of a certain degree of adhesive inflammation; a state in which, as you know, coagulable lymph is thrown out into the interstices of the cellular membrane, and by which the extremities of the living portions of the arteries and veins that are to be separated from their dead extremities, are shut up by the process of adhesion.

It has very often been remarked, that the arteries in gangrened and sphacelated limbs did not bleed, in the division of the soft parts, during amputation. But it is doubtful whether the bleeding in these cases be uniformly prevented by the same means. In general the trunks of the divided blood-vessels are filled with clots or plugs of coagulated blood; and the adhesion of these clots to the inner surfaces

of the divided vessels would, in general, seem to be sufficient to resist the impulse which the blood at the time of amputation receives from the heart. The occasional want of bleeding in the amputations performed on account of sphacelus of the extremities, must have been often observed by practitioners in surgery; but it seems first to have been fully pointed out to the notice of the public by M. Petit, the surgeon, in his valuable Papers on the Process by which Nature puts a stop to Hemorrhage, inserted in the Memoirs of the Royal Academy of Sciences for the year 1732. "When a gangrened limb," says that celebrated surgeon, "is cut off in the dead part, no hemorrhage occurs, because the blood is coagulated for a great way in the vessels. The clot is white and firm, and consists of coagulable lymph, as seems proved by the following observations:—M. Martial, surgeon-major of the hospital at Tournay, cut off, in 1694, the legs of a poor woman affected with gangrene in the part which was dead. No hemorrhage followed the amputation of the first leg; nor would it that of the second, had not the surgeon, after having cut off the limb, pulled out, from the extremity of the artery, a round, firm, and white clot of about three inches in length. The column of blood had pushed it a little forwards, for it projected seven or eight lines from the vessel. The canal of the artery being no longer shut up, blood flowed in it, but was stopped in the usual way. We have several examples of limbs amputated on account of gangrene, in which no hemorrhage occurred, although the amputation was made a considerable way into the living parts; because the clot was not confined in these cases to the dead part, but was continued forwards into the living, as far as the inflammatory disposition extended."

Cases similar to those referred to in the paragraph that I have quoted from Petit, are to be found in the writings of other practical authors. In particular, I may mention those of M. Quesnai and Mr. O'Hallaron. In one of the cases, as mentioned by Mr. O'Hallaron, in which no hemorrhage followed the removal of the limb, the incisions were made four inches above the division of the dead from the living parts. I have seen a longer portion of the femoral artery than this closed up by the blood coagulated in it, in consequence of mortification of the foot and leg: and in one case in which the mortification began in the thigh, I saw the coagulation

of blood in the external iliac extending up to its origin in the aorta. So common, indeed, is this coagulation of blood in the limbs affected with mortification, that it has been supposed to be a necessary and constant effect of this disease. This opinion, however, does not appear to be well founded; for I have now seen several instances in which a limb has mortified and dropt off without hemorrhage having occurred from the vessels divided by nature; and yet, in examining the vessels of the stumps of these patients after death, I have not been able to find any clots either of coagulated blood or of coagulable lymph. In the cases to which I allude, the adhesive inflammation occurring in the line of separation between the dead and living parts had extended to the blood-vessels, and their inner surfaces, being inflamed and pressed together by the swelling which occurs, had adhered so as to close up their extremities. It is in this way we shall find that the common ligature acts, which is applied to the divided extremities of arteries or veins; and it is this obliteration, by the process of adhesion, of the extremities of the arteries and veins in the neighbourhood of sphacelated parts, that in reality prevents the occurrence of hemorrhage when the mortified limbs fall off, or are removed by the knife. The coagulation of the blood in the canal of the vessel is not alone sufficient. It may indeed tend, in the cases in which it occurs, for a time to restrain hemorrhage; but it is by the obliteration by adhesion, of the canal in the extremities of arteries and veins, that the occurrence of hemorrhage can be securely and permanently provided against. Indeed to me it seems doubtful, whether that coagulation of blood which takes place in mortified limbs, ever takes place in the canal of the vessel, till its extremity and lateral communications have been plugged up by the coagulable lymph which is exuded during the state of adhesive inflammation.

The filling up of an artery with coagulated blood, is not, as Professor Himly* supposes, a proof of the death of the artery in which it occurs, but the contrary: for it can only happen, I conceive, by the closure, by adhesive inflammation of the small branches going off from the trunk, and by the disposition which is given to the blood to coagulate, in

* See his "Abhandlung über der Brand der weichen und harten Theile," &c. Gottingen, 1800.

consequence of the secretion of coagulable lymph on the inner surface of the inflamed artery. The coagulation, therefore, of the blood, or, in other words, the closure of the artery, will extend as far as the inflammation goes. I doubt if it ever goes beyond that point.

In cases of sphacelus, where the dead parts are removed by ulcerative absorption, as well as in ordinary amputation for other diseases, a coagulum of blood may be found in the lesser arteries of the stumps, extending to, but seldom, or never, I conceive, extending beyond the first communicating or anastomosing branches which are given off by the divided vessels; and in numerous instances of even original idiopathic gangrene, this coagulation of the blood in the vessels does not, I am convinced, at all occur. In a case of idiopathic, chronic, and dry gangrene, which attacked at the same time all the fingers and toes of the same person, and in which the separation of the soft parts of the lower extremities at the ankle-joints was completed before death, I examined the arteries in the stumps of the legs after death, and found the anterior tibial artery in the right leg still open. The opening, however, was exceedingly small; it allowed the coarse injection to pass out of it, but the diameter of the injection that passed out did not much exceed that of a large hog's bristle. The posterior tibial artery was closed by adhesive inflammation, and contained a small plug, not of blood, but of coagulable lymph. The canal of the anterior tibial artery in the left leg was contracted towards its termination in the granulations covering the surface of the stump. This artery also contained a plug of coagulable lymph of about half an inch in length. The posterior tibial artery divided into two branches about half an inch from the surface of the stump. One of these branches was open, so that the injection passed readily out of it; but the canal of the other branch was completely obliterated by the process of adhesive inflammation.

From this dissection, as well as from several others which I have made, and from others which have since come to my knowledge, in which a similar open state of the extremities of arteries in stumps existed after death, I am inclined to believe that hemorrhage does not always occur during life, even in cases in which the artery of the stump, previously to death, has not been completely obliterated by adhesive inflammation; and that this coagulation of the blood takes

place less frequently in mortification than has been supposed by some late writers, particularly by Mr. Hunter.

This open state of the extremities of arteries is an appearance which I have also repeatedly met with in the dissection of the stumps of those who had died after amputation, in cases which had not been subsequently affected with gangrene, and in which, during life, no hemorrhage whatever had occurred. It is a state also, I suspect, which occasionally occurs in the extremities of the larger arteries, from which hemorrhage takes place after wounds and operations.

The separation of the mortified from the living parts is not as one would, on a careless view, be apt to conceive, the sole effect of putrefaction, nor of the exudation of coagulable lymph in the line of contact between the dead and living parts, as has sometimes been stated. It is, I am inclined to believe, a vital phenomenon, but a vital phenomenon in the production of which several powers co-operate. But this is a point which I have already discussed in the account which I formerly gave you of ulceration.*

TREATMENT OF MORTIFICATION; CONSTITUTIONAL AND LOCAL MEANS OF CURE.

The consideration of the distinction of mortification into acute and chronic, the various forms of this affection, the different states of the body in which it occurs, and the variety of causes from which it proceeds, and by which it may be aggravated, must already have prepared your minds to believe that there can be no general plan of cure for mortification, no measures of treatment equally suitable to the differences which occur in the seat, form, progress, and state of this disease, nor to the various morbid affections of the general system by which it is usually accompanied. In attending to the effects supposed to result from the operation of the external and internal remedies which are daily

* See Lectures, from p. 309 to 322.

employed for the cure of mortification, there are two facts well ascertained which appear to me to be peculiarly deserving of your regard. The first of these is, that mortification often stops spontaneously without any assistance whatever from medicine; the second, that it often begins and continues to spread, or, even after it has stopt for a while, recommences and proceeds to a fatal termination, in spite of the best-directed efforts of the healing art. Impressed as my mind has long been with the knowledge of these facts, you need not be surprised, if, in treating of the cure of mortification, I should sometimes express myself with doubt, as to the real efficacy of some of those substances, which have at different times been greatly extolled for their virtues in stopping the progress of that disease, and in remedying its local and constitutional symptoms.

For the sake of order, I shall divide the observations which I have to make on the cure of mortification, first, into those which relate to the treatment of acute mortification, or of mortification attended by inflammatory fever; and secondly, into those which relate to the treatment of chronic mortification, or of mortification commencing without fever, or attended by fever of a typhoid type. I have adopted this distinction, not because I shall always be able to refer the observations I have to make exclusively to the one or the other of these forms, but partly because it is a distinction to which I have already had occasion to refer; and partly, also, because it is a distinction which, in so far as it can in individual cases be observed, must lead to different, if not, in some respects, opposite modes of treatment. It, however, unfortunately happens, that in mortification, as in many other diseases, there are cases of a mixed nature, in the conduct of which very decided modes of practice will be found to be as uncertain in their principles as they may be doubtful in their effects, and in which you may be assured that he is not the worst practitioner who abstains from doing mischief, nor those the least valuable remedies which, by effecting little, leave much to be done by nature.

The treatment of mortification, like that of almost every other chirurgical disease, may be either general or local. We shall first consider the general treatment. Upon this subject, I may remark, that when a high degree of inflammation threatens to terminate in gangrene, the mode of

treatment which I have already so fully described by the name of the antiphlogistic regimen must in general be pursued.* This regimen, as you all know, consists in the employment of blood-letting, purgatives, diaphoretics, and diluents, and in abstinence from all vegetable or animal substances which have a tendency to excite or to augment the state of febrile action. It is a regimen which must be pursued in all its branches, so long as inflammatory fever continues, or any hope of procuring resolution remains. This is a rule which admits of few, if any, exceptions. It is only in cases in which the fever from the first assumes a typhoid character, or where the mortification takes place without fever having previously occurred, that any deviation from the antiphlogistic regimen can be allowed.

The quantity of blood to be abstracted will vary according to the more or less inflammatory constitution of the patient, the seat of the inflammation, the state of its progress, and according, also, to the knowledge which we have of the particular tendency of the inflammation which prevails. You will find very little difference of opinion among medical men respecting the utility of blood-letting in the earlier stages of all the violent inflammatory affections of the head, chest, or belly, which threaten to terminate in gangrene. It is not so, however, with regard to blood-letting in severe injuries of the extremities, as in compound fractures, for example; nor in particular kinds of inflammations, such as those which occur in erysipelas, carbuncle, hospital gangrene, burns, frost-bite, &c. In these affections the patient can seldom, it is said, bear with impunity any considerable loss of blood. In many instances of these injuries and affections, blood-letting, I know, is not required; but I am doubtful, even if it were generally employed, whether it would produce all the mischiefs which have of late years been ascribed to it. I believe it to be the most efficacious of any of the remedies that can be employed, in all cases of inflammatory fever threatening to terminate in gangrene, and that its use in such cases ought never to be omitted in the young, strong, and plethoric. For one case in which I have seen injury done by bleeding, several have occurred to me in which the disposition to gangrene was increased, and

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* See Lectures, from p. 132 to 142.

its progress accelerated, by the early use of hot and stimulating substances. Indeed the great and sudden relief both of the constitutional and local symptoms, which I have so frequently seen produced by spontaneous hemorrhagies, and that, too, even in cases where the gangrene had actually terminated in sphacelus, has tended much to weaken my fears with regard to the use of the lancet in mortifications. Whether in these cases it would have been safe and proper to have taken away blood in quantities equal to that lost by the spontaneous hemorrhagy, I am unable to say; but the immediately good effects of the hemorrhage, and the successful termination of the cases to which I allude, have left in my mind many doubts with regard to the effects which must have resulted, from the early adoption of a stimulating regimen, and continued perseverance in it in other similar cases, which had ultimately a very different termination.

In the treatment of acute inflammatory mortification, or gangrene, after as much blood has been taken away as may be deemed safe or proper, still the other parts of the antiphlogistic regimen must be continued so long as any increased action of the heart and arteries continues, or any hopes of spontaneous resolution or of recovery remains. The use of purgatives seems to be particularly required in those cases in which the local inflammatory affection is accompanied with derangements of the digestive and biliary organs. Antimonial diaphoretics are those from which I should be inclined to expect most advantage in the commencement of the attack; but after the inflammatory action has been subdued, opiates, either alone or combined with antimony, or, what is still better, with ipecacuanha, as in Dover's powder, are frequently of singular advantage, not only by diminishing pain, but also by inducing a soft and moist state of the skin.

A vegetable is to be preferred to an animal diet in the commencement, not only of inflammatory gangrene, but in that also which is accompanied from the first by fever of a typhoid type. By administering, as is but too often done, wine and animal food, in the commencement of diseases which have a gangrenous tendency, the febrile heat and frequency of the pulse are increased, the stomach becomes loaded, the tongue foul, the patient restless and delirious, and his situation dangerous, if not hopeless. A less stimulating regimen gives the powers of nature time to operate,

and affords us an opportunity of administering as much of a mild, nourishing, farinaceous aliment, as the patient's appetite requires, or his powers of digestion allow.

Every gangrenous inflammatory affection may terminate, as has already been remarked, in resolution, in ulceration, or in a state which must pass into sphacelus. In the transition from gangrene to sphacelus, an abatement of the symptomatic fever usually takes place in almost all cases which have ultimately a favourable termination. This I am inclined to believe is the first period in which it is safe to have recourse to the use of vinous liquors, or of a diet which is chiefly animal. These substances should at first be administered only in small quantities, and their use persevered in or abandoned, according to the effects which they appear to produce upon the intellectual functions, upon the pulse, the skin, and the tongue. If the pulse be rendered quicker, the skin hotter, and the tongue drier and fouler, than before they were administered, we may be assured that they are doing mischief, and may add to the extent of the evil which they are employed to remedy. Even after the state of sphacelus has supervened, we must be regulated in our treatment of the constitutional affection by the kind and degree of the symptomatic fever which prevails, and by the heat and appearance of the parts which more immediately surround those which have passed into the state of sphacelus.

In this state, and during the progress of the separation of the sphacelated parts, you may safely allow your patient whatever kinds of food or drink seem to have the effect of supporting the strength, while they do not add to the frequency of the pulse. A diminution in the frequency of the pulse is by no means an uncommon, and it is always one of the most agreeable effects which, during the progress, and towards the termination of febrile disorders, can result from the use of nourishing food, wine, or other cordials. These are seldom proper, however, in the dry and furred state of the tongue; and therefore we must attend to the state of this organ also, in judging of the propriety of administering them. Before this becomes moist on the edges at least, animal food is seldom proper. In cases admitting of, or requiring animal food, it is the lighter and more easily digested kinds only which should be given. The quantity of wine or other cordial liquors which is allowed, must

be proportioned to the age, habits, and particular situation of the patient, and according also to the effects which it seems to produce. In conducting the regimen of a patient, in circumstances similar to those which I have supposed, it is of great consequence to administer only such quantities of food as the patient can digest easily; to allow one meal to be digested before another is given, by which you avoid the injurious effects which almost always arise from the admixture of different kinds of food; and to keep the intestinal canal sufficiently open by the occasional use, when it is necessary, of proper laxative or purgative substances.

I have insisted longer upon the regulation of the diet, in the treatment of gangrenous affections, than to some of you may seem necessary; but I have done so from a belief, that the due regulation of the diet, particularly in the latter stages of these affections, is of infinitely more consequence to a final cure than any remedies which you can employ. Indeed, in most cases of mortification, I am inclined to believe, that food and drink, properly adapted to the situation of the patient, and the stage of his disease, are almost the only kinds of internal medicines which are required.

Of the various internal medicines which have at different times been recommended for the cure of mortification, the Peruvian bark, or cinchona officinalis, holds undoubtedly the first place. It has, indeed, been so much celebrated as a remedy in mortification, that it might seem culpable in me to neglect mentioning it. The opinions, however, of authors, with regard to its real efficacy in curing mortification, are divided; and we have, perhaps, yet to learn what the particular kinds of gangrene are, the stages of these affections, and the precise circumstances of the patient in which its use will prove beneficial. I think I have frequently seen it prove hurtful, when administered in cases of mortification, by loading the stomach of the patient, creating a dislike to food, and sometimes by exciting an obstinate diarrhœa. I believe it to be, in mortification, a medicine completely inert and inefficacious. This opinion, however contrary it may seem to established creed, and to the usual routine of chirurgical practice, is, I have reason to believe, the opinion of many of the best-informed practitioners of the present day; and I may add, also, that it has been the opinion of many of the best-informed practitioners for a period of more than fifty years. In proof of this, I shall read you

a few extracts from practical authors, by which you will easily be able to form an accurate judgment of the degree of credit to which the reports of the efficacy of this drug, in particular instances of mortification, are entitled.

The bark was first employed for the cure of gangrene by Mr. Rushworth of Northampton, about the year 1715; and various cases, in proof of its singular efficacy in the cure of that disease, were afterwards published by Mr. Rushworth, Mr. Amyand, Mr. Shipton, and Mr. Douglass. In almost all these cases, it is particularly deserving of your notice, that the salutary effects supposed to arise from the use of the bark took place within less than twenty-four hours after it had been first administered; a period obviously too short to have enabled it to produce any considerable effects in cases so desperate as those described, and which ought to have created a suspicion at least, in the minds of those who employed it, that these salutary changes had begun, or were about to take place, before the bark had been administered.

The following opinion, with regard to the use of the bark in mortification, was published by M. Quesnai, in the year 1749. "This remedy is recommended in the Philosophical Transactions by Mr. Shipton, and in the Edinburgh Medical Essays and Observations by Dr. Monro and Mr. Paisley. Besides the works in which it is incidentally mentioned, we have several treatises written expressly on this pretended specific. Heister wished to try the use of the bark in the case of a woman 70 years of age, who had a gangrene of the foot from an internal cause; but as she always vomited this medicine immediately after taking it, Heister was obliged to give up the trial. His patient, however, recovered. Had there been no obstacle to the employment of the bark in this case, the cure might have been regarded as a proof of the efficacy of that drug, not by Heister indeed, but by others who might naturally enough have attributed so successful a termination to the use of the bark; for in all diseases treated empirically, the greater part of mankind almost always regard the recovery as having proceeded entirely from the remedies which have been employed. Single observations are generally more amusing than instructive; and in medicine we may be permitted to doubt, till the truth has been established by a sufficient number of trials. Mr. Amyand, Fellow of the Royal Society of London, and Sur-

geon to his Britannic Majesty, who uses much circumspection in judging of the use of the bark in mortification, has endeavoured to collect a sufficient number of observations, to dissipate the uncertainty which prevails with regard to the use of this remedy. He has communicated several of these to the Royal Academy of Surgery, in order that they might be examined with all the strictness and accuracy which a subject of this importance demands. But this at least is certain, that the results of the trials which have been made with the bark in France have not confirmed the success said to have been obtained in the observations published in England."*

The opinions of Mr. Sharp, with regard to the use of the bark in mortification, published the year after those of M. Quesnai, are, if possible, still more deserving of your attention. They form a singular contrast with the opinions entertained, and modes of reasoning usually employed by a class of practitioners, becoming every day, it is to be hoped, less numerous, who see nothing in the favourable symptoms, progress, and terminations of diseases, but what they themselves have accomplished; and who, in reporting the results of their own practice, attribute every recovery to the efficacy of the medicines which they have employed, every unfavourable or fatal termination to the destinies of nature, but who hesitate not to ascribe every unsuccessful event, in the practice of others, to ignorance, prejudice, neglect, or misconduct.

"There has lately started up," says Mr. Sharp, "in Great Britain, a new practice of treating this complaint, which at present makes some noise in other parts of Europe, and is therefore worth our attention. Every body will immediately conclude, that I mean the cortex peruvianus, which, within these few years, has been so exalted for its virtues in stopping a gangrene, that the cautery itself was not more esteemed among the ancients than is this medicine by some of the moderns. I know it will be looked upon by many as a kind of scepticism, to doubt the efficacy of a remedy so well attested by such an infinity of cases; and yet I shall frankly own, I have never clearly, to my satisfaction, met with any evident proofs of its preference to the cordial medicines usually prescribed; though I have for a

* See Quesnai Traitè de la Gangrene, page 373.

long time made experiment of it, with a view to search into the truth.

"Perhaps it may seem strange thus to dispute a doctrine established on what is called matter of fact; but I shall here observe that, in the practice of physic and surgery, it is often exceedingly difficult to ascertain a fact. Prejudice, or want of abilities, sometimes misleads us in our judgment, where there is evidently a right and a wrong; but in certain cases, to distinguish how far the remedy, and how far nature operate, is probably above our discernment. In gangrenes, particularly, there is frequently such a complication of unknown circumstances as cannot but tend to deceive an unwary observer. Mortifications arising from mere cold, compression or stricture, generally cease upon removing the cause; and are, therefore, seldom proper cases for proving the power of bark. However, there are two kinds of gangrene, where internals have a fair trial; those are, a spreading gangrene from an internal cause, and a spreading gangrene from violent external accidents, such as gunshot wounds, compound fractures, &c. Yet even here we cannot judge of their effect with absolute certainty; for sometimes a mortification from internal causes is a kind of critical disorder. There seems to be a certain portion of the body destined to perish, and no more; of this we have an infinity of examples brought into our hospitals, where the gangrene stops at a particular point without the least assistance from art; the same thing happens in the other species of gangrene from violent accidents, where the injury appears to be communicated to a certain distance and no farther; though, by the way, I shall remark in this place, contrary to the received opinion, that gangrenes from these accidents (where there has been no previous straitness of bandage,) are as often fatal as those from internal causes.

"As I have here stated the fact, we see how difficult it is to ascertain the real efficacy of this medicine. But had bark in any degree those wonderful effects in gangrenes which it has in periodical complaints, its pre-eminence would no more be doubted in the one case than in the other. What in my judgment seems to have raised its character so high, are the great numbers of single observations published on this subject, the authors of which, not having frequent opportunities of seeing the issue of this disorder under the use of cordials, &c., and some of them, perhaps, prejudiced with the

common supposition, that every gangrene is of itself mortal, have therefore ascribed a marvellous influence to the bark when the event has proved successful."*

To the opinions already adduced of the inefficacy of the bark in mortification, I shall only add that of Mr. Pott. "I am sensible," says this author, in his Observations on the Mortification of the Toes and Feet, "that many of my readers will be surprised at my affirming, that the Peruvian bark will not stop a mortification; a distemper in which, for some years, it has been regarded as specific: but I must beg not to be misunderstood. I mean to confine my observation and my objection to this particular species of mortification, which I regard as being *sui generis*: and under this restriction I must repeat, that I have seldom, if ever, seen the bark successful. In all other cases, wherein it is used or recommended, no man has a higher opinion of it; but in this I cannot give it a praise which it does not deserve.

"I believe I may venture to say, that I have tried it as fairly, as fully, and as variously, as any man has, or can; I have given it in the largest quantity at the shortest intervals, and for the longest possible space; that is, as long as the patient's life would permit: I have given it by itself, in decoction, extract, and substance: I have combined all these together; I have joined it with nitre, sal. absynth., with snake-root, with confect. cardiac., with volatile salts, and with musk, as different circumstances seemed to require or admit: I have used it as fomentation, as poultice, as dressing; I have assisted it with every thing which has been usually thought capable of procuring or assisting digestion; still the distemper has continued its course, perhaps a little more slowly, but still it has ended in death.

"I am sorry to rob one of our great medicines of any part of its supposed merit; but as, on the one hand, its claim in this instance is unjust, and as, on the other, I hope to add as much to the character of another, the *res medica* will be no sufferer."†

The medicine to which Mr. Pott alludes, in the sentence last quoted, is opium; a medicine which, though it certainly has not acquired the same degree of celebrity with bark,

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* See Sharp's Inquiry, p. 273.
† See Pott's Works, vol. III. p. 235.

in the treatment of mortification, is one, however, which, from its well-known diaphoretic, stimulant, and anodyne powers, is much more entitled to the attention of practitioners. In saying so much in favour of opium, I would not by any means have you to place the same reliance on its powers for stopping, even the mortification of the toes and feet in old people, which appears to have been done by Mr. Pott. From the trials which I have made, and which I have seen made by others, I cannot allow myself to believe that its powers, in stopping this particular kind of mortification, are greater than in stopping any other form or variety of the disease. It is obvious, however, from Mr. Pott's account, that his mind was strongly impressed with a very different opinion. His opinion seems to me to have been formed from the results of a very small number of cases, and in complete forgetfulness of the invaluable observations of his preceptor Mr. Sharp, with regard to the frequent spontaneous stoppage of mortification in cases in which no medicines whatever are used.

There are few, if any, cases of mortification, I believe, in which, if the patient survives for any length of time, the use of opium is not sooner or later required. Given, it is true, in the commencement of acute mortification, it may prove useless, or even hurtful, by its stimulating effects, in adding to the violence of the symptomatic fever which occurs; but when this fever abates, or has been subdued, there is no other known remedy, from the use of which, in the progress of gangrenous affections, such agreeable effects can in general be obtained. Opium may be given, in the cases requiring it, in doses of a grain, every twelve, eight, or six hours, according to the urgency of the symptoms, and according to the effects which it produces. We should always begin, particularly in elderly people, with small doses, and in these increase the dose as occasion may require. In the continued use of opium, also, we should always allow even the agreeable effects of the previous dose to go off before we administer a new dose, otherwise it will be difficult for us to judge of the real state of the patient, or of the effects which the opium is producing. By allaying the local pain, and by alleviating the general feelings of anxiety, uneasiness, and restlessness, which prevail in most cases of mortification, this medicine often procures sleep, and a temporary oblivion of misery, which would be unceasing but for its use. I can-

not, therefore, but regard the medical profession, and the public at large, as under lasting obligations to Mr. Pott, for having directed their attention, in so particular a manner, to the use of opium in mortification.

Dr. Kirkland, however, in recommending the addition of opium to the local remedies used in mortification of the feet and toes, has mentioned an effect which occasionally results from its internal use, that appears to me to be particularly deserving of your attention. "By this method of proceeding," says he, "there is less necessity for taking large doses of opium, which very frequently bring on a drunken delirium, make the patient sick, take away appetite, and thus do mischief instead of good; as is evident from their no way stopping the progress of the disease, when they have these effects. Whereas small doses, frequently repeated, will gradually lessen nervous irritability without such inconveniences. I can aver, that I have repeatedly seen this kind of mortification removed under the use of anodyne topics, when we were obliged to leave off opium, because it brought on a delirium, and took away the appetite, without producing any good effect: and it may, I think, be laid down as a rule, that unless the patient can eat mild nourishing food, there will be but small hopes of a cure."* In another place, the same author remarks, "Indeed I have constantly observed, while a desire for food increaseth in proportion to the discharge, the patient often recovers; whereas, if the appetite fails, and cannot be restored, medicines afford no relief."

There is one symptom or affection of a constitutional nature, that sometimes accompanies inflammatory gangrene, which I have neglected to mention. This symptom, however, is the more deserving of your attention that it has been made the subject of a short essay by Mr. White of Manchester. That experienced and judicious practitioner had observed, that gangrene, arising from external injury, was sometimes accompanied by spasmodic contractions, and even convulsions; and in these cases, in order to allay irritation, and procure rest, he was led to employ large doses of musk and volatile alkali. "I soon found that it," says Mr. White, (meaning the combination of musk with volatile alkali), "not only removed the singultus, subsultus tendinum, and other convulsive spasms, but also procured ease,

* See Kirkland's Inquiry into the present State of Medical Surgery, vol. II. p. 423.

sleep, and a gentle diaphoresis; whilst at the same time the mortification regularly stopped. The circumstance," he adds, "struck me, but I scarcely durst flatter myself the stoppage of this complaint itself was owing to the medicine, till, from repeated trials of it, I observed the same uniform effects. It has succeeded to the utmost of my wishes in mortification, accompanied with, or occasioned by convulsive spasms, or arising from local injury, producing irritation." Mr. White relates four cases, in proof of the efficacy of this remedy. From the perusal of these cases, you will perceive that the musk and volatile alkali produced uniformly their salutary effects within a few hours after they first began to be administered, at a period when but little of these drugs had been taken, and in which they could not, in my apprehension, be supposed to have produced any very considerable effect. Gangrene, we know, often stops at a particular point, without the least assistance from art, there appearing, as Mr. Sharp has so well expressed it, a certain portion of the body destined to perish, and no more. That the cure, in the four cases mentioned by Mr. White, was in a great measure spontaneous, I am inclined to believe, not only for the reasons I have already assigned, but also from the now very generally acknowledged inefficacy of musk as an antispasmodic; and likewise from the very candid acknowledgment of Mr. White, that he had been disappointed in its effects when it was tried in gangrenes and mortifications arising from other causes. You will find, at p. 53 of Mr. O'Halloran's Treatise on Gangrene and Sphacelus, a still more formidable case of gangrene with convulsions, than any of those described by Mr. White; but which underwent a spontaneous cure. Had bark, opium, or musk and volatile alkali, been used, they would all severally have been supposed to have saved the life of this patient, and to have established, in the clearest and most undeniable manner, the efficacy of these drugs in curing a gangrene accompanied with convulsions.

In perusing the history of the general remedies which have at different times been extolled, for their singular efficacy in stopping the progress of mortification, it cannot fail to surprise you, that medical practitioners, in condemning, without reserve, the remedies employed by their predecessors, should so often have been led, by some lucky hint or fortunate occurrence, to the discovery of a new remedy, or

mode of practice, which is never afterwards acknowledged by themselves to have failed of producing, in their hands at least, the most beneficial effects. If a sufficient explanation of this curious fact be not found in the eagerness with which most practitioners seek for professional reputation, and in the reluctance which they have to part with it, I know not to what other source of information I can refer you, unless to the inestimable observations which I have already quoted from Mr. Sharp's Critical Inquiry. A Materia Medica, composed by a body of experienced practitioners, who had retired altogether from the exercise of their profession, would give us, I suspect, an account of the medicinal virtues of many of our most celebrated remedies, very different from that which is to be found in the treatises which have been compiled for us from the writings of those, who at the time of commencing authors, were either just entering into practice, or who, having been for some time engaged in acquiring the emoluments, become ambitious also of sharing in the honours of their profession. Woe be to the trade in drugs, and to the dispensers of useless medicines, if ever such a work should make its appearance, and get into any degree of popular favour.

The local treatment of mortification, in several of its stages, is a matter which is still very far from being established on any thing like clear and decided principles. In the treatment, indeed, of some of those cases of external injury, in which we have reason to dread the supervention of gangrene from excess of inflammation, advantage may occasionally be derived from the judicious use of the different means which I formerly described, when speaking of the local treatment of inflammation.* But when gangrenous inflammation has once taken place, whether it be of a more acute or chronic character, I doubt much whether there be any local remedies, which can be said to possess discutient or resolvent powers in gangrene; and whether the surgeon, by a very active interference, is not often in danger of doing more harm than good by the use of local remedies. We every day see gangrenous inflammation undergo spontaneous resolution, in situations, as in cynanche maligna, in which it is difficult, if not impossible, to apply local remedies. In erysipelas, also, a disease in which there is always

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* See Lectures, from page 144 to 153.

more or less of a gangrenous tendency, practitioners of experience now usually direct their attention chiefly to the constitutional symptoms, and abstain from the use of local remedies; contenting themselves, in this respect, with desiring their patients to sprinkle the parts affected with flour, and to keep them in a moderate and uniform temperature. But the application of a substance so perfectly inert as flour, can be regarded only, I conceive, as a tacit acknowledgment on the part of those who employ it, that they know of no external remedies which can be of use, or which are required in the treatment of erysipelas. Yet one would require to read through the history of the external remedies recommended in different periods of our art, for the cure of erysipelas, to become fully aware of the merit of this improvement.

In cases of acute inflammation, threatening to terminate in gangrene, the first object of the surgeon should be to remove all the exciting causes by which the state of gangrene is liable to be induced, whether these be irritation by a broken or dislocated bone, strangulation by a tendon, compression by a fascia, the presence of some irritating fluid, acrid applications, &c. No curative mode of treatment need be employed, or can be supposed to prove useful, so long as these causes are permitted to operate. In the treatment of none of the affections liable to terminate in mortification, is the success of the surgeon in preventing the occurrence of this disease, in general so manifest and complete, as by removing, in an early stage, the stricture of tendinous parts producing strangulation in herniæ.

When gangrene actually does supervene, whether due attention has been given or not to prevent it, there are a variety of remedies that are usually had recourse to, some of which are more, others less powerful in their operation. Of these, cold and hot applications are, perhaps, the most important. In practice, however, it must be confessed, that it is often difficult to discriminate the cases in which these applications are respectively required. The choice which we make, however, should in some measure be regulated by the notion which we form of the more or less acute character of the inflammation which we fear will prove gangrenous; by the force of the circulating system; by the local heat of the parts affected; and, in doubtful cases, by the de-

gree of relief which the particular application affords. In cases of the more active kind, the application of cold water, either alone, or holding sugar of lead or vinegar in solution, often affords great and unequivocal relief. In diminishing the temperature, cold applications in these cases lessen the sensibility of the parts to which they are applied, and weaken the impetus of blood into these parts. But in chronic cases, in which the inflammation is obviously of a gangrenous nature, an increase, not an alleviation, of the local affection can be reasonably expected from their use. Here we must content ourselves with preserving, by means of clothing, the natural temperature of the parts affected, or raise it, where it has been too much diminished, by the application of warmth. But caution is required in the use of hot, as well as of cold applications. I doubt much whether there be any cases of gangrenous inflammation, in which the temperature of the hot applications employed should be above the natural heat of the part to which they are applied. If there be any such, they can only be cases, I conceive, of chronic gangrene, in which the temperature of the part, as of an extremity, has, by injudicious exposure, been reduced below its natural standard. In the application of heat to parts affected with gangrenous inflammation, the heat has seldom been applied by simple water alone, but either by decoctions of aromatic herbs, of herbs reputed antiseptic, or by the application of warm vinegar, spirits of wine, with camphor, turpentine, and other stimulating gums, or essential oils in solution. But I know of no accurate observations, no regular series of experiments, in which the effects of temperature, either alone, or of temperature in conjunction with the action of the substances to which I have alluded, have been either ascertained or recorded. The local treatment of gangrenous cases, in what respects temperature, and the application of stimulating substances, has hitherto been purely empirical, and must remain so, till some general facts are ascertained which may serve as principles to direct our practice. I do not by any means believe, nor do I wish to persuade you, that the local means which have been commonly used to stop the progress of a spreading gangrene, are all equally inert and inefficacious; but I have to regret that I cannot, from my own experience, nor that of others, point out to you the remedies that are best entitled to your

attention, nor the precise circumstances in which they ought to be employed.

In the observations which I have made respecting the local treatment of gangrenous inflammation, I have hitherto taken it for granted, that no abrasion of the cutaneous surface, no wound, ulceration, nor sphacelus exist. An abrasion of cutaneous texture is sometimes occasioned in gangrenous inflammation, by the formation of vesications of a larger or smaller size, and in others by the state of excoriation. In these cases the application should be such as can be removed easily without their having adhered to the cuticle; and when portions of this membrane, however small, have been destroyed, the applications must be such as do not stimulate too highly, nor give pain to the denuded cutis. Solutions of sugar of lead, which are not permitted to dry upon the parts to which they are applied, the linimentum ex aq. calcis, and mild ointments, form, in most instances of vesication or excoriation, the best local remedies.

In gangrenous inflammation, succeeding to wound, the state of the wound itself, and of the parts more immediately surrounding it, are those which, in a more particular manner, require the attention of the surgeon. In almost all instances of wounds giving rise to gangrene, re-union by the first intention does not of itself usually take place, nor is it in general to be attempted by the surgeon. A speedy and mild suppuration is the object most to be desired: But this is a process which you know takes place, in general, best under the application of emollient poultices. In severe compound fractures, in gunshot wounds, or in lacerated wounds of the joints, if the injury be recent, and the inflammation threatens to be of the active kind, local bleeding, from the parts more immediately injured, may be required. In these cases, if the inflammation runs high, and the heat of the part be much increased, the temperature of the poultice may be at first a few degrees below that of the part to which it is applied. But when cold ceases to be agreeable to the feelings of the patient, there is, in general, reason to believe that it is improper.

In the less acute and more chronic cases of gangrenous inflammation, as in malignant erysipelas and carbuncle, in the gangrene of the toes and feet of old people, in the sphacelating state of hospital gangrene, and in several contused

wounds in which gangrene and sphacelus have supervened, the emollient poultice, which is applied to promote the separation of the dead parts, may have an addition made to it of a greater or less quantity of the unguentum resinosum, or even of oil of turpentine itself. In the more severe of these cases, where we have reason to dread the extension of the sphacelus, warm dressings, as they have been termed, which are formed by dipping pledgits of charpee in a mixture of equal parts of the unguentum resinosum and oil of turpentine, may be applied, of a temperature as hot as the patient can bear without pain; and over these we may lay an emollient poultice, of a large size and soft consistence. This was the mode of dressing followed by Wiseman in cases of gangrene and sphacelus similar to those which I have mentioned; and it is to be regarded, I am persuaded, as a very considerable improvement on the practice so much used by the ancients, and by most of the older surgeons, of dressing mortified parts with the unguentum Ægyptiacum. Hildanus, in particular, recommends the application of pledgits spread with the unguentum Ægyptiacum, and of an emollient poultice, to parts threatened with, or passing into the state of sphacelus; and adds, that for such parts, they form by far the best local remedy.

After the sphacelus stops, and the process of ulceration begins in the inflamed line of contact between the dead and the living parts, it will often be found that the turpentine dressings are too stimulating, and occasion a considerable degree of pain. When this happens, we must either diminish the quantity of the turpentine in the dressings, or remove it altogether, according to circumstances. Besides the pain, a considerable extension of the ulceration would be, in general, the effect of continuing these applications, after they begin to produce uneasiness. The ulcerating surface is, in the progress of separation, liable to pass, under every mode of treatment, into the state of a painful and irritable ulcer; and in this state it may require to be treated with decoctions of poppy-heads, or with the application of the turnip, carrot, fresh hemlock leaf, stale-beer, fermenting poultices, &c. Whatever application irritates, gives pain, or renders the discharge thin and watery, is to be avoided; while those which we find, from trial, have a tendency to soothe the irritated surface, to promote granulation, and to improve the condition of the discharge, must

be employed, so long as they continue to produce these agreeable effects. In the management, however, of the sores from the separation of dead parts, as in those from other causes, a change in the applications made to them has often a most beneficial tendency.

I mentioned to you formerly, that gangrene not unfrequently occurs from pressure, in persons who are long fixed down to their beds in one particular position by disease. This affection usually has its seat in parts which are but thinly covered with muscular flesh. It occurs towards the latter stages of long-continued febrile diseases, as after typhus or hectic fever, attended by tedious suppurations; or even without these fevers, as in paralysis, and in very bad cases of compound fracture. It must be remarked, however, that there are two forms of disease, arising from pressure, which have not in every instance been very accurately distinguished from each other. One of these is the mortification I have mentioned; the other, a chafed, excoriated, and ulcerated state of the same parts; which seems to be produced also by pressure.

The mortified state arising from pressure, as Mr. Hunter justly remarks, is an indication of a greater degree of weakness in the part than the ulcerated. We not unfrequently see these two states existing in the same diseased surface at the same time. The part in which a mortified slough or eschar has been formed, passes very readily into the state of ulcerative inflammation; and a sore which was at first but small, often acquires in this way a very large size. The occurrence of this ulcerated state is promoted, and its symptoms greatly aggravated, by inattention to cleanliness. The urine, in particular, is apt to produce this affection when allowed to wet the clothes upon which the patient lies. In the management of this case, therefore, it must be obvious that our first attention must be given to cleanliness, and to removing, if possible, the patient from the position in which the affection has been produced by pressure.

If the skin be excoriated and broken, a little tutty powder, or flowers of tin, may be dusted upon the part; or if an ointment be required, those which contain tin or lead in their composition are in general to be preferred. But when the ulceration threatens to extend, these remedies are to be laid aside, and some more soothing applications employed. No application should be continued long which produces

much irritation and pain ; for in this case, the continuance of the application may tend to promote, rather than retard, the process of ulcerative absorption. In the irritable or painful state of this ulceration, the greatest benefit is often derived from the application of an emollient, hemlock, carrot, or fermenting poultice.

Gangrene from pressure occurs in very various degrees. It is sometimes, though but seldom, confined to the skin, which becomes red and painful, without excoriation or desquamation of the cuticle. In this state the parts may be bathed with spirits, either alone, or holding a little camphor in solution. Some prefer a liniment, made by beating the white of an egg with spirits. When, from particular circumstances, it becomes difficult or impossible to turn the patient from the position in which either ulceration or gangrene has supervened, great relief will be obtained by placing a soft swandown-pillow below him, which may be covered with a bit of grey hare's fur, or by using even after the skin has given way, a circular hollow pillow.

When sphacelus succeeds to gangrene from pressure, the fermenting poultice is an application which, from attentive observation to the effects of external remedies in this affection, I should be inclined to prefer. It seems to soothe the gangrened and pained parts, while it promotes powerfully the separation of those already mortified. In some instances, however, I have found it too stimulating, and have been obliged to substitute the simple emollient, carrot or turnip poultice, in its place. Warm and stimulating applications, which are so useful in other cases of mortification, have, in several instances of this affection, appeared to me to excite a great deal of uneasiness and pain. When the sloughs are completely separated, and granulations formed, the affection is to be treated in the manner I have already described, when speaking of granulating surfaces. In the treatment of gangrene from pressure, our attention should be directed, in a particular manner, to the support of the general system. As much mild nourishment as the digestive organs can easily consume, should be given, and every means taken, to prevent, alleviate, or cure the hectic fever, which is so liable to supervene in gangrenous affections proceeding from that cause.

A sphacelus may be in one of two states; first, either spreading from a point; or, secondly, already bounded by

adhesive inflammation. In both of these conditions, it must be a main object with the surgeon, to preserve, if possible, the parts which are still alive; but the means to be employed for this purpose cannot well be supposed to be the same in circumstances so dissimilar. In the first of these cases, cloths dipt in spirit of wine, or in spirit of turpentine, the spirits being renewed from time to time, have often been supposed to be a local remedy, highly efficacious in putting a stop to the progress of sphacelus. They appear to prove useful to the parts to which they are applied, by exciting in them a certain degree of inflammation. But when, in the second state, adhesive inflammation has once decidedly taken place, we must endeavour to promote the growth of granulations upon the ulcerating surface. Warm and emollient poultices are the means which have already been so often recommended for that purpose. By experience we learn, however, that some forms of these preparations are better adapted than others for suppurating surfaces, attended with the separation of parts in the state of sphacelus, such as the hemlock, stale-beer, and fermenting poultices; or those which have a due proportion of turpentine, or of some of the warm gums added to them.

In times not very remote from our own, it was the general practice with surgeons to scarify mortified parts, partly with a view to facilitate the separation of these parts, and partly also with a view to retard the progress of the sphacelus. When the incisions or scarifications are confined to a part that is completely sphacelated, no harm whatever can result from this practice. It may even be of use, by evacuating putrid fluids, and by breaking down the texture of the mortified parts, that are afterwards to be separated. Scarifications, however, have often been productive of mischief, and must always be so when carried so deep as to affect the sound parts, or when they are employed as a remedy for parts in a state of gangrene. The removal of portions of the mortified parts with the knife or scissors, may be useful, by allowing the external applications employed to come more completely into contact with those which are not deprived of their vitality, and the morbid condition of which they are intended to alter.

Amputation was long regarded as one of the most effectual means which could be employed to prevent the extension of gangrene. This practice, however, has not received

the sanction of experience; on the contrary, it has been generally found, wherever it has been practised, in either acute or chronic gangrene, to accelerate much the progress of the disease, and in this way to hasten the death of the patient. The parts which were divided in amputation, though at a distance from a spreading gangrene and from sphacelus, were found speedily to assume the appearance of the affection for which the operation had been performed. Till, therefore, the adhesive inflammation comes on, and a distinctly marked separation of the dead from the sound parts takes place, amputation is, in few, if in any cases of mortification, admissible. We never know, previously to this, where a gangrene or sphacelus are to stop, nor whether the powers of the constitution be sufficient to sustain the injury that the mortification has inflicted. Even when the adhesive inflammation comes on, it is, in most cases, best to allow some time to elapse before we operate, partly with a view to give time for the constitutional symptoms to abate, in other instances to allow the patient's strength to be recruited by nourishment and cordials, and partly also with a view to learn, whether the constitution of the patient be indeed capable of so great a fresh shock, as that which amputation must necessarily occasion.

There are two periods in wounds liable to be affected with gangrene, in which it seems now to be very generally agreed among well-informed practitioners, that amputation may be best performed. The first of these periods is, before the local and constitutional symptoms supervene: The second is, after the mortification has stopt, and the constitutional symptoms attending it have subsided. But these are points which I shall afterwards have occasion to consider, in treating of the cases requiring amputation, and of the periods in which that operation may be most safely performed. If in the meanwhile, however, authority were permitted to influence your judgment in matters of this sort, I might quote to you the opinions of one who was as industrious in acquiring experience, by his own observation, as he appears to have been liberally gifted by nature with all the talents which the practice of surgery can require. The authority to which I allude is that of Mr. Cheselden. This author observes, "When the blood-vessels become unable to preserve the circulation in the extreme parts, whether from particular weakness in the vessels, or any other decay, I have al-

ways observed it to be hurtful to scarify. It lets out the juices that should assist nature to make a separation of the mortified part: nor can it be known in what place we may safely amputate, till such a separation, which teaches us where it can be supported; and in any place short of that, an operation will be both useless and mischievous. I have known many succeed well who have been thus left to separate, but very few that were otherwise treated; nay, I have known some extraordinary instances of success, where the patients had the happiness to have no one about them to interrupt the kind assistance of nature."*

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* See Cheselden's Anatomy, tenth edition, page 208.

BURNS.

Burns are accidents of almost daily occurrence, which are painfully severe in their symptoms, in general very difficult to heal, and not unfrequently fatal in their termination. We include under this appellation, every injury occasioned by heat or fire, from the slightest redness of the skin, to the most extensive and deep-seated destruction of the solid parts. But between these two extremes a variety of morbid phenomena occur, which will require to be separately considered.

It has been usual to divide burns into different kinds or species. These divisions have sometimes been taken from the agents by which the burns are produced, but more frequently from the depth and extent of the local affection. The depth and extent to which the effects of burns have penetrated, appearing to me to afford the best grounds for distinction, I shall, in the few observations which I have to make upon these injuries, divide them, 1st, Into burns which produce an inflammation of the cutaneous texture, but an inflammation which, if it be not improperly treated, almost always manifests a tendency to resolution. 2dly, Into burns which injure the vital powers of the cutis, occasion the separation of the cuticle, and produce suppuration on the surface of the cutaneous texture. 3dly, Into burns in which the vitality and organization of a greater or less portion of the cutis are either immediately or subsequently destroyed, and a soft slough or hard eschar produced. This is a division of burns which, so far as I know, was first made by Fabricius Hildanus; and which since his time has, with some slight modifications, very generally been adopted.*

*"Quia combustiones in tres divisimus species vel gradus, ac deinceps ad uniuscujusque speciem propria præscripturi, simus remedia, neces-

It is to be remembered, however, that this, as well as every other division of burns, must be in many respects arbitrary. The phenomena which occur in the first species present themselves in the second and third; so that, in considering the subject of burns, we shall find ourselves perpetually in danger of confounding the phenomena of inflammation with those of gangrene, and those of gangrene with those of sphacelus. The phenomena peculiar to each of these different states often occur in one and the same burn; and it is probably in some measure from inattention to this circumstance that so great a diversity of opinion has at different times prevailed, with regard to the best method of treating burns. The phenomena of burns, also, are in a state of constant progression; and the remedies which may be proper in one stage or state of these injuries, may become not only useless but injurious in another. Add to this, that peculiarities of constitution in particular individuals often occasion striking diversities in the appearance of burns, and in the effects which different remedies produce upon them; so that of a number of the severer cases of burns, at first perfectly similar in appearance, and treated in every respect

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se est, ut quomodo eæ signis et notis distinguendæ sint, declaremus. Signa itaque primæ speciei, sive levissimæ combustionis hæc sunt: cutis rubicunda, dolor acerbissimus et pungitivus, non aliter, ac si cutis semine urticæ fricàta esset. Mox, (nisi citissimè occurratur ægro remediis aptis) inflatur locus, et elevantur pustulæ, in quibus aqua clara et alba continetur, tandem quoque Epidermis separatur. Ex circumstantiis quoque cognoscitur combustio levis, nimirùm rem ignitam levem fuisse, quemadmodum stramen, linum, stupæ, et similia: aut statim defluxisse, ut aqua fervida, vel corpus exiguo momento attigisse. Contrà verò in altera specie, res ignita aliquandiu corpus attigit, vel vehementiorem in se habuit calorem, quemadmodum ferrum ignitum, aut metallum aliquod liquefactum, lignum durissimum, pix, oleum, cera, vel simile quid. Hinc fit ut pars illicò infletur, rubescat, doleat, urat, et ipso momento pustulæ eleventur, in quibus continetur aqua subtilis et flavescens, ægerque de tensione cutis conqueritur: est enim vi ignis contracta atque densa. In ultima verò specie, ipso quoque momento, dum res ignita adhæret corpori, elevantur pustulæ, sed illicò denuò concidunt, eo præcipuè loco, in quo combustio insignis et vehemens est: subjecta verò cutis nigra, vel saltem livida conspicitur, et obtusè sentit, si scalpello pungatur; est enim dura et exsiccata crusta, ea cùm deciderit, remanet ulcus profundum et putridum. Ex natura quoque rei ignitæ, et spatio, quo corpori adhesit, combustio insignis cognosci potest. Porro quamprimum Chirurgo occurrit Combustio, inquirat ad quamnam speciem sit referenda, hoc est, an levis, mediocris vel insignis fuerit."—*Liber de Combustionibus*, Cap. III.

after the same way, you will not find that any two heal precisely in the same manner.

Superficial burns, or *scalds*, as they are termed, are generally produced by the contact of hot liquids, or of the vapours arising from hot liquids. They are accompanied by redness of the skin, pungent pain, and an increased degree of temperature. To these a slight degree of swelling sooner or later supervenes. The pain in superficial burns is often more severe than in those of the third species, which have destroyed the vitality of the cutis; and this pain is always aggravated for a time, at least, by exposure to heat. The inflammation in superficial burns resembles that produced by the action of a rubefacient. When not very severe, this inflammation, after some time, spontaneously disappears; and is not followed by any constitutional symptoms. But if this inflammation, instead of being resolved, continues, or, as in the severer cases of superficial burns, increases, vesications are liable to form, and a symptomatic fever, proportioned in some degree to the extent of the local injury, and to the more or less irritable nature of the patient's constitution, is almost always produced.

The indications of cure, in this species of burn, are extremely simple. We must endeavour to remove the inflammation, and by this means to prevent the formation of blisters. But if we fail in this, we must treat the blistered parts so as not to induce ill-conditioned sores or ulcers.

Before entering, however, into the consideration of the particular means by which these indications are to be fulfilled, it may be proper for me to remark, that two general methods of treating burns seem at all times to have been followed, in the regular, as well as in the empirical practice of the healing art. One of these has for its object to alleviate the symptoms of burns, by the application of substances which produce a cooling or refrigerant effect, the other to heal burns by calefacient or stimulating substances. Whether, as has often been contended, the one of these modes of treatment be in every instance preferable to the other, or whether there may not be cases of burns in which the refrigerant, and others in which the calefacient mode of practice ought from the first to be followed, are points which are still far from being satisfactorily determined. Judging from my own observation, and from the results of the past experience of medical men, I am satisfied that each mode of treatment

may have its peculiar advantages in the particular cases to which it is adapted.*

Cold is a remedy which has long been employed to diminish the inflammation of superficial burns. Rhazes directs, that, in recent burns, cloths dipt in cold water, or in rose-water cooled with snow, be applied as soon as possible to the parts which have been injured, and that these cloths be renewed from time to time; and Avicenna says, that this practice often prevents the formation of blisters.

The form of cold applications may be varied to infinity, but a sudden relief from pain is an effect which is common to them all. The redness does not always go off in the same proportion with the pain during the application of cold, and the swelling is even sometimes increased by it. In proportion as the coldness of the application, which has been made to a recent burn, diminishes, the pain returns; so that unless the temperature of the application be diminished from time to time, little benefit will be obtained from it.

It is a practice with the common people of this country to apply thin slices of raw and cold potatoes to surfaces which have been scalded, or, what answers still better, potatoes scraped down into a soft pulp, are applied in the form of a cataplasm. This application gives almost instant relief in the slighter kinds of scalds, and is extremely agreeable to the feelings of the patient; but on account of the heat which it is constantly receiving from the burned part, it is an application which requires to be very frequently renewed. The same, or even a greater degree of relief from pain, may be obtained by covering the part which has been scalded

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* "Sed dividi quoque curatio potest in ea quæ mediocriter exedentia reprimentiaque, primo et pustulas prohibeant, et summam pelliculam exasperent: deinde ea quæ lenia ad sanitatem perducant."—Celsus, lib. V. cap. 27.

"Ambusta moderate detergentibus medicamentis opus habent, citra hoc ut manifeste calefaciant aut frigificiant."—Paulus *De re Medica*, lib. IV. cap. XI.

"Quamvis passim infinita ad combustiones apud practicos et plebeios in usu sint remedia, nihilominus tamen omnia ad hanc finem tendunt nimirum ut empyreuma sive calorem, ab igne in parte affecta relictum, aut suffocent, aut resolvant et dissipent. Suffocatio autem empyreumatis fit aut frigidis et humidis, vel aut frigidis et siccis medicamentis. Altera via extinguendi empyreuma in hoc consistit, ut calor extraneus et humores acres resolvantur et dissipentur. Id verò fit calidis medicamentis, ut sequente capite decla abimus. Nunc operæ pretium est inquirere quænam methodus sit eligenda."—G. Fabric. Hildan. *De Combustionibus*, Liber V. cap. 5. *de duplici Methodo Combustionum Curandarum.*

with two or three folds of linen-cloth, and by pouring on these from time to time a quantity of cold water. When the part which has been burned admits of it, it may be immersed in the cold water, and kept in it with safety for many hours. This practice was followed for nearly two days and two nights, in the case of a young lady, whom I attended several years ago, on account of a severe scorch of the arm and fore-arm, which she received in rescuing her mother from the very imminent danger she was in, by her clothes having accidentally caught fire. The pungent pain and sensation of burning returned, during the first part of this period, every time the patient took her arm out of the water. Vesication was prevented; but it was difficult to say whether a slight œdema of the arm, which took place, was the consequence of the burn, or of the long-continued immersion in the cold water. In summer we may cool the temperature of the water, by adding, where it can be procured, a bit of ice, or if this cannot be procured, the water must frequently be brought from the coldest spring in the neighbourhood. Pounded ice enclosed in some folds of cloth, or mixed with some hogs-lard, make very good applications to scalds situated on parts such as the head and back, which do not admit of immersion.* Lion's grease, or simple hog's lard, mixed up with snow, is a remedy of a similar kind which has been mentioned by Pliny. By continuing these applications from ten to twenty hours, very slight degrees of burns are often completely removed, the more severe burns mitigated, and blisters either prevented from being formed, or rendered much smaller in size, than without these applications they would otherwise have become.

Cold, also, is often applied, in conjunction with substances which are supposed to have a specific effect in removing the inflammation produced by burns; in conjunction, for instance, with solutions of sugar of lead, and spirit of wine, of oil of turpentine, of vinegar, &c. These, though valuable remedies in burns, are seldom necessary in superficial scalds; and in the instances in which I have seen them used, they certainly did not give that instant and agreeable relief which the more simple cold applications almost always procured.

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* See an essay by Sir James Earl, on the means of lessening the effects of Fire on the Human Body.

Some caution, however, in the application of cold becomes necessary, when the scald is of a very large size, or situated upon the trunk of the body. In extensive burns, however superficial they may be, the patient is liable to be affected with cold shiverings; and in these shiverings may be greatly aggravated by exposure, and by the application of cold. In instances of this sort, therefore, warm applications ought perhaps to be preferred. Indeed it has often been recommended, to apply heat, instead of cold, in burns. Aristotle appears to be the first who advised this practice to be followed in burns, alleging, that the application of external heat, by extracting that which is left in the body by the burn, prevents the formation of blisters. I do not find that any of the ancients have followed Aristotle in this particular; but the exposure of a part which has not been burnt, to the heat of the fire, or to the action of warm water, has been strongly recommended by many of the older physicians and surgeons.

Fernelius says, that heat is the true antidote for burns; and Ambrose Paré affirms, that "amongst the hot and attractive things which, by rarefying, drawing out, and dissolving, assuage the pain and heat of combustions; the fire challengeth the first place, especially when the burning is but small." Wiseman, in speaking of refrigerants, says, "These must be used warm until the heat and pain cease, or the fire be taken out (as the common expression is), else they will rather cause pain. Hot medicaments assuage the heat and pain by rarefaction, which, in the first place, may be done by holding a burning hot iron or fire to the part; so while the fire calls forth that fire it made, it becomes its *alexiterium.*" "Some hold," Turner remarks, "the burnt parts to the fire, others dip them in hot water, or bathe therewith, affirming the external heat, by a sort of sympathy, draws forth that which was sent in by the fire; according to that common saying, *Omne simile, simili gaudet: vel similem sibi trahit; Ignis ipse est sui ipsius alexiterium.*" "Thus," he adds, "is the phenomenon explained farther, and the practice justified after the same way as is that of plunging the frozen parts into cold water, or rubbing them well with snow, rather than to bring them presently to the fire, or bathe them first of all with hot fomentations." In treating of scalds, Heister says, in one place, that "the common method of applying the burnt part to a candle, or

the fire, and keeping it in that position as long as you can bear it, is frequently attempted with success, where the injury is in one of the fingers, or on the hand. By this means the vesication, and other symptoms which usually succeed, are happily prevented:" And in another, he says, that "the injured part may be fomented with water as hot as the patient can bear it, till the pain and heat entirely disappear." Van Sweiten also affirms, that he had often seen the pain of a burnt part relieved by the application of warm water; and the advantages, he adds, of holding a burn to the fire, usually called *burning* the burn, is proved by daily experience.

Yet notwithstanding the weight of these authorities in favour of the application of heat, in cases of superficial burns, the practice has never come into general use. Indeed, from the pain which is always produced by this method of treating burns, it is not likely that it ever will be generally adopted. The inflammation in superficial burns has, as I have already mentioned, a natural tendency to resolution; and the fact which has been now so fully ascertained, that this resolution takes place under the influence of both hot and cold applications, would almost induce one to believe that nature, in effecting the cure of most cases of superficial burns, stands in need of but little assistance from art; and that whatever degree of credit practitioners may take to themselves for the spontaneous results which occur under different modes of treatment, the cure in reality ought to be ascribed to nature. Many recoveries from scalds have of late years been observed to take place under the application of the metallic tractors; but whether the efficacy of these tractors, in curing burns, might not, like that of the magnets mentioned by Pliny, be increased by roasting and pounding them well, may become, in the unaccountable mutations of public opinion, a matter not undeserving the attention of their ingenious proprietor. The recoveries to which I allude, seem to confirm, in a remarkable degree, the opinion of Heister, "that the first degree of burns is easily remedied."

If the inflammation occasioned by the application of a heated substance to the surface of the body, instead of being resolved, continues, an effusion of serum generally takes place under the cuticle, vesications are formed, and the local affection which is produced seldom heals without pass-

ing into the state of a suppurating sore. This forms the second variety or species of burns, the constitutional and local effects of which vary extremely in their intensity and duration.

When the burn occupies a large surface, the pulse is often quickened from the moment of the injury; more frequently, however, the increased quickness of the pulse does not take place till after a period of several hours. It is then accompanied with a hot dry skin, furred tongue, and the other symptoms of fever. But in burns, as in most other instances of cutaneous inflammation, the pulse, instead of being strong, full and hard, is small, quick and vibratory; so that the constitutional affection seems, in most instances, to partake more of an asthenic than of a sthenic character. It is on this account that blood-letting is so seldom employed in the treatment of burns. It may become necessary, however, in patients of a strong robust constitution, in whom the symptomatic fever assumes an inflammatory type. I have often seen a single bleeding procure great relief in these cases; and I do not remember a case of burns in which bleeding was employed, where it seemed to be followed with injurious effects. In the dry and hot state of the skin, diaphoretics may be used with advantage. Laxatives are often necessary; but it is in general best to employ only the gentler sort, on account of the trouble and pain which moving always gives to the patient. Anodynes are often required, not only to procure sleep, but even a temporary alleviation of the pungency of the pain which the burn occasions. A mild vegetable and farinaceous diet should be used during the period of the symptomatic fever. Animal food, wine, and other cordials, may be required in the progress of a suppurating burn; but they are not necessary at first, and, when given in this stage, are almost always injurious.

The vesications which take place in this species of burn may occur almost from the first moments of the injury, or they may not appear till after a period of some hours. I have seen vesications in burns occur so late as the second or third day. We are directed by some practical authors to open these vesications as soon as they are fairly formed; by others not to open them till after some days, or even to leave them to break of themselves. This diversity of opinion among practitioners is probably to be ascribed to the

different effects which result from the particular manner in which vesications are opened. If a portion of the cuticle be removed, so as to permit the air to come into contact with the inflamed surface of the cutis, pain and a considerable degree of general irritation will necessarily be induced; but if the vesications be opened cautiously with the point of a needle, so as to allow the serum to drain off slowly, without at the same time allowing the air to enter between the cuticle and cutis, the early opening of the vesications will not only not occasion pain, but will give considerable relief, by diminishing the state of tension with which the vesications are almost always, in a greater or less degree, accompanied. When opened in this manner, the vesications often fill again with serum; but the punctures may be repeated as often as is necessary, without any hazard of aggravating the inflammation. Great care should be taken, in every instance, to preserve the raised portion of cuticle as entire as possible, as this membrane is more useful than any other substance which we can employ, in defending the cutis from the action of the air, and in promoting the growth of the new cuticle.

Suppuration is not, in every instance, the necessary consequence of vesication from burns; but it is a very common, and, in many instances, a very troublesome consequence. In severe cases it may take place by the second or third day; often not till a later period. It often occurs without any appearance of ulceration; continues for a longer or shorter time; and is at last stopt by the formation of a new cuticle. In other instances, small ulcerations appear on the surface or edges of the burn. These spreading, form extensive sores, which are in general long in healing, even where the granulations which form upon them have a healthy appearance. In the former of these states, that in which suppuration takes place without ulceration, few local remedies are required; for the suppurating surface, in general, heals readily under the application of mild dressings. These seem to be useful, chiefly by excluding the air, and by keeping the suppurating surface in a soft and easy state. As a general remedy in this species of burns, after refrigerants have ceased to produce beneficial effects, I know of none which deserves a preference to the linimentum ex aqua calcis, so well known in this country by the name of Carron-oil. In cases, however, in which cicatrization is long in being

induced, it may be necessary to substitute, in place of this liniment, ointments containing lead or zinc in their composition. Those which contain lead sometimes give pain; and in most instances where they do so they are improper. The unguentum e lapide calaminare, enumerated by Hippocrates among the remedies for burns, and so strongly recommended by Turner, is one of the most useful applications which has yet been discovered for suppurating burns. Of late years its application has been often advantageously superseded, in the granulating state of burns, by that of adhesive straps.

In the painful or ulcerating state of suppurating burns, the emollient cataplasm is the external remedy from which, in general, you will obtain the most beneficial effects. Often the burn heals completely under its application. In the instances in which the discharge continues, or becomes more profuse, under the application of the poultice, it must be withdrawn, and astringent washes, such as lime-water, compound decoction of oak-bark, a weak solution of the sulphate of copper, &c., with absorbent powders, and the calamine cerate or adhesive straps, employed. If the applications which we employ occasion pain, we have reason to fear that they will produce an irritable or ulcerating state of the parts, states which require the re-application of emollient poultices.

The third and last species of burns, that in which the vitality and organization of a greater or less portion of the cutis are either immediately, or subsequently destroyed, is by far the most important in its consequences. The injury which is done in this species to the cutis may be confined to its exterior layer, or it may penetrate through its whole depth, and affect the subjacent parts. Nothing can be more varied than the appearances which this species of burns at first exhibits. In some instances, a dark-red inflammation of the cutis is at first only perceived; in others this inflammation is accompanied with the formation of vesications; and, in others, with the formation of sloughs. If vesications are formed, the cuticle often gives way, and considerable portions of the cutis are exposed in one or more places; very frequently these different appearances all present themselves in one and the same injury. The colour of the part most severely burned is often of a pale dirty white rather than of a red colour; the pale part is surrounded by others

which have a dark-red or gangrenous appearance; and these again are, in their turn, surrounded by others of a more lively red colour, till the shade of red becomes at last insensibly lost in the surrounding and healthy skin. Here three states are produced, which resemble those of inflammation, gangrene, and sphacelus. The extent of the injury, and the proportion of parts respectively affected with each of these three states, vary in every particular case; and the treatment, we have reason to believe, ought to be modified according to the nature and character of the state which chiefly prevails.

The gangrenous or sloughing burn may be induced in a great variety of ways, as by falling into boiling liquids, by the clothes catching fire, by the explosion of gun-powder, or of inflammable air, and by the contact of actual fire, &c. This enumeration of the causes, by which sloughing burns may be occasioned, is far from being complete; but it comprehends the principal varieties of these burns, as well as those which have been observed to be most frequent in their occurrence. The degree of local and constitutional injury arising from the operation of the causes enumerated, will, in every particular case, be modified necessarily by the temperature of the agent producing the burn; by the length of time which it remained in contact with the surface of the body; and, in an especial manner, by the extent of the surface to which it is applied; afterwards by peculiarities of constitution, and perhaps also by the modes of treatment employed. But it is to the appearances which present themselves, and to the practices which ought to be followed in the early stage of these sloughing burns only, that I wish at present to direct your attention; for when the patient lives, and the sloughs, which may be formed, separate, the burns always pass into the state of ulcers; and in this state must be treated according to the rules which have already been laid down in the account given of ulcers.

In the sphacelated cases of the sloughing burn, the constitutional symptoms are always severe, the extremities become cold, and the patient is usually from the first affected with cold shiverings. These shiverings recur at irregular intervals, and are usually, both in degree and number, proportioned to the extent and severity of the local injury. Indeed a cold shivering fit is a common occurrence in almost all cases of recent and severe injury, from whatever cause it

may proceed, or in whatever part of the body it may be situated. The shiverings which occur in severe burns are greatly aggravated by exposure to the air; and hence the necessity of covering up the body of the patient from the cold, and of giving warm diluents, or even warm cordials. That state of the pulse, which I have already described as occurring in the severer cases of the second species of burns, takes place in the third, but with an increase of its quickness and debility. Often it can scarcely be felt in the extremities. A vomiting comes on, sometimes very soon after the accident, by which the opiates or cordials administered for the relief of the patient are rejected; hiccough supervenes, and the patient dies comatose, not unfrequently before the end of the second day. If he survive this period, he may die from the violence of the symptomatic fever on any of the intervening days to the twelfth. After this period, an abatement of the febrile action usually takes place; and few patients die from the twelfth to the eighteenth or twentieth day. In cases tending to a favourable issue, the constitutional symptoms usually continue mild; but in cases which have a contrary tendency, a recurrence of the febrile symptoms takes place by the eighteenth or twentieth day; and the patient may die of the second febrile attack on any of the days from the eighteenth to the thirty-fifth. If after this death occurs, it is generally produced by a slow exhaustion of the powers of life, by tedious and profuse suppurations, and by the supervention of hectic paroxysms.

In the treatment of the severer cases of sloughing burns, blood-letting is very seldom, if ever required. Wine, or even a stronger cordial, may be necessary from the first; but the quantity of stimulating cordials which we administer should always be regulated by the state of the pulse, by the temperature of the skin, and by the effects which they seem to produce on the intellectual functions. Anodynes are almost always necessary, and they should be given in such quantities, and at such intervals, as the return of pain, or the other exigencies of the case, may require. In allaying pain, and in procuring rest by their means, we must take care that they do not produce the state of coma. A mild vegetable aliment where aliment can be taken without inducing sickness, or exciting vomiting, is proper in the commencement of this as of every other symptomatic fever arising from external injury. From the tendency, however,

to vomiting which occurs, it is particularly necessary to be sparing in the quantity of food and drink which we administer. Whatever has a tendency to excite this by loading the stomach, will, we may be assured, be injurious. Few of those whom I have seen die of burns perished for the want of beef-tea, wine, brandy, or other stimulating cordials. As the febrile symptoms abate, the diet may be rendered more nourishing by an addition of milk or of animal soups. It is only after the second period of symptomatic fever that the use of solid animal food becomes safe or necessary. A diarrhœa not unfrequently takes place from the twelfth to the twentieth day, which has in many cases a favourable tendency. It seems to be an effort of nature to prevent the occurrence of a second symptomatic fever, and on that account should not be rashly nor suddenly checked. We must be careful, during its continuance, not to prescribe any kind of food or drink which can have a tendency to aggravate or support it. The chalk mixture, with opium and catechu, is the remedy which is usually employed to moderate this diarrhœa. It should be used in moderate doses, and chiefly as a palliative, otherwise it may do more harm than good.

Considerable diversities are required in the local treatment of sloughing burns, according to the stage, degree, and extent of the injury which they occasion, the part or parts of the body which they occupy, and according to the effects which the remedies employed may already have produced. Fashion has often a considerable sway in determining the treatment to be employed in the first stage of these injuries; and if we will but listen to the reporters of cures, there is no want of excellent remedies for this species of burns. My own observation leads me to believe, that the remedies which are usually applied for the first twelve or twenty hours after a burn of the third species has been received, have much less influence in preventing fatal effects, and in accelerating or retarding the cure, than has usually been imagined. The severity of the burn, and peculiarities of constitution which manifest themselves only in the progress of the injury, are circumstances, I am convinced, which have much more influence over the immediate and future results in severe cases of burns, than any modes of treatment which you can at first employ. The remedy, however, which has been last and most strongly recommended, is always for the time that, which is said to prove most beneficial; and be-

tween the supporters of the remedy which is coming into fashion, and the defenders of that which is just going out, very hot disputes, and a great deal of useless altercation, generally take place. The fact is, that most of the remedies for the cure of burns, which are at present, or which have been formerly much employed, seem to possess considerable sanative powers: and that their comparative merits in individual cases can often only be ascertained by a fair and impartial trial. Were I to judge from my own experience, and from the effects which I have seen result from these remedies in the hands of others, I should reckon it a matter of very little moment which of those I am going to mention shall be first employed.

Vinegar either alone or diluted with water, has been long used as a remedy for burns. Celsus, Galen, Ætius and Paulus, direct it to be applied in conjunction with chion clay, cimolian chalk, or any light earth; and affirm that it is a remedy which has a powerful effect in preventing the formation of blisters. It is recommended for this purpose by the Arabians, and by all the older physicians and surgeons. Ambrose Paré, in mentioning the remedies to be used to assuage pain, and to hinder the rising of blisters, says, "Clay beaten, and dissolved in strong vinegar, roch alome dissolved in water, with the white of eggs beaten therein, writing-ink mixed with vinegar and a little camphire, unguentum nutritum, and also populeon newly made; these and the like shall be now and then renewed, chiefly at the first, until the heat and pain be gone. But these same remedies must be applied warm; for if they should be laid or put to cold, they would cause pain, and consequently defluxion; besides, also, their strength could not pass or enter into the part, or be brought into action; but so applied they assuage pain, hinder inflammation, and the rising of blisters."

The application of vinegar to recent burns has again of late years been strongly recommended, and was much practised by the late Mr. David Cleghorn, brewer in Edinburgh. You will find an account of his mode of using this substance in the second volume of the Medical Facts and Observations. Though not of the Medical Faculty, Mr. Cleghorn appears, from this account, to have been a man of much practical discernment. The following observation on the effects which result from the continued application of vine-

gar to burns, is, I believe, as original as it is important:—"When I first began this practice, I used to keep the wetted rags on the sores, without any other application, sometimes for two or three days; but experience showed me, that after the pain and heat peculiar to burns and scalds were removed, the vinegar excited smarting in the tender excoriated skin, and was in fact of no farther use: I therefore never employ it longer than twelve hours, excepting on the parts round the edges or outside of the sores, which I foment with it for a minute or two before the dressings, to be afterwards mentioned, as long as they continue in any degree swelled or inflamed."

I have myself applied vinegar, and have oftener seen it applied by others, to all the three species of burns, in their recent state; but I cannot say that I have ever seen more beneficial effects result from its application, than from that of the other remedies which are in daily use. In the first and second species, where the cuticle is unbroken, it seemed to be useful chiefly by allaying the heat and pungency of the pain; effects which are equally soon produced by the application of cold water. In the third, and severer species of burns, where portions of the cuticle had been torn off, the application of the vinegar produced, in different individuals, very different degrees of smarting; in some this was but of short duration, and was followed by an agreeable tingling sensation; while in others the increase of the pain became intolerable, and rendered the removal of the vinegar a measure of necessity. This latter effect of the vinegar does not seem to have escaped the sagacity of Mr. Cleghorn; for, "in severe cases," he says, "or such as are attended with excoriation or loss of substance, when the vinegar is not applied within twenty-four hours of the time the accident happened, it almost always gives considerable pain; but if the patient can endure it, the sores may safely be wetted all over for a quarter or half an hour, or even much longer. The smarting is no doubt a little irksome, but it is worst at first, and at any rate goes off immediately upon discontinuing the vinegar, and leaves the sores in a much cooler or less inflamed state. If the patient, however, cannot, or will not bear the vinegar on the raw and tender parts of the sore, I then cover these parts close with a plaster of the white ointment, and wet all round them with the vinegar, for a quarter or half an hour, or longer. The ointment is then

taken off, and the sores are covered with the powdered chalk, and a poultice laid over all; and they are afterwards to be treated in all respects, till they heal, as the severer sort of sores, to which the vinegar has been early applied, are already directed to be after the pain and heat have left them."

Oily and fatty applications, in the form of liniments and ointments, are recommended by Hippocrates; and have, since his time, been in use to the present day. Many modifications of these have, at different times, been proposed; but those which contain lime, lead, or zinc in their composition have, in general, been preferred. Simple oily and fatty substances have this in common, that they give no pain in their application; they keep the parts to which they are applied in a soft state; and they facilitate greatly the application and removal of any other kinds of dressings. Cloths dipt in linseed or olive oil are a very frequent application among the common people to severe burns in a recent state, and I cannot but regard them as one of the safest remedies which they can employ. They cover and defend the burned parts from the action of the air; they admit of being removed with ease, or, without being removed, they can be easily moistened with fresh quantities of oil. Ætius directs cloths dipt in a liquid cerate, to which some quicklime had been added, to be applied to burns that have passed into a state of vesication; and Paulus repeats this direction. The Arabians, as usual, copy this prescription from the Greeks; and in doing so, direct the quicklime to be repeatedly washed with water. At what time lime-water came to be substituted in the place of the powder of lime itself, I have not been able to discover. Chaumet, in his "Enchiridion Chirurgicum," published in 1560, is the first author I can find who gives directions for the preparation of the linimentum ex aqua calcis, such as we now use. Turner says, that this was his usual remedy for superficial burns. It is known in this country by the name of Carron-oil, because much used in the accidents which occur in the iron-work at the place of that name. This liniment may be used cold or warm, according as the burn is of the second or third species, and applied either by a feather or by cloths which have been dipt in it. The application of these cloths is generally very agreeable to the feelings of the patient. They form a covering which defends the tender and ruffled surface from the action of the air. Dressings with this liniment remain

long soft, if it has been used in sufficient quantity. This liniment may be applied to any part of the body, and to any extent of surface; and in this respect it has a decided advantage over most of the other applications which are used for the cure of burns. It has always appeared to me to answer extremely well in those burns of the face which are produced by the explosion of gunpowder; the least dangerous, in general, I believe, of any of the burns of the third species. When used from the first, it may be continued, in slightly suppurating burns, till cicatrization is induced; and in superficial sloughing burns, which are not accompanied with great pain, it may be mixed with greater or less portions of the spirit of turpentine, and its use continued till the slough or mortified parts have come away, and granulations have appeared upon the surface of the sore. At this period its use may be given up, and dry dressings, with astringent or absorbent substances, employed in its stead.

Spirituous and resinous substances have long been in repute for the cure of burns. The ancients were not acquainted with alcohol or spirit of wine; but they employed wine itself in the preparation of the greater part of the remedies for burns, of which they have left us any account. Sydenham is the first who mentions spirit of wine as a cure for burns; and from the manner in which he speaks of that remedy, it is plain that he must have had considerable experience of its use. "Since," he says, "I have mentioned brandy, I will observe by the way, that it were indeed to be wished, either that it was wholly forbid, or at least used only to recruit the spirits, and not to occasion a stupefaction; or that it was totally prohibited to use it internally, and only allowed to be applied by surgeons in fomentations, to digest ulcers and to heal burns: For in the last case it excels all other applications hitherto known, as it preserves the cutis from putrefaction, and on this account speedily finishes the cure, without waiting for digestion, which runs through its stages very slowly. For this purpose, let a piece of linen dipt in brandy or spirit of wine be immediately applied to the parts scalded with hot water, burnt with gunpowder, or the like, and renew the application between whiles, till the pain ceases, and afterwards apply it only twice a-day." Heister also, in speaking of the treatment of the second species of burns, says, "You will always find it more advisable to apply one of the remedies prescribed above, take

which you please, the nearest at hand, suppose warm water, burnt wine, or spirit of wine, and renew the application of it frequently. By this means you will find the heat and pain quickly go off, and the cuticle will separate from the cutis without leaving any deformity." Yet, notwithstanding the authority of these authors, and the very strong manner in which they recommend spirit of wine, it has never come into very general use in the cure of burns. In the first and second species, where the skin is unbroken, it seems to act at first chiefly by diminishing the temperature. In the cases of the third species of burns, in which I have known it used, it did not seem to produce effects at all different from those of vinegar, or of the next substance which I have to mention to you, spirit or oil of turpentine.

At what time spirit of turpentine first began to be used in burns, does not appear from the records of medicine. Hippocrates strongly recommends, as a remedy for burns, linen-rags to be dipt in a composition of hog's-lard, resin and bitumen, and applied warm to the parts which have been injured. This application seems to differ very little from the warm dressings or terebinthine liniment of the present day. I doubt much whether there be any better application yet discovered for the severer cases of sloughing burns, or indeed for surfaces affected with gangrene and sphacelus, from whatever causes these states may proceed. "Once," says Wiseman, "as I was dressing a gangrened leg with warm spirits of terebinth. &c. Mr. Arris and Mr. Hollyer, chirurgeons, and others, being close about me, and I upon my knees, the candle being too near the hot spirits, caught the flame, and burnt my thumb and fingers before I could get free from those behind me, to throw it into the chimmey, which was some distance off. I felt much more pain for the while in the superficial scalding, than where it was burnt to an eschar." The resins and turpentine are enumerated among the remedies for burns by all the ancient, and by most of the older physicians and surgeons. Paré recommends the use of the thick varnish which polishers or sword-cutlers use; and Dr. Turner says, "that many learned authors recommend the application of spirit of wine, or which is yet better, according to some others, the painter's varnish." In the first species of burns, Heister says, that the oleum terebinthinæ has very good effects, if you apply it in time, and repeat it frequently. The oil of turpentine has

again, of late years, been strongly recommended to the attention of the public by Dr. Kentish, late of Newcastle, in two Essays which he has published on the subject of burns. The kind of burns which Dr. Kentish seems to have had most occasion to treat, were those burns of the third species which happen in coal-mines from the explosion of inflammable air. The injuries produced by this explosion are in general very severe, and often exhibit, from the first, appearances precisely similar to those which occur in gangrene and sphacelus from any other cause. A corresponding treatment accordingly was required, and Dr. Kentish, with great propriety, employed that which has been long in use in the treatment of gangrene. Experience, however, soon taught him that it was advisable to desist from the application of the spirit of turpentine in about twenty-four hours after the accident; because its use, if continued after this period, is, like that of vinegar or spirit of wine, liable to occasion considerable uneasiness and pain, by exciting secondary inflammation. If I am not mistaken in my conjecture, Dr. Kentish was led also, by experience, to alter his practice a little with regard to the internal treatment of burns; though, from the manner in which he expresses himself, I am doubtful whether his theoretical opinions, which I profess not to understand, underwent a corresponding alteration. As I would not willingly do injustice to one who has been so laudably zealous as Dr. Kentish has been, in recommending practices which he regarded as material improvements in surgery, I think it right to quote to you the passage upon which my conjecture is founded. "The circumstance of the accidental diarrhœa has convinced me of a fact which might have remained long in obscurity had it not been for this opportunity. It will be recollected, by those who read my former Essay, that in the case of E. F., in the second mode of treatment, I mention his being a twelvemonth under cure; and I there hazard a conjecture, that it was very materially owing to an ill-conceived prejudice which I had adopted, of *supporting* the system under that diseased action. This case convinces me, that I was right in my opinion of that case being rendered so tedious by my being unacquainted with this law of the system. Chance has here unfolded to me the necessity of restoring the equilibrium of the system, by lessening the action of the arterial system, which prejudice would have prevented my daring to adopt.

To have given a severe cathartic at this period would have appeared like madness in my eyes at one time; but now I look upon it as dictated by experience." The latter part of this paragraph does great credit to Dr. Kentish's candour; but it accords ill with the severe censures of the practice of his predecessors and contemporaries, in which, both in this as well as in his first pamphlet, he has so freely indulged.

The last remedy to be mentioned, though in my opinion not the least important of those which ought to be employed at first in the treatment of severe cases of burns, is the emollient poultice. This, prepared sometimes with water, sometimes with vinegar, is one of the remedies which has been mentioned by every author since the time of Hippocrates. Indeed where a portion of the skin has been injured by a burn, so that it must slough off, it seems to be now generally agreed, that the poultice is the remedy under the application of which the separation of the dead parts is most easily and agreeably accomplished. The question, it seems to me, at present most deserving the attention of medical practitioners, with regard to the use of the warm emollient poultice in burns, is, whether we should apply it immediately after the burn has been received, or interpose for some hours, as has been so strongly recommended, dressings with vinegar, spirits of wine, or oil of turpentine. My own experience has not been sufficient to enable me to determine this point to my entire satisfaction. Yet I think it right to state to you, that in a number of trials made at different times, I have had occasion to see burns, to which common emollient poultices had been from the first applied, slough and granulate faster, and in a more kindly manner, than similar burns in the same persons, to which in some instances the Carron-oil, in other instances vinegar, and in others, again, oil of turpentine, were applied at the same time with the poultices. This is a point, however, which is still open for your investigation. In entering upon it, I have only to caution you against an error that has, more than any other, tended to retard the progress of the healing art, I mean the practice of drawing general conclusions with regard to the efficacy of particular remedies, from the spontaneous or merely accidental results which occur in individual cases. Great objections have been made in the treatment of burns, to the use of poultices, on account of the tendency which they have to induce, and to keep up the

process of suppuration. But the first of these effects is one which is necessary, and therefore certainly one which is very desirable in the cure of every sloughing burn; and it may, I think, be regarded as a period soon enough to abandon the use of poultices, when they seem to begin to produce injurious effects, by rendering the suppuration too copious. But this is an effect which can occur only in the secondary stage of burns; a stage in which their peculiar characters as burns go off, and those of ulcers appear.

The sloughs which occur in burns may be produced from the first, or they may take place at very different periods afterwards, from the parts in which gangrenous inflammation has been excited passing into the state of sphacelus. The period at which these sloughs begin to separate, after they have been formed, varies extremely in different individuals. In general, however, this separation begins sooner, and goes on faster, in young than in old subjects. I have seen marks of separation appear on the second; but more frequently these marks do not appear before the fourth or fifth day. Nothing can be more various, also, than the period required for the complete separation of sloughs. In some instances this is begun and ended in the course of four or five days, in others not till after two or three weeks.

The first visible mark, in the process of sloughing, is the formation of the red line, already so often mentioned as occurring in the separation of dead parts. In this line ulceration takes place; and this process is always accompanied with a greater or less degree of pain in the parts in which it occurs. If irritating or highly stimulating substances be applied to the painful and ulcerating skin, inflammation will be excited, and an unnecessary and injurious extension of the ulceration produced. Hence the necessity which has been discovered, of removing, by the end of the fourth day, the stimulating substances, such as spirit of wine, vinegar, and oil of turpentine, which may have been at first applied, and of employing only the mildest dressings. Of these there is none, the agreeable and soothing effects of which are at all equal to those of the emollient poultice. If the parts surrounding the sloughs should, in the progress of the separation, put on an appearance of gangrene, it may be necessary, along with the poultice, to use the terebinthine liniment with a greater or less proportion of the oil of turpentine, according to the degree of gangrene which exists,

or according to the effects which seem to result from its application. Hemorrhage is an occasional, but not a very frequent occurrence, during the separation of the sloughs which are produced by burns. Care must be taken not to increase this by too liberal an allowance of animal food, wine, or other stimulating cordials.

In concluding this subject, which is worthy of a much fuller and more minute investigation than it has hitherto received, it is unnecessary for me, I trust, to observe, that when surfaces opposite to each other have been burned, they must never be permitted to come into actual contact. In the dressings, a bit of rag must be kept between them; and when burns are situated on the joints, they must be healed up with the limb in the extended position. By not attending to these circumstances, it is no very uncommon thing to see the eye-lids adhering together, the chin fastened down by adhesive inflammation to the chest, the arm to the side, the fingers glued to one another, and the knee-joint and the elbow bent, so as to be very inconvenient, and in some measure even useless. These appearances, however, are not always certain marks of bad surgery; for they sometimes occur in situations in which it is impossible to prevent them; and they often become worse a long time after the burns themselves have been cured. As containing no imperfect summary of the doctrines which I have endeavoured to inculcate, respecting the remedies used for burns, and the proper treatment for these injuries, permit me to quote to you the following paragraphs from Dr. Turner's Treatise upon this subject.

"Yet, after all, how well soever a medicine may be contrived, as I am satisfied are most of these, which I have used with good success, whoever is conversant in these cases will find occasion to vary them, according to the exquisite sense of the parts, the variety of constitutions, and the several occurring accidents: Nay, to use several medicaments more or less humecting, digesting, deterging, incarning or desiccative, to the sundry burnt parts of the same patient; for all which no exact rules can be laid down, however this general one is always to take place, viz.

"That the utmost diligence and prudence be observed to keep the raw parts asunder, enclosing them separately with their outward applications and suitable bandage, taking care also to preserve as much as possible the use and comeliness

of each part: for if the fingers and toes are suffered to touch each other at these times, or the backside of the ear, or the head, there will be a *symphysis* or growing together. Likewise if the fingers are kept always straight, or always clutched, as they say, or the wrist and elbow in the same positions great danger may ensue of difficulty afterwards in their freedom of motion: Wherefore, in the times of dressing let the parts be gently moved so as not to stir up pain, at least as little as 'tis possible; and if some motion must needs be lost, or one posture always continued, use your utmost skill to preserve the most decent position, and the most useful motion."

FROST-BITE.

Of the different vital powers possessed by the human body, there is none more remarkable than that by which it preserves during life, a temperature nearly uniform, amidst all the variations of the medium in which it is placed. In cold climates, where the surrounding air carries off quickly, from the surface of the body, the heat that is generated within, this temperature must be preserved by the use of such substances for clothing as are known to be slow conductors of caloric; for if this precaution be not taken, and the body, or any part of it, exposed to a very cold air, or brought into contact with substances, the temperature of which has been reduced below that of the freezing point of water, a number of morbid appearances will necessarily be induced, varying, indeed, according to the degree of the temperature, the density or rarity of the medium through which the heat is conducted off, and according also to the situation and extent of the parts which are exposed. We are as yet but very imperfectly acquainted with the circumstances which modify the direct action of cold upon the human body, applied to it in different degrees, and under different conditions of health and disease, and which determine it to produce what, from experience, we know it produces, such a variety of dissimilar and apparently opposite effects. It is our ignorance of these circumstances that has given rise to the disputes so much agitated among medical men, concerning the stimulant and sedative effects of cold; disputes in which it seems to have been completely forgotten, that the human body is an organized whole, the combined parts of which exert a perpetual and reciprocal influence upon each other; and that a powerful application of an external agent is never made to one part of this machine, which is confined in its operation to the point of application, or limited in its effects

to the production of simple, unmixed, and independent phenomena.

Instead, therefore, of entering into the discussion of the controversy relating to the stimulant and sedative effects of cold, in which it seems to me doubtful, whether the meaning of the terms used be at all fixed or the points at issue fairly ascertained, I shall proceed to give you a slight account of some of the more obvious and immediate effects which cold produces, when it is applied either to the whole body, or only to particular parts of it.

Several of these effects may be very well observed in the phenomena which occur in cold bathing. Great variations, however, even in these phenomena, will be produced by differences of constitution, by the temperature of the bath, by the degree of heat to which the body had been previously subjected, by the exercise taken in the bath, by the extent of the parts immersed, and by the duration of their immersion. A sensation of cold, disagreeable at first, is excited, which is felt as if creeping along the skin. The skin itself seems to contract, but the small bulbs which surround the roots of the hair, not contracting in the same proportion, that peculiar rough appearance, termed the cutis anserina, is produced. On the first immersion, especially when the water reaches the chest, an uneasy, quick, and somewhat irregular action of the respiratory organs takes place; a state in which the person sobs much, and from which he endeavours to relieve himself by fetching one or more deep sighs. If the bathing be continued, those slight tremulous motions, to which we give the name of shivering, come on, accompanied with convulsive motions of the muscles, particularly of those which move the lower jaw. In very irritable persons, painful cramps or spasms are often felt in the deeper-seated parts of the limbs. The skin of the face, in many individuals, becomes unusually and irregularly red, the lips are of a deep purple, and the red colour of the face acquires gradually a blueish or livid tinge. It has been said that this redness comes also upon the skin of the body immersed in the water. Authors, however, are not agreed with regard to the occurrence and continuance of this red colour. In Dr. Spooner's Thesis, "De Ascite Abdominali," printed at Edinburgh in the year 1785, you will find it mentioned, that Dr. M'Moran, having put a ligature round his arm, went into the cold-bath, in the Royal Infirmary of

this place, with a view to determine whether the diameter of the part would be increased or diminished by cold. The temperature of the bath was at first about 62 degrees of Farenheit, but it was speedily reduced to 54 degrees. After twenty minutes had elapsed, the skin became red, and the ligature round his arm felt tighter than before. This ligature produced a slight furrow in the arm, which was attended with some pain. The temperature, after more than an hour, being gradually raised to 80 degrees, the redness of the skin disappeared, and the ligature became looser even than at its first application. But Dr. Marcard, in his Treatise on the Nature and Use of Baths, says, that the red colour produced by the cold-bath disappears after a short time, and that a paleness succeeds in its place. The fingers and toes become pale, stiff, numb, and incapable of being easily moved; and the pulsations in the radial arteries are rendered so weak as to be difficultly, if at all, perceptible. An inclination to void urine comes on, which generally lasts for some time after coming out of the bath.

Nothing can be more discordant than the reports which have been given by different authors, with regard to the effects of the cold-bath upon the pulse. Some affirm that the cold-bath uniformly diminishes the frequency of the pulse; while other authors, of equal credit, contend, that the constant effect of exposure to great or long-continued cold is, to increase the number of the heart's pulsations. You will find many experiments in support of these opposite opinions detailed in the writings of Doctors Athill, Rush, Marcard, Spooner, Currie, Stock, and others. Are the effects of the cold-bath upon the pulse different in different individuals? Are they varied by the temperature of the body, and by the previous healthy or unhealthy state of the pulse? Are the first effects of immersion different from those which its continuance produces? or have the differences of opinion which exist, relative to the effects of the cold-bath upon the pulse, been occasioned by inattention to the variations produced in it by the exercise taken in the bath, and by the position of the body of the persons on whom the observations were made? In none of the experiments to which I have alluded, does any attention appear to have been given to the effect which the position of the body has upon the pulse. This, however, is too remarkable to be passed over in experiments which have any pretensions to accuracy; for the

pulse, even in health, is from 12 to 20 pulsations in the minute quicker, in the standing or perpendicular position than in the lying or horizontal. The differences, also, in the quickness of the pulse, produced by position, is greater in tall than in short persons; and varies, as I have found by many trials, in the different degrees of inclination from the horizontal to the perpendicular posture of the body. This difference in the frequency of the pulse from position, was first mentioned to me, many years ago, by Dr. Macdonnel of Belfast. I have not met with any reference to it in the course of my reading, and cannot but regard it as singular, that a fact, so very curious and important, should have so long escaped the attention of practitioners, the more so that the difference produced by position in the frequency of the pulse, is greater in many states of disease than in health. The affusion of cold water diminishes very speedily, we know, the quickness of the pulse in the earlier stages of typhus, scarlatina, &c.; but no conclusion can be drawn from this with regard to its effects on the pulse of persons in health, and still less with regard to the effects of the immersion of the body for longer or shorter periods in cold water. The effect of cold-bathing upon the pulse, therefore, still lies open for experiment, and is worthy of a much more minute and accurate investigation, than it has hitherto received.

Cold seems to produce very various effects upon the nervous system. The sensibility to external impression of the parts exposed to cold is always more or less impaired; and this diminution in the sensibility of the nervous system seems to admit of degrees, from the slightest perceptible numbness, to that of the most complete insensibility. This diminution, however, of the sensibility to external impression, is not unfrequently accompanied with severe degrees of pain. A lethargic state occasionally takes place in man, as the consequence of long-continued exposure, without motion, to the action of cold. This state, however, is but of short duration; for, if he be not roused from it speedily, it soon terminates in death. Those who are affected with this drowsiness become insensibly dull and heavy, their eyes close; and they seem to feel a pleasure in indulging in sleep, which takes away from them all fear of annihilation. You will find, in the 27th volume of the Journal de Medicine, for the year 1767, an account given by Dr. Pilhes of a man

who lay buried for four days in a wreath of snow. During all this time he remained in a state of profound sleep, breathing through a small funnel-like opening in the snow which covered him. On the morning of the fifth day, he was awoke from his sleep by a most distressing sensation of thirst. When found at this time by those who had been sent in quest of him, the epidermis was separated from his thighs and from the greater part of the body; but his sensibility was so inconsiderable, that he experienced none of the feelings which his situation seemed to indicate. His limbs, which were at first pale, became afterwards red, purple and black, and soon fell into a state of putrefaction. This, Dr. Pilhes seems to think, was hastened by the warm applications which were at first employed.

Brambilla remarks, that it is no uncommon thing for the young and inexperienced sentinels, both of horse and foot soldiers, who remain without motion in exposed situations, during intense frosts, to fall fast asleep. Some, he adds, have been found dead and stiff, who had not been above an hour upon duty. When so found, he advises that the soldiers should be carried first into a cool place, and, by degrees only, into a warm room; because the sudden application of warmth is liable to produce a painfully pungent sensation of heat all over the surface of the body.* Richter observes, that those persons who are obliged to expose themselves to extreme cold, ought, in order to avoid the impending danger, particularly to shun the immoderate use of spirituous liquors, to keep themselves constantly in motion, never to stand or sit still, or rest themselves in any manner whatever; and as soon as they perceive languor and inclination to sleep come on, they should exert their strength to the utmost, in order to accelerate their motions, and preserve the circulation of blood in the extreme arteries.

You will find the following very interesting account of the tendency which cold has to produce sleep, in the 2d volume of Dr. Hawksworth's Edition of Captain Cook's Voyages round the Globe. At the time when Captain Cook lay off Terra del Fuego, Mr. Banks (now Sir Joseph) and Dr. Solander, with other ten men, went on shore, with a view to penetrate as far as they could into the country, and

* Trattato Chirurgico Practico sopra il Flemmone, &c. Part 2da, pag. 215. In Milano, 1777.

to return that evening. After various hardships, and after having travelled through swamps for a considerable way, the weather, which had been very fine, became gloomy and cold, with sudden blasts of a piercing wind, accompanied by snow. Before they had accomplished their object, the day was so far spent that it was found impossible to get back to the ship before next morning. This being their situation, it was proposed to push through a swamp that lay in their way into the shelter of a wood, and there to build their *wig-wams*, and kindle their fire. It was now eight o'clock in the evening, and Mr. Banks undertook to bring up the rear. Dr. Solander, who had more than once crossed the mountains which divide Sweden from Norway, and who well knew, that extreme cold, especially when joined with fatigue, produces a torpor and sleepiness that are almost irresistible, conjured the company to keep moving, whatever pain it might cost them, and whatever relief they might be promised by an inclination to rest. Whoever sits down, said he, will sleep ; and whoever sleeps, will wake no more. Thus admonished and alarmed, they set forwards; but they had not gone far before the cold became suddenly so intense as to produce the effects that had been most dreaded. Dr. Solander was the first who found the inclination against which he had warned others, irresistible, and insisted upon being suffered to lie down. Mr. Banks entreated and remonstrated with him in vain ; down he lay upon the ground, though it was covered with snow ; and it was with much difficulty that his friend kept him from sleeping. One of the black servants began to linger in the same manner with Dr. Solander. After much persuasion and entreaty, they were dragged on a little way ; but they again both declared they would go no farther. The black servant was then told, that if he did not go on he must be frozen to death ; but to this his answer was, that he desired nothing but to lie down and die. The doctor said he was willing to go on, but that he must first take some sleep ; though he had but a short while before told the company that to sleep was to perish. They were both suffered to sit down; and in a few minutes they fell into a profound sleep. After Dr. Solander had slept about five minutes, Mr. Banks endeavoured to awake him, and happily succeeded ; but it being impossible to make the servant stir, two people were left along with him to bring him forward, as soon as he could be roused. Of the three

that were left in this situation, it is sufficient to say that only one survived, and that he too seems to have been preserved by leaving his charge, coming soon to join the company, and by partaking of the benefit of their warm fire.

My friend, Dr. Kellie of Leith, in the relation of a case of torpor, which you will find in the first volume of Dr. Duncan's Medical and Surgical Journal, has mentioned several circumstances respecting this state, which, so far as I know, had escaped hitherto the attention of former observers. The success with which, in this case, perseverance in the measures employed for recovery was finally rewarded, in holding out to your consideration an instructive example of professional skill, cannot fail to operate as a most powerful incitement to use equal diligence on similar occasions.

"On the evening of the 26th of February, I was requested by Mr. Charles Cheyne, in the absence of my friend Dr. Cheyne, to visit William Dennis, a lad of 16 years, belonging to the Glasgow Packet, who had been found (as was supposed, dead) in a boat at the end of Leith pier.

"He had, along with some companions, left the harbour about one o'clock, with the intention of taking a sail in the roads; and on attempting to regain the harbour, between four or five in the evening, the boat grounded on the flats a little to the east of the pier. His companions got ashore, leaving him in charge of the boat, and promising to return to his relief as soon as they had refreshed themselves.

"Two seamen, who were walking the pier some time after, observed him stretched out in the stern of the boat, as they imagined asleep; but, becoming alarmed, they went to his assistance about half past seven. He was found cold and insensible, and immediately transported to a neighbouring house, were we soon after saw him. When we arrived, he was stretched out, before the fire, on his back, with very little appearance of life; the whole body, with the exception of the face, which was well coloured, was of a deadly pale appearance, and very cold. The powers of sensation, and of muscular motion, were completely suspended. The head and limbs, perfectly flexible, fell lifeless to the ground, from whatever position they were raised to; the mouth was half open, and the jaw, obedient only to the hand, could be moved upwards and downwards, but returned to the half-closed position; the respiration was obscure and insensible; but the pulse was quite distinct even at the

wrist, though irregular and slow. The organs of sense were equally inexcitable; a candle held close to the exposed eyes made no impression, the eye-balls remained fixed and motionless; the pupils, though dilated, contracted irregularly, while yet exposed to the light, in the way I have sometimes observed them to do in the recently dead.

"From every thing I could learn from the attendants, as well as from the natural and inoffensive smell of the patient's mouth, I was satisfied that intoxication was here out of the question. The most careful examination did not discover the smallest appearance of external injury; I concluded, therefore, that the symptoms had arisen from the operation of cold. To this cause he had been many hours exposed; the influence of the diminished temperature of the atmosphere had also been assisted by moisture; it rained; and the subject himself had previously suffered from fatigue and inanition; he had eaten nothing since the morning.

"To excite the organs of respiration to the due performance of their almost suppressed functions, to assist the circulation, and to restore the heat carried off from the surface, were the obvious indications. With these last intentions were employed all the usual means of communicating heat, and diligent frictions, with warm flannels.

"Meanwhile the assistants, little satisfied with the slow effects of these means, were clamorous for the usual practice, on such occasions, of opening a vein, to see if the patient would bleed, which was accordingly practised; about four ounces of blood trickled down the arm. A phial of aqua ammoniæ, which I had ordered, being now brought in, I directed my principal attention to the excitement of the muscles of respiration, and it was with infinite satisfaction I perceived, on the very first trial, that I had these so much under my command. The first applications of the ammonia to the nose occasioned some retraction of the muscles of the face, but did not produce any deeper breathing, or more perfect inspiration. On pouring a little of it, however, on the breast and epigastric region, and rubbing it forcibly in with my hand, I soon had the pleasure of observing the belly to swell up from the violent and prolonged action of the diaphragm; and this succeeded by a proportionally full expiration. This was repeated at short intervals with the same success, the assistants being meanwhile unremittingly employed in chafing the body and limbs with

warm flannels. Shortly the ammoniacal frictions of the epigastric region not only excited the usual full inspirations, but a writhing motion of the neck and shoulders, which could now also be reproduced by the vapour of ammonia applied to the nose. Now, too, the pulse began to rise, to become more regular, and more frequent; and, in about an hour after my first endeavours, the jaw was observed to be more closed, to resist a little the attempts made to open the mouth, and to return when the force was withdrawn. There was reason to expect that he might now be able to swallow; the trial was made, but this power was found as yet too imperfect. At length, however, after several attempts, a few tea-spoonfuls of warm brandy and water were got down; and, by previously irritating the lips and tongue, this was repeatedly, and at short intervals, effected. This gave great satisfaction to the attendants, and encouraged them to persevere in the measures I was enforcing. About two hours from the time I was first called in, the life of my patient seemed secure; the respiration was no longer obscure, the pulse was regular, full, and fluent, beating 100 in the minute; the heat of the face and chest had risen, though the extremities were still very cold. Warm bricks were applied to the feet, the body was covered with blankets, and the frictions of the limbs were continued. It was not till half past eleven, that is, after three hours unremitting labour, that the natural temperature could be said to be generally restored. At midnight, when I left him, it was uniformly diffused over the body; the respiration was easy and natural; the pulse full, and rather bounding; but the *coma* continued as profound as ever. In this state he remained till three in the morning, when he awoke as if from the most natural sleep, spoke to his father, complained only of thirst, drank a bason of tea, and again slept for a few hours.

"I saw him at nine; he had just finished his usual breakfast, which he had taken with his customary appetite; complained of nothing but a little thirst, and the excoriations produced by the ammonia; the tongue was clean; the pulse 90, and soft.

"He remembered that, when left by his companions in the boat, he felt cold, fatigued, and sleepy; but, of all that had afterwards passed, he had not the smallest recollection."

Quelmaltz mentions, in the 7th volume of Haller's *Disputationes Medicæ Selectiores*, that the blood-vessels in the

head of a man, who appears to have died of an affection similar to that which has now been described, were found turgid with blood; and that an effusion of serous lymph had taken place into the cavities of the ventricles.

It is doubtful, however, how far the state of sleep is the necessary consequence of simple exposure to cold, or at least what other circumstances besides cold are necessary for its production, since this exposure may be made to an intense degree of cold, for a considerable length of time, without sleep being induced. Dr. Reeve mentions, in his Essay on Torpidity, the case of Elizabeth Woodcock of Impington, near Cambridge, who, in returning from market on Saturday evening, February 2, 1799, was lost in a storm of snow, which drifted over her about six feet deep; under which she lay buried, without food, until Sunday noon, the 10th of February, when she was found alive and sensible; though she died some weeks after, from mortification of her legs. It did not appear, Dr. Reeve remarks, that she had slept a great deal; because, in all the accounts, it is expressly mentioned that she remained sensible during the whole time. Dr. Currie, also, in the very interesting account which he has given of the shipwreck of an American vessel, on the coast of Ireland, by which the greater part of the crew, in all fourteen, were kept for twenty-three hours under water, the temperature of which did probably not exceed 33 or 34 degrees of Farenheit, states expressly that none of the men were drowsy, and that sleep did not precede death in any of the three who perished.

Sudden death has often been observed to be produced by drinking large draughts of cold water. Indeed this effect of cold upon those who have suffered much from previous heat, thirst, and fatigue, has been long known. Quintus Curtius, in particular, gives a very interesting account of the fatal effects which the army of Alexander the Great experienced on reaching the banks of the river Oxus, after a fatiguing march through the sterile and burning sands of the desert. Those who indulged in drinking freely of the stream, died immediately; and Alexander, the historian remarks, lost more men by this means than he had ever lost in any battle. Numerous well-authenticated instances of sudden death from the same cause are to be found in the records of medicine. Dr. Rush states, that few summers elapse in Philadelphia in which they are not many in-

stances of persons dying suddenly by drinking cold water. These accidents, he observes, seldom happen unless when the mercury is above 85 degrees of Farenheit. The following are the symptoms, according to Dr. Rush, that are usually produced in the cases which have a fatal termination.

"A few minutes after the person has swallowed the water, he is affected with a dimness of sight; he staggers in attempting to walk, and unless supported, falls to the ground; he breathes with difficulty; a rattling noise is heard in his throat; his nostrils and cheeks expand and contract in every act of respiration; his face appears suffused with blood, and of a livid colour; his extremities become cold, and his pulse imperceptible, and unless relief be speedily obtained, the disorder terminates fatally in four or five minutes."

When a small quantity of water only has been drank, the patient more frequently is seized with acute spasms of the breast and stomach. These spasms are so painful as to produce syncope and even asphyxia. In the intervals of the spasms the patient appears to be perfectly well; and these intervals become longer or shorter according as the disease tends to life or to death. Punch, beer, and even toddy, when drank under the same circumstances as cold water, have all been known to produce the same morbid and fatal effects. "I know," says Dr. Rush, "but of one certain remedy for this disease, and that is liquid laudanum. The doses of it, as in other cases of spasm, should be proportioned to the violence of the disease. From a tea-spoonful to near a table-spoonful has been given, in some instances, before relief has been obtained. Where the powers of life appear to have been suddenly suspended, the same remedies should be used, which have been so successfully employed in recovering persons supposed to be dead from drowning." Such of you as are desirous of farther information respecting this subject, will find your curiosity amply gratified by the perusal of the historical details contained in the twelfth Chapter of Dr. Currie's Medical Reports.

One example only of sudden death, from the drinking of cold water, appears to have occurred to Dr. Currie's observation. "It was in the case of a young man who had been engaged a long time in a most severe match at fives. After it was over he sat down on the ground panting for breath, and covered with profuse perspiration. In this state he

called to a servant to bring him a pitcher of cold water, just drawn from a pump in sight. He held it in his hand for some minutes, but put it to his head as soon as he had recovered his breath, and drank a large quantity at once. He laid his hand on his stomach, and bent forwards; his countenance became pale, his breath laborious, and in a few minutes he expired. Various methods were employed to restore him, but in vain."

The only facts with which I am acquainted, that seem to prove the production of immediate death by the inhalation of cold air, are to be found in the first volume of the Memoirs of the Medical Society of Lyons, published there in the year 1798. In the account given of the dreadful havock made by cold, among the French soldiers who were employed in driving the Piedmontese from their entrenchments along some of the passes on the top of that part of the Alps which extends from Mount St. Barnard to Mount Cenis, it is particularly stated, that the effects of cold, when applied to the external parts of the body, were comparatively trifling to those which it produced upon the pulmonary organs. Parat and Martin, who are the authors of this account, observe, that this affection of the lungs is produced by the brisk and freezing impressions of blasts of wind over the whole inner surface of the organs destined to respiration. The mouth and nose are involuntarily contracted, the respiration is suspended, the patient makes an effort to dilate his chest, but the keenness of the air, and a sensation of cold, prevent him: if the storm, instead of ceasing, is redoubled, if the person cannot protect himself by a change of position, or if he cannot weaken the force of the blast by placing his hand before his mouth, in a word, if his respiration remains for any length of time suspended, his head soon becomes giddy, he falls down, or is swept away by the blast, and soon finds a tomb under the snow which the winds rapidly accumulate over him.

This accident, we are told, befalls indiscriminately all constitutions, because it is produced by those great storms, or rather tempests, the terrible effects of which, upon the summits of high mountains, can be well conceived only by those who have had the good fortune to escape from their ravages. These storms, according to the relation of those who inhabit the principal passages of the high Alps, seldom

fail every year to surprise and to carry off some unfortunate travellers.

Maupertuis, in his account of the measurement of the earth at the polar circle, gives a very lively description of some of the effects of cold, which he, and the other French philosophers, engaged in that undertaking, experienced during their winter residence at Tornea, in Sweden. The cold was so intense in the month of January as to freeze the spirit of wine in their thermometers. When they opened the door of a warm room, the external air, in rushing in, immediately converted the vapour of their breaths into whirling clouds of snow. At this time they felt as if their breasts had been rent asunder. They were every moment startled and alarmed by the loud noises, which the bursting and cracking of the wood by the cold occasioned in every part of their houses. They saw, during their residence at Tornea, various persons who had suffered the loss of an arm or a leg by the cold. Indeed, the sudden increase of the cold in that climate often proves fatal to those who are exposed to it.

The more prominent and extreme parts of the body are capable of being cooled for a considerable length of time far below the natural standard of heat, without any morbid alteration of these parts being induced, or any injury of the general system sustained. Most animal substances are known to freeze in a temperature of about 25 degrees of Farenheit; and if any part of a living animal be cooled below this temperature, it may be presumed that the congelation of that part will be induced. The state of congelation may be regarded as the extreme effect of cold upon any part of the body; and wherever it occurs, we have reason to fear that the vitality of the part either has been destroyed, or is in danger of being so. What parts of the human body admit of being frozen without the destruction of life, and how long they remain in this state with impunity, are points which observation does not hitherto appear accurately to have determined: but this we know, that portions of the cheeks, of the ears, and of the nose, have often appeared to be frozen by exposure to cold, and yet that, by a proper management, the vital functions of these parts have afterwards been restored. It seems probable therefore, that a small part of the cutaneous texture may be frozen for a

short period, without the necessary destruction of its vitality; and from the results of the few experiments hitherto made, it would seem that the congelation of the extreme parts of warm-blooded animals, is, upon the whole, less destructive of life, than the congelation of similar parts of cold-blooded animals. Spallanzani found, by many trials, that the irritability of the muscles of several cold-blooded animals, such as the frog, toad, and lizard, was not destroyed by keeping these animals for a considerable length of time in snow; but that if the cold was increased, so as to freeze any part of the animal, the frozen part was uniformly deprived of its vitality, and consequently rendered incapable of having any motions excited in it by the application of stimuli.* The results which I have obtained in freezing the limbs of several frogs, coincide very nearly with the observations of Spallanzani. But by far the most curious and valuable experiments which have hitherto been made on freezing the different parts of living animals, are those which you will find recorded by Mr. Hunter, at p. 80 of his Treatise on Inflammation.

"As all the experiments," says he, "I had made upon the freezing of animals, with a view to see whether it was possible to restore the actions of life, when they were again thawed, were made upon whole animals; and as I never saw life return by thawing, I wished to ascertain how far parts were, in this respect, similar to the whole; especially since it was asserted, and with some authority, that parts of a man may be frozen, and may afterwards recover; for this purpose I made the following experiments upon an animal of the same order with ourselves.

"In January, 1777, I mixed salt and ice, till the cold was about 0; and on the side of the vessel containing them was a hole, through which I introduced the ear of a rabbit. To carry off the heat as fast as possible, the ear was held between two flat pieces of iron, that sunk further into the mixture than the ear; the ear remained in the mixture nearly an hour, in which time the part projecting into the vessel became stiff; when taken out, and cut into, did not bleed; and a part being cut off by a pair of scissors, flew from between the blades like a hard chip. It soon after-

* See his Opuscules de Physique, tom. I. p. 118.

wards thawed, and began to bleed, and became very flaccid, so as to double upon itself, having lost its natural elasticity. When it had been out of the mixture nearly an hour, it became warm, and this warmth increased to a considerable degree; it also began to thicken, in consequence of inflammation; while the other ear continued of its usual temperature. On the day following, the frozen ear was still warm, and it retained its heat, and thickness, for many days after. About a week after this, the mixture in the vessel, being the same as in the former experiment, I introduced both ears of the same rabbit through the hole, and froze them both; the sound one however froze first, probably from its being considerably colder at the beginning, and probably too, from its powers not being so easily excited as those of the other: when withdrawn, they both soon thawed, and became warm; and the fresh ear thickened as the other had done before. These changes in the parts, do not always so quickly take place; for on repeating these experiments on the ear of another rabbit, till it became as hard as a board, it was longer in thawing, than in the former experiment; and much longer before it became warm; in about two hours, however, it became a little warm, and the following day it was very warm, and thickened. In the spring, 1776, I observed, that the cocks I had in the country had their combs smooth with an even edge, and not so broad as formerly, appearing as if nearly one half of them had been cut off. Having inquired into the cause of this, my servant told me, that it had been common in that winter, during the hard frost. He observed, that the combs had become in part dead, and, at last, had dropt off; and, that the comb of one cock, had dropt off entirely; this I did not see, as the cock by accident had burnt himself to death. I naturally imputed this effect to the combs having been frozen in the time of the severe frost, and having, consequently, lost their life by this operation. I endeavoured to try the solidity of this reasoning by experiment. I attempted to freeze the comb of a very large young cock, (being of a considerable breadth) but could only freeze the serrated edges, (which processes were fully half an inch long); for the comb itself being very thick and warm, resisted the cold. The frozen parts became white and hard; and when I cut off a little bit, it did not bleed, neither did the animal show any

signs of pain. I next introduced into the cold mixture, one of the cock's wattles, which was very broad and thin; it froze very readily; and, upon thawing both the frozen parts of the comb and wattle, they became warm, but were of a purple colour, having lost the transparency which remained in the other parts of the comb, and in the other wattle; the wound in the comb now bled freely: both comb and wattle recovered perfectly in about a month: the natural colour returned first next to the sound parts, and increased gradually till the whole had acquired a healthy appearance. Finding that freezing both the solids, and the blood, did not destroy the life in either; nor the future actions depending on organization; and that it also did not prevent the blood from recovering its fluidity, I conceived the life of every part of the body to be similar: what will affect, therefore, the life of any one part, will affect, also, that of another, though probably not in an equal degree; for in these experiments, the blood was under the same circumstances with the solids, and it retained its life; that is to say, when the solids and blood were frozen, and afterwards thawed, they were both capable of carrying on their functions."

The state of the circulation in parts, the temperature of which approaches to that of congelation, has not been ascertained. In some cases, these parts appear to contain more, in others less blood than natural; and it is often not very easy to conjecture how these different states should be induced. We may presume, however, that the velocity of the circulation, in parts reddened by cold, is diminished rather than increased, from the lowness of their temperature, and, from the want of arterial pulsation. In applying ice to the web of the foot of the frog, I have observed the arteries to contract gradually, and the blood to circulate both in them and in the veins more slowly than before the application of the ice. The accumulation of the red globules, and their slower circulation in the veins, give to these vessels an unusually red colour; but I have not seen, unless in very weak frogs, complete capillary stagnation produced in those instances in which ice was placed over, and allowed to melt upon the smaller arteries in the feet of these animals. In subjecting repeatedly the feet of frogs to temperatures below the freezing point of water, the arteries

have always contracted so as to disappear, and the blood, so far as I have hitherto been able to perceive, has been frozen only in the veins.

We are told by Dr. Spooner, in his Inaugural Thesis, that he, together with two other gentlemen, went, in the month of January, to the top of Arthur's Seat, and that having slipt off their clothes, they exposed their naked bodies to a temperature of about 32° of Farenheit. These gentlemen found, that the pulsations of the arterial system became more frequent and more languid in proportion to the length of time they were exposed to the cold, till at last the pulsations in their arms could be no longer perceived. One of them, who had sat down upon the snow, became so weak that he was unable to rise without assistance. During this experiment it was observed, that those parts of their bodies which came into contact with the ice or snow, always became red and swollen; while the pulse in those parts at the same time became very weak. This redness and swelling continued to increase, till it was judged necessary to terminate the experiment by putting on their clothes. That it was continued long enough was but too evident from some of the local effects which were produced. In one gentleman, the glans penis swelled to such a degree, that the fore-skin could with difficulty be drawn over it, nor could he make his water with the same ease as usual; and it is mentioned that in another, similar effects were beginning to be produced.* Whether the swelling, which is mentioned as having occurred in these and other similar instances, under the direct action of cold, depended upon accumulation of blood in the veins, or upon the extravasation of serum into the interstices of the cellular membrane, are points which require to be ascertained.

Between the reduction of temperature in the extreme parts of the human body, which occasions merely sensations

* "En passant les monts environ le Noël, 1537, avec gens de Guerre du Roy François I. plusieurs en nostre troupe endurerent telle froidure qu'à aucuns, non seulement le nez ou les oreilles, mais aussi la verge se tumefia; és uns quelque peu, és autres, si vehementement, que le cuir se dilaceroit par trop grande tension; és autres il s'y fit telle privation d'esprit, qu'il y eut commencement de gangrene: pour la curation desquels je leur faisois fomentation avec vin, &c. Ausquelles choses si l'intemperie estoit trop grande, seroit bon adjouster eau de vie." La Methode Curatoire de la Maladie venerienne, composée par Thierry de Hery, p. 141.—Paris, 1660.

of cold, and that which produces the state of congelation, a great variety of morbid local appearances occur, which may all perhaps be comprehended under the general appellation of *Frost-bite.* It deserves to be particularly remarked, however, that few or none of the appearances to which I allude ever occur under the direct application of cold. They supervene to that state, and are to be regarded as the secondary or indirect effects of a reduction of temperature, or perhaps, more properly speaking, as the consequences of sudden alternations of cold with heat. There is another circumstance also respecting these effects, which seems to me to be particularly deserving of your attention, and it is this, that the phenomena of frost-bite, which occur indirectly from reduction of temperature, bear a very striking resemblance to those of burns, not only in the local appearances which are produced, but also in the nature and character of the constitutional symptoms by which these appearances are accompanied.

In considering, therefore, the local effects which result from the application of cold to the human body, I shall divide the different cases of frost-bite, as I did formerly the different species of burns, 1st. Into those in which inflammation is excited, but an inflammation which, under proper management, has a tendency to terminate in spontaneous resolution ; 2dly. Into those in which the inflammation excited is followed by the state of vesication, suppuration, or even ulceration ; and, 3dly. Into those in which the vitality of greater or less portions of the extreme parts of the body is either immediately destroyed by their congelation, or the same destruction effected afterwards more slowly by gangrene, terminating in sphacelus. The cases belonging to the two first of these divisions, are treated of by practical authors under the name of Pernio, or Chilblains, while the term Frost-bite has in general been applied only to those cases of injury from cold, which are followed by mortification. But as the phenomena peculiar to each of these three divisions may all occur in the same individual injury from cold, I have taken the liberty to include them under one generic appellation. With what propriety this has been done, you will be better able to judge after the particular enumeration of the phenomena produced by cold.

It was observed in the experiments of Dr. Spooner, that those parts of the body which had their temperature re-

duced by bringing them into contact with cold water, with ice, or with snow, became uniformly of a red colour. This is an effect which, during the winter season, is every day seen in this country in the cheeks, noses, and ears, of those who have been long exposed to the action of cold air; and this turgescence in the blood-vessels of parts affected with cold, appears to be in most instances accompanied with a slight increase of volume. After a short time the red colour acquires a violet or a blue tinge. In the intense colds of more northerly climates, the part of the cheek, nose, or ear chiefly acted upon by the cold, becomes of a pale colour; and it is by this that the by-stander often perceives, and informs the person affected with frost-bite of the accident which has befallen him, and that even before he becomes sensible of it from his own feelings. This change of colour is accompanied with a stiffness and numbness of the parts in which it occurs. In some persons, however, it is attended by severe pain, even during exposure to cold. If those, who are affected in the manner described, go imprudently into a warm room, or apply heat, the return of temperature in the frost-bitten parts is followed by a warm tingling sensation, increasing often to an intense, painful, and insupportable glow of heat. M. Pelletan, in freezing mercury, which takes place in a temperature about forty degrees below zero in Farenheit's scale, allowed a bit of it to remain for a short time upon his hand. A burning pain was immediately felt, which he could not endure. The part with which the mercury came into contact, was at first of a pale white colour, but it soon became red, and continued so for several days.

It has often been observed that those who suffer in their hands and feet from cold, seldom experience much uneasiness so long as the cold continues, but the moment that they expose these parts to heat, or that a sudden rise takes place in the temperature of the atmosphere, the parts formerly much cooled, begin to be affected with heat, redness and pain, varying in different degrees from the slightest erythematic inflammation to the most intense gangrene. Parts which have been once affected in this manner by cold, are more liable than similar parts, which have never been so affected, to new attacks of frost-bite, and on that account require in cold situations to be protected from the cold with much caution.

M. Larrey, in the third volume of his Memoirs of

Military Surgery, mentions several facts which confirm the statements I have given you respecting the excitement of inflammation by the sudden change from a cold to a warm temperature. During the three or four days which immediately preceded the battle of Eylau, the weather was remarkably cold, the thermometer having fallen from twenty to thirty degrees below the freezing point of Farenheit, yet none of the French soldiers, who had remained in the snow under an intense frost, experienced any uneasiness in their feet or hands from the exposure. In the night, however, of the 9th of February, a shower of sleet came on, and the thermometer rose suddenly to six, and eight, and even ten degrees above the freezing point. From that moment, many of those who had been exposed to the cold began to complain of acute pains in their feet, of numbness, sense of weight, and prickings in their extremities. In some, the parts affected were at first but little altered in size or colour; in others, a slight redness was perceptible about the base of the toes and on the upper part of the foot; in others again, the toes deprived of motion, sensibility, and heat, soon became of a black colour and hard consistence. M. Larrey justly remarks, that the cold in producing this affection seemed to act merely as a *predisposing* cause. But he is mistaken in asserting, that all writers upon Frost-bite have regarded cold as the immediate cause of that affection, for Richter has long ago asserted that cold alone, even the most intense, never occasions chilblains or frost-bite,* and Parat and Martin particularly remark, that these affections never appeared among the soldiers, who on the high Alps were exposed to the effects of a constant and steadily applied cold. It is not easy to conceive why M. Larrey should have regarded the affection which he describes as a gangrene from congelation, since he particularly informs us that it did not occur till the thermometer rose a considerable number of degrees above the freezing point of water.

Effects similar in kind, though less in degree, to those which have been mentioned as arising from the sudden alternations of the weather in cold climates, may be produced by the same cause even in temperate climates during the colder seasons of the year. The toes and heels, the fingers, lips, cheeks, nose, or ears, may all severally become

* See his Anfangsgrunde der Wundarzneykunst, Band I. S. 222.

affected with an inflammation, which is, from the first, attended with an intolerable degree of itchiness and sense of tingling,—sensations which are greatly aggravated by exposure to external heat. In the progress of this affection, a greater or less degree of swelling comes on, and the redness of the skin gradually acquires a livid or purple colour. The cuticle often exfoliates, and these exfoliations may be repeated several times in the course of the winter or spring. This is the mildest form in which the affection usually denominated *chilblains* appears.

In a great proportion of those who suffer from cold, vesications sooner or later occur. These are often formed in the course of a few hours, and in other instances not till a day or two after the exposure to cold. They may be almost instantaneously produced by the application of even moderate degrees of heat to parts affected with frost-bite. The inflammation, in cases of frost-bite accompanied with vesication, is in general severe, the swelling considerable, and often attended with a sense of tension, and most afflictive degree of pain. It is in this state, that the appearances of frost-bite bear so remarkable a resemblance to those which are produced in burns. This resemblance did not escape the observation of Marcus Aurelius Severinus. "I have often," he says in his Tractatus de Pernionibus, "observed in our hospital, during the year 1624, very large blisters, or phlyctenæ, produced in chilblains, giving to this affection an appearance resembling that produced by the action of fire."

When the serum contained in these vesications is let out by a small opening, a portion of new cuticle is usually formed to supply the place of that which has been separated; but when the inflammation is severe, and the affection neglected or improperly treated, the parts which are the seat of vesication are liable to pass into the state of vitiated ulcers. In this state they yield a thin ichorous or sanious discharge, and are in general brought only after a long time, and with much difficulty to a healthy suppuration. In neglected cases, these ulcers not unfrequently become covered with foul sloughs. Ulceration often supervenes, and the soft parts covering the bones are destroyed. This forms the ulcerated chilblains of practical authors, and is at all times an affection extremely difficult to cure.

In the third species of frost-bite, the vitality of greater or

less portions of the extreme parts is either immediately destroyed by the direct action of cold, or a disposition is given to sphacelus by the excitement of gangrenous inflammation. The destructive action of the cold may have penetrated through the whole depth of the parts exposed to it, or it may have been limited to the external cutaneous texture. Great varieties are produced in individual cases in the constitutional as well as in the local symptoms, by the extent of the parts which are deprived of life, by the more or less acute character of the gangrenous inflammation, which is excited, and by the tendency which this manifests, to terminate in adhesion, or to pass into the state of sphacelus. But it is unnecessary to take up your time in describing the particular appearances which occur in the progress of mortification from cold, as they differ in no respect from those which have already been so fully detailed under the heads of Acute and Chronic Gangrene.

From the very great resemblance which occurs between the phenomena of burns and those of frost-bite, it might a *priori* be supposed, that similar modes of treatment would be found useful and necessary in the corresponding varieties of these affections. This is a point which experience seems to have confirmed. I have already stated that the only material difference of opinion among practical authors, which has ever occurred respecting the general treatment of burns, relates to the management of these injuries during a few of the first hours which elapse after they have been received. Little or no difference of opinion exists, or indeed seems ever to have existed, respecting the treatment of the different kinds of frost-bite in their first stage. For all authors agree that the immediate application of external heat is injurious, and that cold applied by ice, snow, or snow cold water, is the best, if not almost the only local remedy which at the first should be employed. The inhabitants of cold climates have long been aware of the beneficial effects to be obtained from the application of cold in frost-bite; and, accordingly, their uniform practice is to rub frostbitten parts with snow, and to avoid going near to a fire, or warming these parts, till a considerable time after their natural temperature has been restored. Mr. Boyle, in his Experimental History of Cold, informs us that Dr. Fletcher, who had been physician to the Emperor of Russia, told him, "that he had seen several persons that had

been frozen ; and that when a man is told that he is frozen, and having asked whereabouts, (for the party himself usually knows it not,) is informed that it is in this or that place, which is commonly the nose or the upper part of the cheek, or perhaps the tip of the ear, he usually rubs the part very well with snow, and lets it thaw by degrees, else, if without that preparation he should go immediately into the stove, he would be in danger to lose his nose, or other frozen part." The doctor added, "that he once examined a man who in his youth had been frozen all over, and who informed the doctor, that having had occasion in a journey to quit his sled for a while, and to do some exercise that had almost made him sweat, being careless of himself when he returned to the sled again, he was frozen all over, and had so died, had not the company by accident taken notice of him and by rubbing him over with snow, and by the use of like means recovered him again ; but he told the doctor, that by this whole accident he was put to no pain, save that when he came to himself again he felt such a pricking all his body over as men are wont to find in an arm or leg benumbed, by having been long leaned upon."

Besides rubbing frost-bitten parts with snow, it has been recommended to immerse them in ice cold water, and to keep them there till they undergo a complete thaw. Professor Richter, of Gottingen, has given very particular directions with regard to this immersion, which you will find translated from his Elements of Surgery into the article Chilblains in Dr. Rees' Cyclopedia. "The best method," says this author, "of warming a frozen limb gradually is to rub it with snow, till it recovers its powers of sensation and motion, but this must be done with caution, for fear of destroying its continuity, which may easily happen when the part is not supported by a bone, for example, the tip of the nose and ears. Or it may be sufficient to plunge the frozen part into ice cold water ; and in order to keep the water sufficiently cold, lumps of ice should now and then be thrown into it. When the powers of sensation and motion have been completely restored, we may wash the parts with cold brandy, or oil of turpentine, camphorated spirits, hartshorn drops, and such like stimulating fluids; or we may apply electrical sparks, upon which it generally soon recovers its natural warmth. When this has been done it is very ser-

viceable to administer some gentle diaphoretic remedy, such as warm tea or wine-whey; to lay the patient in bed in a chamber without a fire, and to let him remain there for two or three hours, till a gentle perspiration takes place."

"When a frozen limb has been too suddenly warmed and is very much swelled, painful, red, blue, nay, even black, and to all appearance already gangrenous in several places, it may nevertheless sometimes still be completely restored, and all the above mentioned symptoms removed, by plunging it immediately into ice cold water. But it must be suffered to remain in the water, till after all the symptoms have disappeared; upon which we may rub it as above-mentioned with brandy, &c., and gradually warm it. This treatment now and then succeeds in cases where it could scarcely have been hoped for. No benefit, however, can be expected from it, when it has been so long deferred, that mortification has already actually taken place, which must then be treated in the usual manner." This seems all very plausible, and must be very consolatory to those who are in danger of having their limbs frozen by cold; but I do not know of any experiments upon brute animals, nor of any observations or trials made upon the human subject, which would in the slightest degree warrant us to believe, that a man could endure, without the destruction of life such a degree of cold, as would freeze completely any of his extremities. A variety of experiments were made in the year 1785, at the Royal Medical Society of this place, with a view to discover some of the effects, which exposure to intense degrees of cold produces upon warm-blooded animals. In these experiments it was uniformly observed that death took place in the animals subjected to the cold, produced by freezing mixtures, long before the irritability of the heart and other internal parts was destroyed, and at a time when the temperature of the blood, circulating in the heart and larger vessels, was but little, if at all, reduced below 60° of Farenheit. I have not, in the course of my reading, met with a single unequivocal example of the restoration to life of a frozen limb: indeed, such a case would require to be very well authenticated, since it would present to us an observation disagreeing with the results of all the experiments which have hitherto been made upon this subject. But if the restoration to life of a single limb, which has been com-

pletely frozen, be in itself a thing so hopeless as I am disposed to believe, what are we to think of the directions which Richter gravely gives us in the following paragraph?

"The body of a person who has been frozen, must be treated in the same manner as a single member. He must be brought into a cold chamber, laid in snow, or in a vessel filled with ice cold water, with his nose and mouth above the surface: the necessary caution should be also used, lest any frozen part might break; and in this situation he is suffered to remain till he begins to exhibit signs of life. As soon as these are observed, strong stimulants and sternutatories are to be applied to his nose; air must be blown into his mouth; tobacco smoke should be injected into the rectum, the fauces are to be irritated with a feather, a cloth dipt in cold vinegar and camphorated spirits is to be laid over the pit of the stomach, &c. If the jaws are firmly closed, they must be rubbed with the above-mentioned spirituous and stimulating remedies. When the body has thawed, and more signs of life appear, the patient must be taken out of the water, rubbed with water or brandy less cold than the former, and brought gradually into a warmer atmosphere; gentle sudorifics are also to be administered, for example, an infusion of lemon and orange-peel with a little vinegar; and after he has carefully been wiped dry, he must be laid in bed, where he should remain till a gentle perspiration comes on. If after he has been revived, a violent inflammatory fever comes on, it is necessary to draw blood from the arm. When the patient still remains insensible, when his face and the veins of the neck are swelled, so that an apoplexy is to be apprehended, the jugular vein must be opened. If after he has been revived, any part of the body exhibits appearances of being still frozen, continuing rigid, hard, inflexible and without sensation, we must cover or rub such part with snow, or with cloths dipt in cold water, till its powers of sensation and motion are restored; but on no account, use hot applications to it."

That such a paragraph should have been written by Richter, must fill every one with astonishment, who knows with how much good sense, knowledge, and practical skill, he has written upon all other parts of surgery. It is much to be regretted, that the learned translator of the article Chilblains, from which these paragraphs are taken, should, in a work of extensive circulation, have given to the Eng-

lish public, so unfavourable a specimen of Richter's surgery.

It has been long said, that if apples and other fruit which have been frozen, be exposed suddenly to the heat of the fire, they lose their firm consistence, become flaccid, and putrefy speedily; but that if they be allowed to thaw slowly in ice cold water, their texture and other properties are but little altered by the circumstance of their having been frozen. Avicenna alludes to this, and adds, "that some treat frostbitten parts with great advantage, by plunging them into very cold water, in the same manner as is usually done with fruit which has been frozen." It was, I suspect, on the faith of this analogy that Bernhardus ab Hatzfelt ventured to tell Fabricius Hildanus, that he had once on a time, in travelling through a very cold region, found a man by the road-side, frozen stiff and almost dead by the cold, whom he laid upon a waggon, and had conveyed to the next inn, where he had no sooner arrived than the landlord forthwith plunged the frozen man into cold water. Immediately the frost came forth from all parts of his body, which was soon covered with ice, as with a coat of mail. This being removed, the landlord gave the man a large draught of honey and water, by which, after he was laid in bed, a sweat was excited that restored him to himself and to his former good health, with the loss only of his toes and fingers. Fabricius seems to regard this story as a proof of the possibility of restoring to life, a person who had been completely frozen; and, it is probably upon it, rather than upon any other analogous observations on man, or the results of experiments upon brute animals, that the very minute and particular directions for the recovery of persons who have had large portions, or even the whole of their bodies frozen by cold, are founded, and which have been delivered with so imposing an air of sincerity by Richter, and some other authors of less eminence. The phenomenon mentioned in the story told by Fabricius, of the incrustation with ice of the body of the frozen man, during the time that he is said to have remained in the cold water, has often been observed in the thawing of frozen eggs, apples, dead flesh, and other inanimate substances, in ice cold water, as you may see from the results of numerous experiments, contained in the Appendix to Mr. Boyle's Experimental Essay on Cold, as well as in the Essay itself.

But to return from this digression, I have already remarked, that the treatment to be followed in the first stage of the three species of frost-bite which have been described, is the same, or very nearly so. We are to endeavour to bring back gradually the natural temperature of the part by rubbing it with snow, or with some other cold, but very soft substance, such as a bit of fur, for example, and afterwards to endeavour to prevent this temperature from rising above its natural standard, by the application of cold water, or of cold spirits of wine. In rubbing parts which have become stiff with cold, we must be careful not to use too much mechanical force. The part is to be stroked gently, rather than rubbed; nor must we attempt to bend it till every suspicion of its being frozen has been removed. The stiffness of a frostbitten part may be produced by congelation, or it may be owing merely to the fixation by cold, of the oil contained in the cellular membrane. This fixation of oil out of the body takes place at a temperature several degrees above the freezing point of water. But at what temperature it occurs in living animals, has not been ascertained, though it seems probable that it takes place at a temperature above that of the freezing of water, and may therefore be the cause of much of the stiffness which occurs in parts that have been exposed to cold.

The return of the temperature, and of the circulation in frostbitten parts, are accompanied with an increased degree of redness, a tingling sensation, and an intense glow of heat. It is the continuance of these symptoms which constitutes the state of inflammation, and renders the application of cold proper or necessary. In cases where the inflammation seems to possess an acute character, cloths dipt in a cold solution of sugar of lead may be applied, but should the inflammation become chronic, or show any tendency to pass to the state of gangrene, more stimulating applications, such as solutions of the muriate of ammonia, spirit of wine, oil of turpentine, or diluted ammonia, may be required.

Common chilblains begin with a slight degree of swelling, attended with itchiness, and a slight redness of the skin. The swelling is seldom considerable, but the itchiness is often quite insupportable. The redness increases with the progress of the disease, and in long-continued or severe cases, acquires a purple, bluish, or leaden cast. "As it is

easier to prevent the accession of chilblains, than to cure them, our attention," as Mr. Pearson justly remarks, "ought first of all to be directed to the means of prevention. The methods proper to be employed for this purpose, are, 1st. To defend the parts carefully from the action of extreme cold, by warm clothing. 2d. To avoid sudden and great transitions from cold to heat. 3d. To give tone and action to the vessels by exercise, or friction. 4th. To harden the cuticle and promote the circulation of blood in the parts most exposed to the effects of cold, by stimulants, as alcohol, spirit of turpentine, diluted volatile alkali, warm plasters, hot sea-water, &c. The simple pernio will generally disappear as soon as the weather becomes permanently mild: little more is requisite than to rub the part frequently with a warm spirituous embrocation, and to apply a plaster of simple diachylon. Exposure to a very strong heat has been recommended, and will prove successful: but it is too painful a mode to be generally adopted."* Parat and Martin, the authors of the memoir to which I formerly referred, remark, that the fingers of the soldiers, who were provided with gloves, were very seldom frostbitten. They remark also, that the men who are accustomed to the use of spirituous liquors, or who had recourse to their flask of brandy, after half an hour's march, required the dose of spirits to be very frequently repeated, and that these men were sooner affected with lassitude, debility, and frost-bite, than those who resisted fatigue as long as possible, and who took the precaution to eat a crust of bread, or something solid, before drinking their quota of brandy. If the means already suggested, fail in preventing or curing the first species of chilblains, you may have recourse to some one or other of the remedies enumerated in the list which Richter has given for these purposes. In perusing this list, you cannot fail to be convinced, that there is almost no mild unirritating substance, under the application of which, recovery from the first degree of chilblains may not with time take place.

The formation of vesications in frost-bite, as well as in burns, is, it must be remembered, a vital phenomenon. It may take place in the progress of the inflammation, excited during the direct exposure to cold, as has been repeatedly

* See Pearson's Principles of Surgery, p. 168.

observed in those who have been found buried in snow, or in those who in intensely cold weather have taken a great deal of exercise, during exposure to the action of brisk and biting cold winds. More frequently, however, these vesications appear in the progress of the inflammation, which succeeds to long-continued exposure to cold. Their occurrence is always hastened, and the inflammation upon which they depend, greatly aggravated by the action of external heat; and hence the propriety of continuing cold applications to frostbitten parts, so long as their temperature continues above the natural standard, or the inflammation excited seems to retain an acute character. From the tendency which the inflammation excited, has to pass into the state of gangrene, the more stimulating applications, such as spirit of wine, diluted ammonia, or oil of turpentine, may be required. But should these applications prove too stimulating, their strength may be weakened by additions of greater or less portions of the linimentum ex aqua calcis. It is unnecessary for me, I conceive, to insist longer on the treatment of this species of frost-bite, since, in the state of vesication, this treatment differs in no respect from that which has been already described for the second species of burns.* When the vesications pass into the state of sloughing, or vitiated ulcers, they require no treatment that I am acquainted with, different from that which I have already described, as proper for the ulcers designated by these names.

In the treatment of the first stage of the third species of frost-bite, forming, what has usually been termed, mortification from cold, we are directed by those practitioners who have had frequent opportunities of treating this affection, to employ at first frictions with snow, and afterwards the application of ice, cold water, or of cold spirit of wine, with a view to prevent the subsequent excitement of high degrees of inflammation, and to secure as much as is possible against an attack of sphacelus, the parts more immediately surrounding those, the vitality of which may have been destroyed. Most of those instances of mortification from cold, which have fallen within my own observation, had passed through their first stage, before I had an opportunity of seeing them, so that I cannot pretend to judge from

* See Lectures from p. 481 to p. 483.

my own experience of the utility of this practice. If, however, it be, as I am inclined to believe, well founded, it should tend, I conceive, to diminish in a considerable degree the apprehensions of danger which have been entertained, of the application of cold to the severer cases of burns, during a few of the first hours after they have been received. Mortification from cold, after the state of gangrenous inflammation has once been excited, requires precisely the same constitutional and local means of cure which I have already had occasion to enumerate, when treating of gangrene. In their application, however, you will do well to attend to the injurious effects which I have had occasion to remark also, as arising from the too long continued use of stimulating remedies in sloughing burns, affections between which and the severer cases of frost-bite your future opportunities of observation cannot fail to suggest to you many analogies.

THE END.

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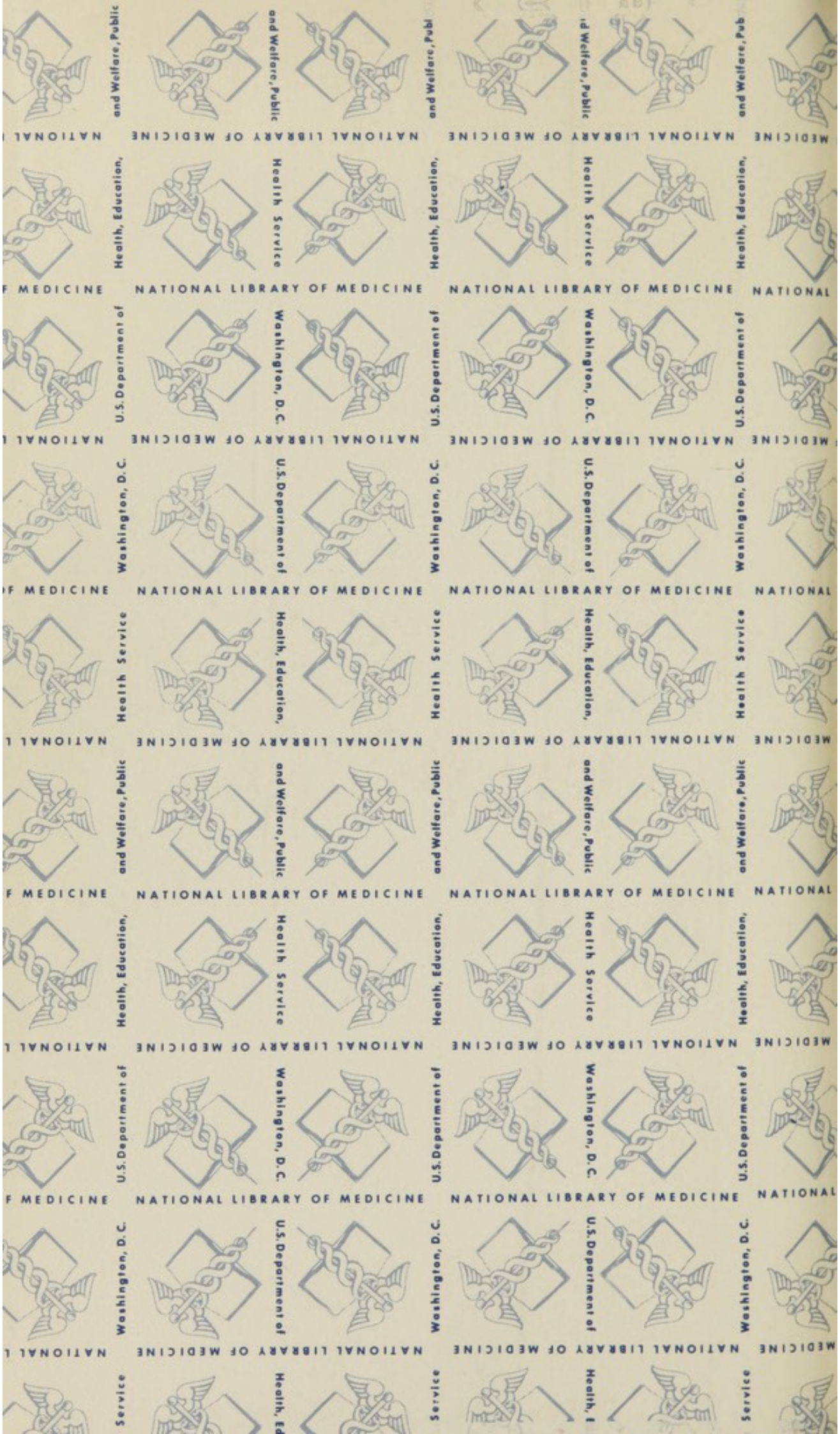
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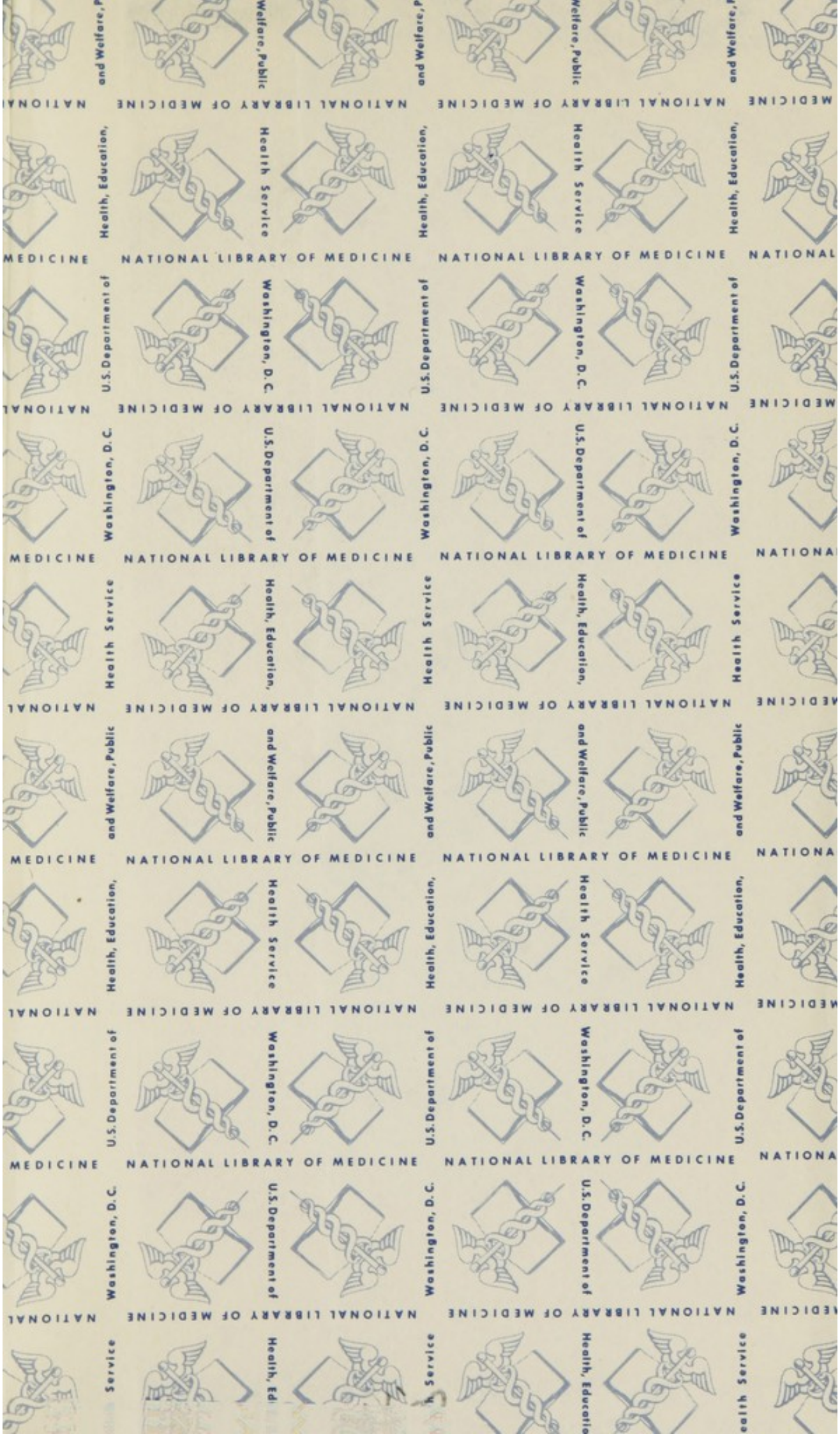
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