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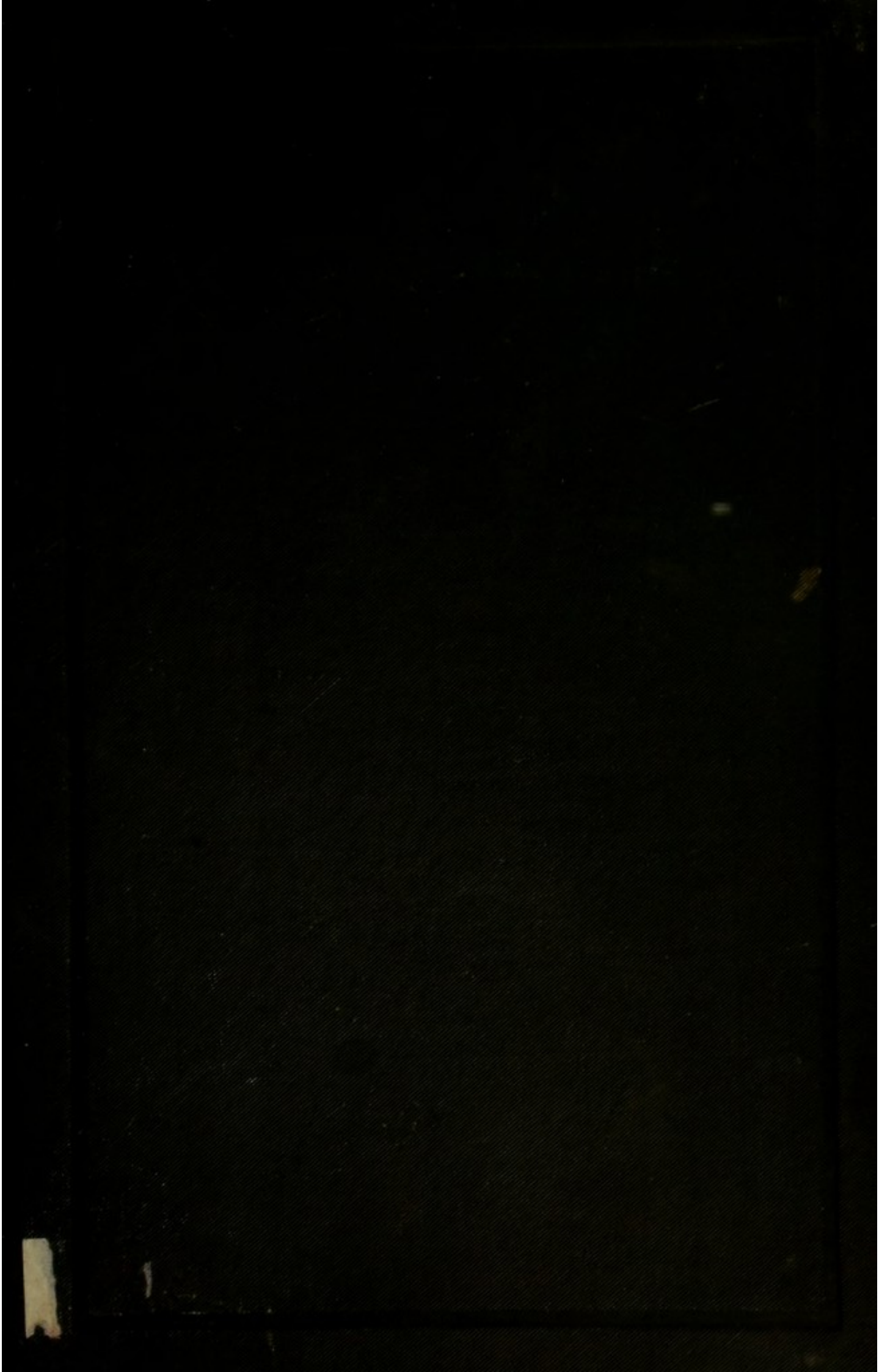

SURGERY

FOR

DENTAL STUDENTS.

BY

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SURGERY SPECIALLY DESIGNED

FOR

DENTAL STUDENTS.

CHAPTER I.

LIFE, HEALTH, ILLNESS, AND THE NATURE OF A CELL.

It being the purpose of this handbook to consider certain states of disease and death affecting living tissues, and the various methods which collected experience has found to be the best for arresting or alleviating the disturbances of life, and averting or postponing the dénouement of death, it will be necessary to commence with a clear understanding of what this "life" is, of which disease is the disturbance, and death the end.

Before it is possible to define and discuss the morbid conditions and abnormalities of a living organism, we

must agree as to what the healthy or natural state of a living organism is.

There have been many definitions of life suggested from time to time, from which we shall borrow those elements most serviceable for our purpose.

A living thing does not differ from a thing just dead in its chemical composition; a man does not weigh less after death. He has not lost any element we can point to; we cannot say he is minus so much carbon or so much sulphur. The simplest elements to which he is reducible might be collected together, in similar proportions, without bearing any trace of this property of "life" which he has possessed. He has not been robbed of anything appreciable, he has only been *disarranged*. His component elements may be brought together, but cannot, so far as we know, be similarly arranged.

Life, then, as far as concerns us, is a special arrangement (of the nature of which we are ignorant) of materials with which we are familiar.

The secret of the arrangement is at present unknown to us; the results are well known enough.

The living thing has functions not possessed by the dead one; it can move, the dead thing can only *be* moved; it can perform, do, and act independently; it can recreate its own species—all this depends upon an arrangement.

The intimate relationship of one part to another is necessary to vitality. The higher we mount in the scale

of life, from an amoeba to man, the more complex the arrangement and the greater the life, but the animal possessed of the power of religion and philosophy is not composed of more gases than the creature that has neither, only they are differently arranged.

Now in man, with whom we have to deal, the arrangement is very complicated and liable to numerous forms of disturbance. He has many systems working together, which, by their healthy unanimity, produce his complete manhood, and which, if disturbed and disarranged, are unequal to the task, and if thoroughly upset fail altogether, and the man ceases to live and becomes resolved into his component parts, which may, no doubt, be subsequently re-arranged so as to form a new man.

While the individual is living he is constantly exhibiting changes, by which energy which is latent is being converted into energy that is active.

These changes are maintained by an elaborate mechanism, a large system of supply and demand. Material is constantly being brought into the body, absorbed and distributed to the tissues, some stored up, some used at once, while the refuse is got rid of by the process of excretion. Part of the food is introduced into the system by the alimentary canal, part through the respiratory apparatus; thence it is passed on to the blood, which is the medium for distributing it to the tissues and removing their refuse, which refuse is again

passed from the blood to the excretory apparatus, the kidneys, the skin, and the lungs, while that portion of the food that is never absorbed at all finds an escape at the anus. The calibre of the blood-vessels and consequently the amount of blood-supply to a part is regulated by the nervous system.

While these functions are being regularly performed the organism is being satisfactorily nourished and enjoys what we call health. If one or all of them are deranged the organism is said to be diseased or ill, and so intimate is the relationship between one function and another that the derangement of one generally affects the rest.

This derangement may be "local," or limited in its effects to one small area, or "constitutional"—that is, affecting the whole system. The disturbance is evidenced to the surgeon by various signs which he calls "symptoms." These symptoms are also divided into "local" and "constitutional." An instance may make this clearer. Suppose, for the sake of illustration, a man has his leg broken, and tranmatic fever ensues, the resulting phenomena may be roughly described thus:—

Symptoms (*only mentioning a few typical ones*).

Local:

1. Loss of power, *i.e.* he cannot himself, by muscular effort, wield the part of the limb beyond the point of fracture.

2. Præternatural mobility, *i.e.* any other person can move the part beyond the point of fracture more than would be possible if the bone was intact.
3. Crepitus—the surgeon can hear and feel a grating between the two broken ends when rubbed together.
4. Deformity—the shape and symmetry of the limb are altered, and most likely it is shorter than the corresponding limb.

Constitutional :

1. Prostration from shocks.
2. Subsequent effects upon the various functions of the system of the condition called tranmatic fever, that is, a general elevation of the temperature of the blood, accompanied by,
   (*a.*) *Disturbance of the digestive tract* as shown by a furred tongue, parched mouth, thirst, loss of appetite, and constipation.
   (*b.*) *Disturbance of the circulation*, as shown by a quickened heart's action and quick hard pulse.
   (*c.*) *Disturbance of the nervous system*, as shown by excitement, irritability, headache, and perhaps delirium.
   (*d.*) *Disturbance of the excretory system*, as shown by a foul breath, hot dry skin, and scanty high-coloured urine.

(*e.*) *Disturbance of the muscular system*, as shown by general lassitude and loss of power.

Treatment.

Local:

1. To get the parts in apposition, *i.e.* set the fracture.
2. To keep them there by splints and bandages.
3. To prevent local complication, suppuration, &c.

Constitutional:

1. To treat the fever symptoms—
   (*a.*) *For digestive tract*, keep the bowels open, give ice to suck and cooling diluent drinks for the thirst, slop food (beef tea, &c.).
   (*b.*) *For the nervous system*, procure sleep and quiet.
   (*c.*) *For the excretory system*, diaphoretics and diuretics (drugs to induce perspiration and a flow of urine).
   (*d.*) *For the muscular system*, rest in bed in a quiet dark room.

The foregoing account is simply intended to illustrate how all the functions share in the derangement caused by the fractured limb, and how a local disturbance may create constitutional disturbances and require constitutional as well as local treatment.

Another point is necessary to the understanding of disease and its treatment, namely, the nature of a cell, and the part that cells play in the living organism

when it is an embryo and when it is a healthy being, and lastly, when it is in a state of disease.

A cell has been defined as "a cell wall and cell contents, among which may be reckoned a nucleus." Against this definition it has been objected that cells often have no walls and no nucleus, and it might be further urged that it gives no clearer idea of what a cell is than if the writer, desirous to define a torpedo, had stated that it consisted of a torpedo wall, or torpedo contents among which was a bullet, but that some torpedoes had no walls, or no bullets inside them. A cell might be defined as a very small collection of protoplasm, the average size is perhaps about $\frac{1}{3000}$ of an inch. Some are smaller, some larger; some have walls and nuclei, and some have neither. What protoplasm is, no one exactly knows; it is living and structureless, and is the simplest material of which living things are made.

Some living bodies consist of one cell, some of many, but all consist of cells in some form or other, though these cells may be changed in shape, pinched, pulled, twisted or flattened, till they are hard to recognise. Thus, for instance, a round cell gives out processes, which join their tips to the tips of other processes from neighbouring cells, forming a net-work, the original cells almost disappear, and connective tissue remains. Again, salts of lime are deposited in certain cells, more at the outside than the middle, and here and there not at all,

and the result is human dentine, with its tubes, fibrils, and matrix, and interglobular spaces. Or a few cells collect together in a band or rod, the outer ones get flat or close together, the middle or axial ones remain free; most of them get dyed with iron, a little serous fluid is secreted round them, and you have a blood-vessel, containing its red and white corpuscles and liquor sanguinis.

As it is true that all the body is formed by the activity of cells, so is it equally true that all repair throughout life is performed by cells too; whether it be the continual invisible repair that is always counterbalancing the continual invisible wearing out of tissue, and which in a certain lapse of time completely replaces the whole man by a new one; or whether it is the more visible repair necessary to heal a wound, or fill up the breaches made in a tissue by disease, it is always active cells that do the work. And lastly, when in obedience to an unknown cause, a new and unusual growth appears in any part of the frame, and, to the danger of life, grows rapidly, as in a cancer, here again it is active cells that do the work. It may be added that the cells employed in the forming process, whether in the making of a complex individual out of the simple elements of a single cell from the female ovary, vivified by a cell from the male testicle, in the womb, or in the healing of a wound, or in the creation and maintenance of a cancer, or lastly, in the normal work of tissue repair, these cells, with their various works to perform, do not differ greatly

in appearance one from another; a germinal cell, a white blood-corpuscle, and a cancer cell are not so very much unlike each other.

At first, the cells of the embryo are all doing the same thing, dividing and multiplying; later on they become less active in this respect, and branch off into different special lines of work, some to make one organ or tissue, some another; a hair, a tooth, a blood-vessel, or a muscle, and in so doing lose their cell-like appearance, and become indistinguishably merged together. They cease to divide, and throw out processes; they are no longer so active, yet these, so to speak, "retired" cells, if called upon (as in healing a wound,) can resume their original function and once more proliferate, throw out processes and form new tissue; never again indeed so well as when they were in the full swing of such work in fœtal life, (the tissue they make is not so good) yet pretty efficiently. This may be seen in the cells of a wounded tissue joining in the tissue formation necessary for healing, and the old odontoblast cells resuming the dentine-forming business when secondary dentine is wanted to protect the pulp cavity against the encroachments of decay, neither tissue is perfect; in the wound a severed muscle is united by fibrous tissue only, a patch-work, and the secondary dentine is very inferior in arrangement to the primary, which those same cells formed first of all; they seem to have forgotten the niceties of the work. Those cells do this second work best that have never layed it

aside. Epithelial cells are constantly reproducing themselves by subdivision. Throughout life, therefore, wounds of the skin are repaired by epithelium as good as ever. Cells are the main agents in the phenomena of inflammation, and before closing this chapter, it will be well to urge the enormous importance of inflammation in disease or injury. Most of the mischief that takes place in the human frame is dependent upon inflammation, and inflammation itself is dependent on the activity of cells; and in non-inflammatory affections, such as tumours, cells are again the active ingredients. Therefore I have devoted a chapter to the attempt to render plain what these all-important elements really are.

CHAPTER II.

DEATH, GANGRENE, ATROPHY, AND DEGENERATION.

DEATH is defined as "the ceasing of the vital functions completely and permanently."

A part that has died can never resume its functions, but must be separated from the living, and will undergo decomposition or resolution into its simplest elements.

When a part has died, the living parts surrounding it will always attempt to get rid of it.

There are three degrees of death:—

1. Death of the whole individual.

2. Death *all at once* of a large part or tract of tissue. —large enough, that is, to retain, when dead, to a certain degree the form and structure it possessed when living. This is called gangrene if the tissue be soft, or necrosis if it be bone.

3. Molecular death; that is the constant death, one

after the other, of microscopically minute particles which are got rid of as fast as they die, and, therefore, there is no dead part bearing traces of its former form and structure. This is called ulceration in the soft parts, or caries in bone.

Gangrene.

When a soft tissue dies in a sufficiently large tract, at once, for the dead mass to retain somewhat the appearances of the same tract when living, the process of dying is called "gangrene" or "mortification," the dead piece is called a "sphacelus" or "slough." When bone dies in this way the process is called necrosis, and the dead piece a "sequestrum" (see *Inflammation of Bone*).

Varieties of Gangrene.

1. *Dry Gangrene.*—If the part does not contain much blood it shrivels and turns black, but does not suffer such extensive changes as in the opposite condition.

2. *Moist Gangrene.*—If the part does contain much blood the process of disorganisation proceeds to complete destruction of the tissues.

Causes

Depend upon interference with the blood stream and, consequently, with the supply of nutrition to the part.

1. *By obstruction of the arteries*, the most common cause, produces dry gangrene. It may be due to,—

(*a.*) Ligature of the principal arteries where collateral circulation is insufficient to replace the blood-supply.

(*b.*) Compression, as by tourniquets or the pressure of tumours.

(*c.*) Division of the arteries.

(*d.*) Disease of the coats of the vessels resulting in aneurism.

(*e.*) Thrombosis, or the formation of a clot in a vessel (usually a vein).

(*f.*) Embolism, or the carrying of a clot along the circulation till it stops in a vessel too small to let it pass (usually an artery).

2. *By obstruction of the capillaries.*—By pressure in stretching (generally less extensive than No. 1).

3. *By obstruction of the veins.*—Usually combined with No. 1 ; by itself not generally complete enough to cause gangrene. Seen in strangulated hernia or tight bandaging. Always moist gangrene.

4. *By inflammation.*—When very excessive inflammation may cause gangrene (always moist), as in diphtheria, carbuncle, and erysipelas.

5. *By weakened heart's action.*—This assists rather than causes gangrene, as in senile gangrene or gangrene consequent on exhausting disease.

6. *Mechanical injuries.*—Such as violence, heat, cold, &c.; usually accompanied by inflammation.

7. *Poisons.*—Such as phosphorus and ergot of rye.

Symptoms.

These are the same in death of the part as they are in death of the whole organism.

1. The nervous influence ceases over the part. It loses the power of motion and sensation. It cannot feel or move.

2. The blood stands still in the dead vessels, and is no longer a source of warmth to the part which consequently becomes cold. The hæmoglobin escapes from the red corpuscles and stains the liquor sanguinis, which in turn escapes from the vessels and stains the surrounding tissues.

3. The dead epidermis prevents evaporation. The surface is therefore dry, and the fluid, unable to escape, collects and renders the part soft and doughy, and forms "bullæ" or blisters, beneath the epidermis.

4. The tissues decompose, or resolve themselves into their simplest elements, viz. the gases CO_2, NO_2, N, and sulphuretted hydrogen, which cause the emphysematous crackling when the part is manipulated.

5. The part finally softens and liquifies and turns green and black.

Necrosis, ulceration, and caries will be considered under the head of inflammation.

Atrophy.

While an organ is healthily performing its function it remains nearly always of the same size and power.

Every day some of it is worn out and got rid of, while new material is brought by the blood to replace the worn-out tissue. If there is not enough new material brought to replace the daily waste the organ will lose in size and power—this is "Atrophy."

If there is more new material brought than is needed to replace the daily waste the organ will increase in size and power—this is "Hypertrophy."

Such conditions always arise in consequence of some change in the work required of the organ, as, for instance, in the atrophy of a woman's breasts when the function of suckling will be no more required of her, and the hypertrophy of the walls of the heart when the exit of the blood is opposed by an obstruction, or when the amount of blood to be expelled is increased by regurgitation.

The minute particles that go to form a tissue (as the fat cells in fatty tissue) may suffer either in *size* or *number*. If in size the atrophy is called "simple," if in number the atrophy is called "numerical" That is, supposing a piece of fat to contain 2,000 large well-filled fat cells, these may become 2,000 small empty cells (simple atrophy), or half of them may disappear altogether, leaving only 1,000 cells in all (numerical

atrophy). Atrophy is usually accompanied by degeneration.

It attacks the tissues in the following order :—

1. Subcutaneous fat.
2. Deep fat (round viscera, &c.).
3. Muscles.
4. Glands.
5. Nerves and bone.

Causes

Of general atrophy of the whole organism are anything which may impede the nourishment thereof.

1. By interfering with the supply, as in starvation or non-absorption of the food.

2. By increasing the demand beyond the power of the supply to meet it; as in excessive and prolonged hæmorrhage, diarrhœa, or suppuration.

3. By inability on the part of the tissues to appropriate the nutriment when sufficient is brought, as in old age.

General atrophy is generally due to a combination of these causes.

Local atrophy may be caused by,—

1. Lessened blood-supply.

2. Diminished functional activity, the commonest of causes for atrophy; the organ having less to do loses its now superfluous power for work. Thus many organs are useless and atrophy after fœtal life. Organs

rendered inactive during adult life atrophy: the tongue in deaf-mutes, the lower jaw in toothless people, the limbs in paralysed people, the breasts in women after the "change of life," &c.

3. Interference with the nervous influence, a cause little understood. If the sensory root of a spinal nerve, or the ophthalmic branch of the fifth cranial nerve be divided, the part not in connection with the ganglion atrophies.

Degeneration

Means a loss of efficiency, or working power, in a tissue, due to a change not in its *quantity* (as in atrophy) but in its *quality*; the tissue becomes not *less*, but *less good*.

As in atrophy, the tissue loses power to perform its functions; but while in atrophy this is because the waste exceeds the supply of nutriment, in degeneration it is because the tissue, not losing in amount, is changed in quality.

This change in quality may take place in two quite different ways: first, by the particles of the tissue changing into inferior material, and secondly, by the introduction of inferior material by the blood to the tissue.

The first of these two ways is called *metamorphosis*, because the thing itself changes. The second is called *infiltration*, because the different material is brought

ready-made as it were, and mixed with the original tissue.

Take a muscle, for instance; it may suffer atrophy, degeneration by metamorphosis, or degeneration by infiltration In all three cases its function of contracting and bringing together two points of bone will be interfered with, but from a different cause in every case.

1st, *in atrophy*, the muscle will become smaller, and, therefore, weaker; more muscle-tissue will be worn out and taken away as refuse by the veins, than will be compensated for by the new material brought by the arteries to form new muscle. Like an army where there are more soldiers killed in the field every day than the daily reinforcements make up, the army gets weaker because smaller.

2nd, *degeneration by metamorphosis*: here the muscle will remain as big, but, under the microscope, each individual cell will be seen to be changing from a muscle-cell to fat, small globules of fat collecting in the muscle-cell at the expense of its albuminoid constituents. Like an army in which the soldiers are not killed, but turn chicken-hearted in themselves, the numerical strength is kept up because the reinforcements exactly balance the loss in the field, but the army is weaker, though not smaller.

3rd, *degeneration by infiltration*: here the muscle loses power, not because it is smaller, nor because its cells are changing in nature, but because the blood is

bringing too much fat, which accumulates, not inside each cell, but between the cells, till the isolated muscular fibres are lost to sight, imbedded in adventitious fat, and loss of power of course ensues. In this case the army is weaker, though the original soldiers remain brave, and the reinforcements still balance the loss in number, but the new men constantly being brought in and interspersed among the old ones are cowards; the daily loss of good men is made up by worthless ones. The army is weaker because the reinforcements are bad.

Degeneration may be what is called mucoid or colloid, but the common form is fatty. The heart is often subject to fatty degeneration, which is sometimes an infiltration, and sometimes a metamorphosis; the latter is, of course, the most serious form, as infiltrated fat can be reabsorbed, leaving the muscular tissue unaltered, but when the muscle itself degenerates, if the fat be absorbed, nothing is left behind.

Lastly, a good instance of fatty infiltration may be found in ordinary adipose tissue, which is simply areolar tissue infiltrated with fat-cells, which fat-cells may be removed by absorption, leaving the connective tissue intact.

CHAPTER III.

HYPERTROPHY, TUMOURS, CYSTS.

Hypertrophy.

Just as in atrophy a tissue may lose in size and power, so it may gain in one or both. Hypertrophy is the opposite of atrophy; it is an increase in the size and power of a tissue because it was not big enough to get through its work. The increase is always in answer to a demand for more tissue, because what there was was not enough. So when muscular tissue is added to a muscle, and gland tissue to a gland, in excess of the normal amount, the muscle or gland is said to be hypertrophied; as in the hypertrophied calf-muscles of the ballet-dancer, the hypertrophied heart-wall where the orifice of the aorta is constricted by disease and it

becomes harder work to force the blood through. The hypertrophied kidney, when one has been rendered useless by disease and the survivor has to do all the excretion by itself.

Hypertrophy is "simple" or "numerical,"—that is fifty ordinary fibres may be increased to fifty large fibres (simple), or one hundred fibres the same size (numerical).

In this way the various tissues and organs accommodate themselves to altered circumstances, nothing being allowed to remain that has ceased to be useful, and an effort being always made to supply any want, and replace any loss—all surgery has to do being to remove obstacles and place the parts under such conditions that the cure may be most easily or quickly performed by nature.

Tumours,

Or new formations, are divided into inflammatory and non-inflammatory growths. The inflammatory will be considered under the head of inflammation; the non-inflammatory now.

The tumours we are going to consider are always attended with an increase of *size*, never with an increase of power.

Where all authorities differ it is necessary to follow some one in the use of various names, seeing that the confusion that at present reigns upon this subject (the nomenclature of morbid growths) is very great.

Many old names have been discarded by some authorities, retained by others, and applied in quite a different sense by others again, leaving not a little bewilderment in the mind of the seeker after knowledge. I shall use the various names of growths in the sense in which they are employed in Dr. Green's *Pathology*.

The increase of tissue in size and power to meet an emergency in the shape of increased work, namely, hypertrophy, has been considered. The consideration of inflammatory increase, caused by irritation and disappearing on the removal of irritation has been postponed (see *Inflammation*).

It remains to consider that form of increase in size which does not depend upon inflammation, nor upon an increase of work, and which, having reached a certain point, does not ever disappear of its own accord, but either remains stationary, or, to quote Dr. Green, "tends continuously to increase, apparently independent of the rest of the organism, with an activity and a life of its own." This is a tumour. Its tendency is continually "to increase and deviate from the normal type," while the tendency of the inflammatory growth is, on the removal of the irritation which caused it, to approach to a healthy condition and disappear.

Tumours have been divided into two large classes, innocent and malignant. To understand the distinction between these two kinds it is necessary to notice how they are developed.

All tumours, like all other parts of living things, are first formed by active cells, which cells are always derived from some pre-existing tissue. Having commenced to grow, then, the tumour has three courses open to it :—

1. First to degenerate and die and perhaps disappear, retrogressive development, the course adopted by inflammatory growths.

2. To develop into a higher tissue, resembling some fully-formed adult tissue, the course of innocent growths.

3. To remain embryonic in nature, the cells neither improving nor degenerating, but simply proliferating, the course of malignant growths.

A malignant growth, therefore, is one consisting of *embryonic cells* that neither tend to degenerate nor to develope, but, remaining embryonic, simply proliferate.*

The characteristic phenomena of malignancy may all be traced to this cause. The phenomena may be roughly summed up as six :—

1. A tendency to recur after removal (*a*) at the same place or (*b*) at some other part of the body.

2. Growth at the periphery and absence of a capsule, and adherence to the surrounding tissues.

3. Rapid growth.

* This definition was suggested by Mr. Savory in a paper upon malignancy.

4. Great vascularity.

5. Peculiar pain.

6. Cachexia, or general appearance of illness on the part of the patient.

To examine these points *seriatim*:—

1. *A tendency to recur*,—

(*a*.) At the same place. This may depend upon incomplete removal, as the irregular trabeculæ or limbs of the tumour spreading far and wide in all directions into the adjacent tissues render it very difficult to remove completely, and any portion left behind, owing to its embryonic, nature will rapidly reproduce itself.

(*b*.) At some other part of the body. The embryonic cells having the power of proliferation when not in connexion with the parent growth, form new centres of mischief when carried by the circulation to distant parts; whereas a fully-formed cell, such as a fat-cell or an epithelial cell, would not have that power, and would under similar circumstances simply perish.

2. *Growth at the periphery, absence of a capsule, and adherence to the surrounding tissues*.—If the cells developed into a higher non-reproductive state, that higher tissue would naturally be found at the periphery where the growth was oldest, forming a fibrous non-

adherent covering or capsule; whereas, when the outside cells continue throughout to reproduce themselves without developing, there is less possibility of a capsule being formed more irregular piercing of, and adherence to, the surrounding tissues. The difference being not unlike that of a hedgehog growing at the points of his quills and an elastic ball growing by distension from the inside.

3 *Rapid growth.*—Embryonic tissue always grows rapidly. The human fœtus presents in nine months an increase in size that would be highly alarming in a tumour.

4. *Great vascularity.*—As blood is necessary to any nutrition, so a great and rapid increase in nutrition requires and receives a great increase of blood-supply.

5. *Pain.*—This symptom is a necessary attendant upon a rapid increase of size, and extensive implication of surrounding tissues.

6. *Cachexia.*—The unhealthy appearance of the patient is very natural under the circumstances. The cachexia always follows and never precedes the more aggravated symptoms of the growth. It consists of prostration, weakness, diarrhœa, and an earthy tint of the skin, and it is hardly to be expected that a patient suffering from a large, painful, rapidly-increasing tumour, endangering his or her life, should be lively, robust, plump-looking, full-blooded, and with regular bowels.

The phenomena of malignancy, then, depend upon

the consistently embryonic nature of the cells forming the growth.

The great point of importance in the diagnosis of tumours is to decide whether a tumour is malignant or not; it does not matter so much whether the surgeon knows exactly to which of the many sub-divisions the growth belongs, or what it would look like under the microscope, but if he cannot decide to which of the main classes it belongs he is likely to fall into errors of practice prejudicial to the patient and himself.

Classification of Tumours.

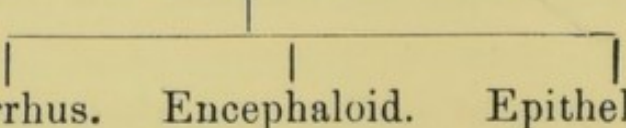
Tumours on the type of Connective Tissue.

1. On the type of embryonic connective tissue—sarcomata.
2. On the type of fibrous connective tissue—fibromata.
3. On the type of fatty (adipose) connective tissue—lipomata.
4. On the type of cartilage connective tissue—enchondromata.
5. On the type of bone connective tissue—osteomata.

Tumours on the type of Epithelial Tissue.

1. On the type of papillæ—papillomata.
2. On the type of embryonic epithelial tissue—

Carcinomata (cancer).



Scirrhus. Encephaloid. Epithelioma.

It will be well to remember that these distinctions suggest a greater clearness and simplicity than really exist. Tumours often present mixed characters, and are at one time innocent and at another malignant, or at the same time innocent in one part and malignant in another, in one part producing fully-formed tissue, in another remaining embryonic. Still the distinctions are necessary to any comprehension of the matter.

Sarcomata

Are tumours consisting of embryonic connective tissue. They include those growths called variously in old times fibro cellular, fibro plastic, recurrent fibroid myeloid, &c.

Embryonic connective tissue differs from adult connective tissue in consisting almost entirely of cells, the intercellular substance being amorphous and not fibrous; as the tissue develops the round cells become spindle-shaped, and eventually fibres. In the tumour this development only happens here and there in the mass of the growth, the greater part remaining embryonic. Such little intercellular substance as there is is not fibrillated but homogeneous. The blood-vessels are numerous, and often themselves embryonic in nature, and therefore easily burst, carrying frequent extravasations. They are intimately connected with the cells.

Development.—Sarcomata always arise from connective tissue, as periosteum, submucous, and sub-

cutaneous connective tissue, connective tissue of organs (liver and lungs, &c.), and medullary tissue of bones.

They undergo fatty degeneration, and tend to produce cysts filled with extravasated blood.

Varieties :—

1. Spindle celled.
2. Round-celled.
3. Myeloid-celled.

1. Spindle-celled sarcomata : The cells are spindle-shaped, on their way, as it were, to fibrillation, half inclined to develope, less malignant than the other forms, more often encapsuled, and more inclined to form fibrous tissue in their substance.

2. Round-celled sarcomata : Cells like white blood-corpuscles, more embryonic and therefore more malignant than the preceding.

3. Mycloid sarcomata : Large, many-nucleated cells, like the embryonic cells in the marrow of bone, always start from bone or periosteum (malignant epulis). They are often encapsuled, and are the least malignant of the sarcomata.

The great characteristic of the sarcomata is their intimate connection with the blood-vessels, and not with the lymphatics (as in cancer) ; therefore, while cancers are always reproduced in the neighbouring lymph-glands, the sarcomata reappear in other parts of the body.

Fibromata consist of connective tissue in a fully-

formed fibrous state; have all the characters of innocence, and always arise from connective tissue.

Lipomata consist of adipose tissue, grow from connective tissue, and are perfectly innocent.

Enchondromata consist of a tissue resembling cartilage; they are usually encapsuled, and grow from bone and connective tissue, *rarely from cartilage*, and are developed just like normal cartilage. They grow slowly, and rarely attain a large size.

About 75 per cent. of these tumours are met with in connection with the osseous system, particularly at the tips of the fingers and toes, the remaining 25 per cent. in the parotid gland and the testicle; they are mostly innocent, but sometimes show a malignant tendency, due, perhaps, to their frequent association with sarcomata. It must be borne in mind that a tumour may remain innocent for years, and suddenly assume malignant characteristics.

Osteomata consist of tissue resembling normal bone. (It is important not to confuse these growths with inflammatory additions to bone, such as "callus" (see *Fracture*).

Osteomata are divided into three varieties:—

1. Eburnated osteomata—compact bone-tissue, lamellated, but without blood-vessels or cancellous tissue.

2. Compact osteomata—like compact bone-tissue, in long bones, only the Haversian systems are less regular.

3. Cancellous osteomata—like cancellous bone surrounded by a thin capsule of hard bone, the medullary tissue containing embryonic tissue and fat.

Osteomata arise from bone, periosteum, cartilage, and even ordinary connective tissue.

When the structure of a tumour is like that of the normal tissue from which it springs, as in a bony tumour springing from bone, it is called homologous; when it is like another tissue, or spreads away into another tissue—as an enchondroma springing from a gland, or a bony tumour springing from connective tissue, it is called heterologous.

Homologous osteomata, or exostoses, are generally found growing from the skull, inside or outside, from the orbit, or jaws; their periosteum is continuous with that of the normal bone, but there is generally a line of demarcation plainly separating the new from the normal tissue.

Osteomata are innocent, but they may be confused with malignant growths that have undergone calcareous degeneration.

Papillomata consist of tissue resembling a papilla, that is, vessels and nerves embedded in connective tissue, and covered with spilhelium. They are innocent and homologous, but may cause death by ulceration and hæmorrhage.

Carcinomata or Cancers consist of cells on the type of embryonic epithelial cells. There is no intercellular

substance, that is, the cells are not separated from each other by anything, unless it be a little fluid, but are collected in groups, which groups are held together by a fibrous stroma. The cells vary in nature, form, and size. The stroma is rich in vessels and lymphatics; the lymphatics dip into the groups of cells, but the other vessels do not, therefore the second appearance of the growth is usually in the nearest lymphatic glands

The carcinomata are highly malignant in every respect.

There are three chief varieties :—

1. Scirrhus.
2. Encephaloid or medullary.
3. Epithelioma.

1. *Scirrhus* contains more stroma and less cell elements than the others. The stroma grows rapidly, and as it grows, contracts upon and strangles the blood-vessels contained in its meshes, arresting the nutrition of the whole growth ; for this reason the whole tumour grows comparatively slowly, and the cells degenerate and die.

Scirrhus is most often found in the female breast and the alimentary canal.

The secondary growths of a tumour are generally more malignant than the primary tumour ; thus, scirrhus is usually reproduced as encephaloid in its second appearance.

2. *Encephaloid* has small amount of stroma and

quantities of cells, which grow rapidly; it is soft and vascular, and the soft tissue not giving much support to the vessels, they often burst and cause hæmorrhages. It is usually a secondary growth.

3. *Epithelioma* consists of squamous cells indistinguishable from normal ones. They do not degenerate like other cancer-cells. The outside cells are flat and hard, the inside ones spheroidal. They are collected in tubular-shaped or round masses, called "epithelial nests." The stroma is very embryonic in nature.

Epitheliomata always begin from epithelium, but after extend in any direction into any tissue, and thus become heterologous. Epithelioma is so often met with in the mouth that it will be well to quote Dr. Green's description of it in full:

"Epithelioma usually presents itself in the first place either as a small foul ulcer, with indurated edges, or as an induration or nodule, which subsequently ulcerates. The surface of the ulcer is frequently papillated, or villous, owing to the irregular growth of the corium. The tumour itself is firm in consistence, often more or less friable, and on section presents a greyish-white granular surface, sometimes intersected with lines of fibrous tissue. The cut surface yields on pressure a small quantity of turbid liquid, and in many cases also a peculiar thick crumbling, curdy, material can be expressed, which often comes out in a worm-like shape, like sebaceous matter from the glands of the skin. This

latter is very characteristic; it is composed of epithelial scales, and on being mixed with water it does not diffuse itself like the juice of other cancers, but separates into minute visible particles, and the material in the cut surface as small scattered opaque dots.'

Epithelioma is most common in the following situations:

Lower lip,
Tongue,
Eye-lids,
Cheeks,
Bladder,
Scrotum (chimney-sweep's cancer),
Labia vulvæ,
Uterus.

It rarely occurs in internal organs.

The carcinomata or cancers clinically present all the characteristics of malignancy, scirrhus and epithelioma being the common form of primary, and encephaloid of the secondary appearance. The indication is to remove the whole of the growth at once—the earlier the better; it is proper to cut wide of the growth through healthy tissue. The removal may be effected by the knife or the electric cautery, and any implicated glands must also be removed. The prognosis is very doubtful at best.

Cysts.

A cyst is a cavity containing fluid not the result of inflammation.

Fluid may collect in a pre-existing cavity, or both cavity and fluid may be new.

Cysts may be due to four causes:

1. The retention of a normal secretion, the ordinary passage by which it escaped being closed—*retention cysts.*

2. The excessive secretion of a normal fluid in a cavity which has no outlet or duct—*exudation cysts.*

3. The extravasation of blood into closed cavities—*extravasation cysts.*

4. The independent formation of a cyst, cavity and fluid being both abnormal.

The structure of cysts.—Cysts have contents and a wall. The wall is either that of the pre-existing cavity, as in cases 1, 2, and 3, or a fibrous sac without any epithelial lining, as in case 4. The contents may consist of almost any fluid present in the body in health or disease.

Secondary changes may be inflammation ending in suppuration or granulation and obliteration of the cyst, ossification or calcification.

Cysts may be single or compound, and compound cysts may become single by destruction of the partition

walls. Cysts often result from cystic degeneration of tumours as in the cystic sarcomata.

Classification of Cysts (from Green's *Pathology*).

I.—*Cysts formed by the Accumulation of Substances within the Cavities of Pre-existing Structures.*

A. Retention cysts.—Cysts resulting from the retention of normal secretion. These include:

(*a.*) *Sebaceous cysts*, formed by retention of secretion in sebaceous glands, viz. comedones or atheromatous tumours.

(*b.*) *Mucous cysts*, formed by retention of secretion in mucous glands.

(*c.*) *Cysts due to retention of secretion in other parts*, viz. ranula (occlusion of the salivary ducts), encysted hydrocele (occlusion of the tubuli testis), mammary cysts (occlusion of the mammary ducts), cysts of the ovary, liver, and kidneys.

B. Exudation cysts.—Excess of fluid in cavities that have no duct, viz. bursae,* ganglia, hydrocele, &c.

* *Bursae*—synovial sacs that obviate the friction of tendons passing over bones: they normally contain a little synovial fluid.

Ganglia—cysts containing gelatinous fluid often found in the wrist after too much piano-playing.

Hydrocele—effusion in the tunica vaginalis of the testicle.

C. EXTRAVASATION CYSTS. — Extravasations into closed cavities, viz. hæmatocele,* &c.

II.—*Cysts of an Independent Origin.*

A. CYSTS FROM SOFTENING OF THE TISSUES, cystic sarcoma, &c.

B. CYSTS FROM EXPANSION OR FUSION OF SPACES IN CONNECTIVE TISSUE.

These include :

(*a.*) *Bursae*, due to irritation.

(*b.*) *Serous cysts* in the neck, congenital.

(*c.*) *Compound ovarian cysts.*

C. CYSTS FORMED AROUND FOREIGN BODIES, EXTRAVASATED BLOOD, AND PARASITES.

D. CONGENITAL CYSTS, as many dermal cysts often remains of blighted ova, contain fatty matters, hair, and teeth, &c.

* *Hæmatocee*—extravasation of blood into the tunica vaginalis of testicle.

CHAPTER IV.

PATHOLOGY OF INFLAMMATION.

Inflammation.

It is as well to state, before entering upon this chapter, that observers are by no means agreed as to the causes of the phenomena of inflammation. It will not be within the scope of this book to detail the many interesting experiments, and the ingenious reasoning founded upon them. For such details the reader is referred to the works of Billroth, Cohnheim, Stricker, and others. It will be enough for our purpose to examine the most prominent phenomena without discussing their causation.

Inflammation is the name given to a series of changes in a tissue which follow an injury; "provided that this

injury be insufficient immediately to destroy its vitality."

The injury may be mechanical, or chemical, external, or internal.

The changes are perceived in three situations :—

1. In the blood-vessels and circulation.
2. In the component parts of the blood.
3. In the tissue surrounding the blood-vessels.

Changes in the Blood-vessels and Circulation.

Probably the whole series of phenomena depend upon changes in the blood-vessels.

First the arteries dilate, then the capillaries, and lastly the veins. The dilatation is the *first* change; there is *no previous contraction.* This continues for about twelve hours; the vessels also become longer, and therefore tortuous. The current of the circulation becomes slower, and at last stops. The stasis (stopping) begins in the veins, and passes to the capillaries. Cohnheim has described three degrees of retardation of the current in three different parts of the inflamed tract.

1. A central area which usually dies—here there is complete stasis (or standing still) of the current, and no emigration of corpuscles (*vide infra*).

2. And area round this where the current is very slow, but does not quite stop; here both red and white corpuscles emigrate.

3. A still more external area, where the current is still less slow, and where only the white corpuscles escape.

Changes in the Component Parts of the Blood.

These chiefly consist in the emigration, or escape of the corpuscles (especially the white ones), and the liquor sanguinis. This phenomenon is probably due to a change in the walls of the vessels, and not to an increase in the activity of the cells.

The white corpuscles accumulate in large numbers along the sides of the walls of the veins, and seem to stick there. They then sink into the walls and pass through them into the surrounding tissue. Red corpuscles (but fewer than white) also pass through the walls, mainly of the capillaries. Liquor sanguinis also passes out with the corpuscles, and forms the inflammatory effusion.

Changes in the Surrounding Tissue.

These consist mainly in an increase in the activity of the cell elements. By an increase of activity is meant an increased tendency on the part of each cell to divide and make two cells: this subdivision is called "fissiparous prolieration," and may go on to any extent. The leucocytes that have escaped from the veins in the two outer areas of inflammation above alluded to, also fissiparously divide. The new cells that are the result of the division of the old ones are less developed than their parents, and degenerate more quickly.

These changes are, like those of atrophy and hyper-

trophy, changes in nutrition, but they are changes in quality rather than quantity.

They vary in degree according to the peculiarities of the tissue inflamed; the more vascular the part, the more readily will the vascular phenomena be brought about. Where there are many cells normally the cell-changes will be more extensive, especially if similar (though less vigorous) cell activity is required in health for the maintenance of the tissue; that is, that cells, whose every-day business it is to divide and form new ones, are more readily induced by an unnatural stimulus, such as inflammation, to divide and form new ones to an excessive degree; thus the changes are greatest in epithelium, not so great in cartilage, and least in nerve cells, where no such activity ever takes place. The more rapid the proliferation, the more abortive the young cells, and the more useless and unlikely to develope, or be absorbed by the resulting tissue. The cells not only divide, they also perform what are called amoeboid movements; this means that they alter th eir shapes by shooting out processes, and even increase in bulk, the cells themselves often become cloudy, so that the nucleus is no longer visible. In those tissues where there is an intercellular substance, this also undergoes changes for the most part by softening. In fibrous connective tissue the fibrous elements soften and disappear, in cartilage the matrix liquifies, in bone the lime salts disappear, the osseous structure becomes medullary tissue. It will

be well to notice briefly the views now entertained with regard to the possible causes of inflammation.

The mechanism by which inflammation was brought about was at one time supposed to be a reflex nervous message; that is, the sensory nerves were supposed to convey a message to the nervous centre reporting, as it were, the irritation. The return message was conveyed by the sympathetic or vasomotor nerves, causing a relaxation of the muscular walls of the vessels. This view was upset by the observation that the phenomena might be induced by irritating the tongue of a frog after everything had been cut but the lingual artery and vein, which showed that the cause could not be reflex, unless both the centripetal and centrifugal nerves were contained in the walls of the vessels.* Neither are the phenomena dependent upon a peculiar state of the *blood*, but upon a peculiar state of the vessel walls themselves, for "stasis may be produced in the web of a frog in which milk or defibrinated blood has been injected in the place of normal blood," "but if the vitality of the vessel walls themselves be destroyed by poisonous injections no stasis can be produced."

The emigration of the white corpuscles is not due to

* Nerve terminations are at present so little understood that it is better to wait for more information upon this subject before making any deductions about nerve influence in inflammation. All we *know* is that nerve influence *can* produce the phenomena. It also seems as if the phenomena could be produced without it, but this is far from certain.

their own activity, nor that of the red ones to increased blood pressure, as used to be thought, but to an alteration in the walls of the vessels.

The structural changes in the inflamed tissue are due to stimulation of its elements by the exuded material, and not to nervous influence.

It is, however, impossible to prove that these changes are not sometimes caused by nervous influence.

Inflammation may of course present any degree of intensity, according as the irritation producing it is severe or slight. It may be acute, subacute, or chronic.

The phenomena may depend upon an external injury, mechanical, or chemical — *traumatic* inflammation. They may depend on the conveying of infective materials by the blood—*infective* inflammation. Again, the resulting inflammation may present special phenomena, such as the rashes of the various fevers, the lesions peculiar to syphilis, &c.—*specific* inflammation.

One of the common results of inflammation is the formation of pus or suppuration. This suppuration varies in extent according to the intensity of the inflammation.

The pus consists of liquor sanguinis containing leucocytes. The origin of those leucocytes is not quite decided; they may come from the escaped blood-corpuscles, or they may come from the cells of the inflamed tissue; they probably came from both sources.

The pus-corpuscles have the power of absorbing and

causing the liquification of the tissues with which they come in contact. The pus may be pure—*pus laudabile* or *healthy pus*; it may be mixed with blood—*sanious pus*; it may be thin, irritating, and corroding—*ichorous pus*; it may contain bacteria—*putrid pus*; it may be flaky or curdy—*strumous pus*.

The pus may collect in a circumscribed area of tissue beneath the surface—*an abscess*; or it may occur on a surface—*an ulcer*.

Pus may after a time undergo fatty degeneration and be absorbed, or it may become caseous or calcified.

Varieties of Inflammation dependent upon its Situation.

Inflammation, though always essentially the same process, is somewhat modified in its phenomena according to the nature of the tissue inflamed.

Inflammation of Common Connective Tissue.

The fibrillar intercellular matrix becomes homogeneous and gelatinous; the emigrant leucocytes and perhaps the cells of the connective tissue itself proliferate. The number of the cells, therefore, increases at the expense of the matrix, which is reduced to a minimum. There are the three areas of retardation of the current above alluded to, and outside the outermost a layer of organised tissue forming the sac of the abscess.

This process may end in one of three ways :—

1. Resolution
2. Organisation.
3. Suppuration.

It depends upon the severity of the inflammation which of these processes takes place; the difference between them is only one of degree.

Resolution.—When the inflammation is slight its results are slight and are quickly absorbed, leaving no trace behind them. The inflammation ceases, that is :—

(*a.*) The vessels resume their calibre and the blood-current its rapidity; the tissue is no longer hyperœmic.

(*b.*) The leucocytes cease to cling to the sides of the veins, and cease to escape with the liquor sanguinis into the surrounding tissues.

(*c.*) Those cells that have escaped either degenerate or are re-absorbed by the veins and capillaries.

Organisation.—When the disturbance is a little greater, the escaped elements instead of being re-absorbed are "organised" or developed into fibrous tissue. The process is as follows :—

There is a budding out of new loops of capillaries surrounded by leucocytes in a slightly higher state of development than the original emigrants. They no longer divide and multiply, but turn into fibres by personal elongation. This tissue, consisting of leucocytes about to become fibrous and permeated by loops of new

capillaries, is called "granulation tissue." The cells diminish in number. A good many of the new capillaries atrophy and disappear, because less blood is necessary to nourish a tissue than to form it. The new fibrous tissue is called cicatricial tissue, and goes on for some time contracting.

Suppuration.—When the injury and the consequent inflammatory process are too severe for organisation of the products, the leucocytes go on for a longer time proliferating by division or fission, instead of steadying down to form granulation tissue. Instead of becoming more highly developed, they become less so and form pus, which may either collect within a tissue and form an abscess, or be continuously discharged from the surface of a wound or an ulcer. After the suppuration has, as it were, worked itself out, there is a second chance of organisation to which the name of healing by "second intention or granulation" is given (as will be explained in the chapter on wounds). It occurs in injured tissues to which the air and the dust containing germs has free access, such as gaping wounds, ulcers, broken or opened abscesses, stumps after amputation (when not treated antiseptically). The granulation tissue is here arranged in little tufts or papillæ to which the name "granulations" is given, and these are coated with a layer of pus. Lister has shown by innumerable experiments, based on the original ones by Pastur, that putrescence or decomposition will not take place unless the dust

containing bacteria be admitted with the air. Thus it has been seen that the escaped leucocytes may be re-absorbed, or may develope into fibrous tissue, or degenerate into pus.

Inflammation of Bone

Is usually attended by an increase of the soft parts or medullary tissue at the expense of the hard or calcified tissue. After the emigration of the leucocytes the cells of the medullary tissue join in the process. The result is many small round cells and a few myeloid cells; all the fat is removed. The lime salts disappear from the calcified portions, which are gradually absorbed by the cells. The canals enlarge and become filled with granulation tissue, and the bone altogether becomes soft, vascular, and porous. The process rarely terminates in resolution; sometimes in organisation when the enlarged Haversian canals are filled up again with dense bone, this is called sclerosis; sometimes suppuration is the result, and the disease is called acute ostitis or osteomyelitis.

Periostitis.—Inflammation of the periosteum presents the usual degrees of intensity and extent, which are inferred by the terms acute, subacute and chronic, local and diffuse.

The periosteum is shown by Billroth to consist of an inner slightly vascular portion covering the whole bone, and an outer very vascular portion covering all the bone

except where muscles and tendons are attached It is this outer layer that is the seat of inflammation. When acute, the pus accumulates between the periosteum and the bone, cutting off the blood-supply, and causing death (necrosis) of the superficial part or of the whole thickness of the bone, according to the extent of the disturbance, and the consequent extent of the interference with the blood-supply.

Necrosis.—Any cause which interferes with the blood-supply to a part may cause its death Thus, if the blood-supply to a limb is obstructed by an elastic bandage gangrene may ensue, and if the blood-supply be cut off from a bone necrosis ensues. This stripping off of the periosteum is performed by the pus in periostitis.

The dead bone is a foreign body, and nature at once tries to get rid of it by surrounding it with a layer of inflammation (granulation tissue coated with pus). If superficial the sequestrum (the dead piece) is easily freed and rejected, but if deep it is apt to become encased in the new bone, through which openings communicate with the surface, and afford an exit for the discharge; these openings are called "sinuses." In such cases the aid of the surgeon is necessary to get rid of it.

Caries is the molecular death of the bone, or death by little atoms instead of the simultaneous death of a large mass (necrosis). It differs from the latter just as

ulceration differs from gangrene in the soft parts. It consists of chronic inflammation of the superficial parts, and is attended with a considerable formation of granulation: these granulations cause the slow disintegration and absorption of the osseous structure forming an osseous ulcer.

Inflammation of Mucous Membranes.

Divided into:—

1. Catarrhal.
2. Croupous or fibrinous.

Catarrhal Inflammation, sometimes called catarrh, is very common. The increased vascularity is attended with an increased secretion of mucus. The mucous corpuscles, epithelial cells, and escaped blood-corpuscles proliferate; the superfluous mucus is therefore richer in cells than normal mucus. The membrane is red and swollen (after death it becomes pale). In more severe cases the secretion becomes puriform, and the loss of epithelium in parts forms ulcers. The lymph glands are increased both in function and size. Acute inflammation may subside or become chronic. In chronic catarrhal inflammations the increase of vascularity is not so great, but the proliferation of cell elements is more continuous. These new cells infiltrate the subepithelial connective tissue, and may become developed into fibrous tissue. The membrane becomes hard and thick and the glands atrophy, or if their ducts are

blocked up or strangled, form cysts (retention cysts). The lymphatic structures enlarge, giving a "nodular or granular appearance" (Green), as in follicular inflammation.

Croupous Inflammations.—A more severe form; inflammatory fluid is effused which tends to coagulate. A "false membrane" is formed, sometimes very tough, forming a cast of the passage where it forms. In diphtheria this false membrane implicates the submucous tissue much more extensively than in croup.

Inflammation of Serous Membranes.—The effused fluid collects in the serous cavity and cannot escape, causing a fluctuating swelling. The surface becomes rough, dull, and very vascular, and covered with a fibrinous layer which coagulates, and, if there is not much fluid to separate them, sticks them together. After the subsidence of the inflammation and the absorption of the fluid, the exuded materials often organise themselves here and there into fibrous adhesions between the two surfaces, as in pleurisy.

Before dismissing this chapter I must remind the reader of a fact, pointed out by Billroth, that explains much of the constant changing of opinion that attends scientific investigation into inflammation:—no one has ever seen the inflammation itself, even with the best microscopes; it is only the *results of its action* that we see. We feel sure that the changes we see are the product of "chemical and physical forces inherent in the

materials of the tissues." From certain experiments we are able to guess at the particular tissue they begin in, simply by exclusion. We find the changes take place without the co-operation of this and that tissue, and so narrow down the possible sources. We find the sensory nerves and the blood may be dispensed with, but any interference with the vessel walls prevents the phenomena ; so far we attribute the source to a change in the vessel walls. But as the results of the process are all we can see, and the process itself is invisible, so all statements respecting it must rest on deduction and conjecture.

CHAPTER V.

UNION OF WOUNDS AND FRACTURES.—TREATMENT OF WOUNDS.

Union of Wounds.

The various classifications of the modes of healing are somewhat confusing, because the same word is not unfrequently used by different authors to mean different things. Perhaps the simplest plan is to divide the process into three heads, indicating three degrees of disturbance :

1. Primary adhesion.
2. First intention.
3. Second intention.

Inflammation has been held to occur wherever a wound heals. Billroth asserts that the process which follows the injury of a tissue cannot be referred other-

wise than to those changes comprised under the head of inflammation. Wherever a microscope has been brought to examine a healing wound dilatation of the blood-vessels, emigration of corpuscles, and increased cell activity have been seen to occur. Again, certain authorities maintain that wounds do unite sometimes without inflammation; and certainly the outward signs, heat, redness, &c., are often absent. Moreover, they maintain that such healing is ideal and perfect, and that inflammation is only accidental and mischievous, and when present prevents and does not assist the healing process. Time will, perhaps, establish this view, or perhaps reconcile both views by throwing more light upon what inflammation really is; at present it is better here to state the more common opinion.

When a simple incised wound of the soft tissues is inflicted, the following phenomena take place:—

1. Blood is shed in more or less quantity, filling the wound; this clot may be microscopic in size, or appreciable to the senses. This blood coagulates, and thus unites the surfaces of the wound with a clot, which clot extends up the cut vessels as far as the nearest branch.

2. Beyond this branch the vessels dilate and the white corpuscles emigrate, in more or less numbers, according to the severity of the wound; the cells of the tissue become active in proliferating.

3. The original clot is either organised or absorbed,

it is not certain which is most frequently the case; perhaps both are equally frequent.

4. The nearest capillaries to the surface send off branches which communicate with those of the opposite side, and the emigrant cells surrounding them become developed into fibrous tissue forming the cicatrix or scar, which, in the case of a slight wound, disappears after a time.

If the wound is so deep as to cause gaping of the surfaces, or in any way to produce a loss of tissue or gap that must be bridged over by new tissue, the healing process is necessarily more elaborate. A great many more cells must be formed, surrounding the loops of new capillaries which jut out in minute tufts into the wound. The superficial cells are often discharged as pus, while the deeper are organised into fibrous tissue. These loops of capillaries, surrounded by active cells, are called "granulations," and this manner of healing is called "healing by granulation," or "suppuration," or "second intention." This granulation tissue advances into the wound, leaving newly formed, and forming, fibrous tissue in its track, and covered in front by a layer of pus (which is, however, not always present, even in the healing or skinning over of large wounds, such as excised breasts, &c. when treated antiseptically, its presence being entirely prejudicial, and an evidence of too much cell activity). After enough fibrous tissue to fill up the gap (never flush with the

edge, always cupped) has been formed, the excessive vascularity subsides, having performed its function. The contraction of the new fibrous tissue strangles many of the vessels, and the scar is in the end less vascular than the surrounding tissue.

Such are the main phenomena. They may be assumed to take place to some degree in the healing of all wounds, but upon the *degree* rests the classification.

1. *Primary adhesion.*—In this form of healing, which may be noticed in a scratch of the finger, and in wounds that have been treated antiseptically, the inflammation, if it occurs, is so slight as to cause no visible sign of its presence. The edges of the wound are neither redder, hotter, nor more swollen than the rest of the surface. Nothing at all can be seen but that the wound unites. The temperature of the patient remains normal. This is, of course, the most satisfactory course a wound can possibly run.

2. *First intention.*—After twenty-four to forty-eight hours the borders of the wound are red and swollen, and somewhat painful and hotter. The inflammation is obvious to the senses. No more than this happens. The disturbance is strictly confined to the borders of the wound. The temperature may rise a little. From the third to the fifth day, redness, swelling, pain, and increase of temperature disappear. In from six to eight days the surfaces

are enough united to hold together without artificial support, and the cicatrix looks like a fine red streak.

3. *Second intention.*—Here we can see the *surface* as well as the borders of the wound. In from twenty-four to forty-eight hours the borders may be slightly inflamed, or may exhibit no change (just as in first intention). During *the first twenty-four hours* very little change can be seen in the surface. The different tissues are recognisable, but the surface looks somewhat gelatinous and grey, because it is thinly covered with fibrinous material. Here and there are little yellow-and-red particles (bits of dead tissue) sticking to the fibrine.

On *the second day* thin reddish-yellow fluid is seen on the surface; the tissues are indistinct, greyer, and more gelatinous.

On *the third day*, secretion pure yellow and thicker; the dead particles pass off with the fibrine in the secretion, the surface becomes even and uniformly red, technically *it becomes clean.*

The secretion, at first bloody and therefore reddish, becomes gelatinous and grey, and finally yellow.

With a lens on the third day, numerous red papillæ, rather smaller than a millet seed, may be seen dotted over the surface, the granulations; these afterwards coalesce into a granular bright red surface. The thick, pure yellow, creamy fluid is pus.

Of course this process may be slower under disadvantageous circumstances.

As the secretion of pus goes on, the granulations rise up to, and sometimes higher than, the level of the skin; if too exuberant they must be artificially restrained, especially at the edges where the cicatrization is to commence.

Cicatrization.—The surface begins to contract at the edges, pus ceases to form, a narrow dry red zone appears and advances towards the centre of the wound covering the granulations, followed by a pale bluish white zone, which passes into normal epidermis. This advance continues till the whole surface is covered with this new epidermis. The new scar becomes presently paler than the rest of the skin.

It remains to state that these two forms of union may take place in the same wound, thus a deep wound may heal by first intention at the surface, while it may go on to suppuration at the bottom. If this takes place, the results are more serious than if the whole wound had healed up from the bottom by granulation. Such wounds frequently result in what is called "septic poisoning or pyœmia," because the decomposed materials are pent up by the closure of the wound. The causes of the disturbance are that blood which is putrescible collects, as in a bag, in the depths of the wound, air has been admitted through the external wound, and with the air dust, containing minute living organisms called bacteria.

Without these organisms, putrescence cannot occur Air not containing them, such, for instance, as air filtered through carbolic gauze, or through the minute bronchial tubes (where the ciliæ stop the dust), is incapable of causing putrescense. If, therefore, a deep wound be made under strictly antiseptic conditions, that is, under a carefully applied spray, if no precaution be omitted to avoid the admittance of this septic dust, no such putrescence can occur.

Union of Fractures.

We have discussed the healing of wounds, or solutions of continuity, of the soft parts. It remains to show how wounds of bone, or fractures, unite. The process is *essentially the same*; a peculiar state of the blood-vessel walls permits the migration of leucocytes, all the cell structures in the neighbourhood of the wound actively proliferate, and form new tissue, which restores the severed continuity. This difference there is, however, that bony fragments must be united by bone, the cicatrix in bone consists of bone. First, we shall examine what happens after a simple subcutaneous fracture of a long bone, the fragments being kept in good apposition; afterwards, the minuter processes will be described.

Three or four days after the fracture, the soft parts around are swollen and firmly elastic, forming a spindle-

shaped tumour round the broken ends. There is some extravasated blood in the medullary canal, and outside the periosteum. The periosteum is seen between the swoollen soft parts and the bone.

After ten or twelve days, the extravasated blood has disappeared; it is not certain whether it has been absorbed or partly organised. The spindle-shaped swelling feels and looks like cartilage (which it resembles microscopically). There is a fresh formation of cartilage in the medullary canal. "The broken bone lies in this cartilage just as if the two fragments had been dipped into sealing-wax and stuck together." The periosteum is swollen and indistinct in the mass of cartilage (not outside it); there are traces of new bone lying close to the old bone, both inside and outside the canal. This new formation is called callus.

The cartilaginous callus, formed from the whole surrounding soft parts, including the periosteum, is now an isolated whole and ossifies completely, until the ends are held firm in bone, as they were before held firm in cartilage.

This bony callus is spongy bone, and is called provisional callus, because it is only there for a time, until the really permanent union takes place between the broken ends. After a time, the callus within the medullary canal and the callus outside the bone are gradually absorbed; meanwhile, a bony union goes on between the broken ends themselves; the new bone here

formed is called permanent callus ; it grows as hard as compact bone, and when the temporary scaffolding, as it were, of " provisional callus " is removed, the continuity of the bone is found to be restored as perfect as it was before Of course, if the displacement is great, the formation of provisional callus is great in proportion, and in spongy bones, where the displacement is not generally great, there is very little provisional callus.

This new bone may arise from any of four possible sources :—

1. The bone itself.
2. The periosteum.
3. The surrounding soft parts.
4. The extravasated blood.

Recent observations tend to show that the bone (the old bone) has nothing to do with it : the extravasated blood is probably organised into callus to a certain extent, but this is doubtful. Hitherto the whole bone-forming process has been attributed to the periosteum, but Billroth shows that the surrounding tissues really do the major part of the work, the periosteum becomes lost in the callus, and a new periosteum formed outside it, from the outer layer of callus, which becomes developed into rather vascular fibrous tissue.

The minuter details of the process are as follows :— Cells appears first round the vessels in the Haversian canals, the lime salts are absorbed (possibly by a

formation of lactic acid in the new growth converting the carbonate or phosphate of lime into soluble lactate—Billroth) and carried away in the circulation. The canals increase in calibre and the blood-vessels they contain not only in size, but even in number.* The young cells are no doubt transuded white blood corpuscles. The bone thus becomes porous, at first its Haversian systems are increased in size and filled with young cells and extra blood-vessels; this new growth is also going on outside the bone and in its medullary canal. The bone-cells (osteoblasts) in the lacunæ may or may not join in the process. Billroth thinks they do not. These numerous cells form fibrous tissue, which is afterwards the seat of the ossific deposit.

Wound Fevers.

After some period of from twenty to thirty hours after the injury, the patient displays certain constitutional symptoms which indicate a condition called traumatic fever or wound fever. The temperature has risen, as seen by the thermometer, the pulse is frequent, tense and full, the skin dry and hot. The bowels are constipated, and the patient is restless and hot, and complains of thirst, loss of appetite, headache, and sleeplessness. The tongue is coated. The highest temperature in traumatic fever is 104° to 105° F., but it

* Sawyer has seen two in one canal.

does not usually rise above 101° to 102° F. It usually lasts two to five days, but may go on to seven. In trifling wounds, and most antiseptic cases, it does not occur at all. There has been much discussion about how the injury produces the fever, whether it is a mechanical diffusion of the local increase of heat by the means of the blood or whether it is due to a poisoned condition of the blood caused by the imbibition by the blood of a poison generated in the wound. This latter view is supported by the generality of modern investigators.

What this poison is, is not known, that is, it is only partly known.

When first formed, the substance is poisonous by its *chemical effects*. This first manifestation of the poisonous action is called *septic intoxication*. The effects of the poison depend on the dose, that is, a very large dose may kill at once (within a few hours). The blood of animals dying thus is not poisonous when injected into the circulation of other animals, the disease is non-infective. So far it resembles the results of any other chemical poison, there are no bacteria in the blood.

If, however, the animal recovers from the first effects of the poison, not having taken a fatal dose, after a variable time the blood generates bacteria, or minute living organisms (or, as some observers state, a non-organised ferment). These bacteria produce by

infinite multiplication a blood disease, for which the name of *septic infection* has been proposed. Bacteria are found in the blood both before and after death. Such blood injected into the circulation of healthy animals produces similar symptoms. This disease terminates fatally without secondary formations.

Lastly. *Pyæmia* is an infective process, probably similar to septic infection, but differing from it in giving rise to local inflammation and suppurations called metastatic abscesses, often complicated by thrombosis and embolism, possibly due to the blood condition.

These distinctions are explained at length in the report of the Committee on Septicoemia, published in the Pathological Society's Transactions for 1879.

Treatment of Wounds.

A wound is a solution of continuity of the soft parts; it may, of course, be any shape or size. Wounds have, for convenience, been divided into :—

1. *Incised wounds*, in which the length is much greater than the depth.

2. *Punctured wounds*, in which the depth is much greater than the length.

3. *Subcutaneous wounds*, in which the division of tissue beneath the skin is greater than the division of the skin.

4. *Contused wounds*, in which the tissues are bruised as well as cut.

5. *Lacerated wounds*, in which the tissues are torn instead of cut.

In all wounds there are three general indications or lines of treatment.

1. To clean the wound, and stop the bleeding.
2. To bring the parts together, and keep them so.
3. To prevent complications.

1. *To Clean the Wound and Stop the Bleeding.*

All foreign bodies must be removed, such as dirt, gravel, pieces of glass, splinters of wood, bits of clothing, hair, &c. The wound should then be washed with a stream of cold or hot water, and the bleeding must be quite stopped. (See Chapter VII.)

2. *To bring the Parts together and keep them there.*

If there is not much gaping this may be done by strips of adhesive plaister (as in a cut head). If there is much gaping it will be necessary to keep the flaps in apposition with sutures of silk, catgut, metal, and other substances. Silver sutures cause least irritation, as they do not absorb the products of putrefaction, but they are not very pliable. Catgut sutures are absorbed in the wound, and do not, therefore, require to be removed, but they are for this reason useless when required for long. Silk sutures are most used.

There are various forms of suture :—

The *interrupted*, a series of separate knots.

The *continuous* (glover's), where the thread is carried through the tissues, exactly as it is in that mode of sewing which ladies call "running."

The *twisted*, here a hare-lip pin transfixes the wound, and the suture is twisted round the two protruding ends like a figure of 8.

3. *To prevent Complications.*

The chief object of a surgeon in treating a wound is to procure a speedy union with as little constitutional disturbance as possible. He wishes the wound to heal from the bottom, not to skin over and have a bag of pent-up discharge, and he wishes to avoid as far as he can traumatic fever. Concerning the best method of ensuring this result authorities differ. Professor Lister after a vast series of experiments has come to the conclusion that the wound, however large, will heal quietly by itself, without constitutional disturbance, if the germs contained in the dust of the air be sedulously excluded. Sir William Fergusson used to teach that wounds did best under a simple water-dressing. For the details of the discussion about antiseptic dressings it would be necessary to consult the works of those who have very fully discussed the matter.

If the wound is made by the surgeon, as in an amputation, it is made in an atmosphere rendered pure

by the carbolic spray, and all the instruments employed, and the hands of those who touch the wound are also carbolised. The sutures are carbolised, and the wound covered with materials (gauze) which are previously carbolised, so that the entrance of germs is impossible. The dressings are changed under the spray.

CHAPTER VI.

INFLAMMATION IN ITS CLINICAL AND SURGICAL ASPECT.—ABSCESS.— ULCERS.

HAVING discussed the pathology of disease as far as has seemed necessary, the rest of our work will be to examine how far the surgeon may, by judicious interference, ameliorate the condition of the sufferer, and conduct his disorder to a favourable issue. How he may discover by certain signs—both *objective*, those obvious to his own senses, and *subjective*, those only perceived by the patient—what is the nature of the malady he is called upon to treat. His examination of symptoms should be very thorough, however simple the case may at first sight appear, remembering that patients sometimes conceal their really most mischievous symptoms through mistaken delicacy or stupidity. Moreover, the interference of the surgeon must, in many cases, be very

little, and he must remember that nature is generally trying to effect a cure herself, and he is only required to assist her and render her task more easy.

Both the symptoms and the treatment of disorders will be divided into *local*, or those confined to the seat of the injury and *constitutional*, or those affecting the whole system.

Causes of Inflammation.

Predisposing causes.—These determine the kind or variety of the inflammation. They are general and local:—

1. *General.*—Debility, with poor blood; plethora, from excess in feeding, &c.; blood disorders, as gout, rheumatism, syphilis, purpura, scurvy, &c.; enfeebled action of kidneys or skin; extreme youth or age; sanguine habit.

2. *Local.*—Passive congestion, defective nutrition of the part, impaired innervation.

Exciting causes.—Direct or indirect injury.

1. *Mechanical injury*, such as a wound, the presence of a foreign body, or a sequestrum.

2. *Chemical injury*, such as results from the application of arsenic or iodine to the skin.

3. *Extreme heat or cold.*

4. *Irritation of a nerve.*

Symptoms of Inflammation.

After a certain irritation or injury has been inflicted upon a tissue it presents four local symptoms:

Redness.
Swelling.
Heat.
Pain.

The first three of these are objective, the last a subjective symptom.

The redness is due to increased vascularity. The swelling is due to the effusion of inflammatory products.

The heat is partly due to the excess of blood supply, at the same time the blood itself is hotter that comes from than that that goes to an inflamed spot (Simon). This may be due to the activity of tissue change.

The pain is not a constant symptom, and probably depends upon whether or not the nature of the inflamed tissue will allow of its distension. In whitlow the fibrous tendon-sheath binds down the swelling and causes acute pain, while inflammation of loose cellular tissue where swelling is free and unrestrained, though very extensive, may be comparatively painless.

The *constitutional* symptoms of inflammation are called collectively inflammatory fever. These symptoms usually commence before twenty-four hours have elapsed from the receipt of the injury. They consist in an abnormal state of the several "systems" and "functions" of the individual.

The circulatory system is out of order, as is evidenced

by a general feeling of heat and discomfort alternating with chills. The heart's action is rapid, the pulse rapid, hard, and bounding. The temperature, which may be tested by a thermometer in the mouth or axilla, is raised above $98\frac{2}{5}^{\circ}$ F. (normal).

The digestive function is disturbed, as shown by parched lips and thirst, furred tongue, loss of appetite (*anorexia*), and constipation.

The excretory systems are deranged, as shown by hot dry skin and scanty high-coloured urine.

The brain is disturbed, as shown by headache.

These symptoms are worse at night, and reach a climax and decline in simple cases in from one to seven days. The first definite rise of temperature (2° F. or so) accompanied with a rigor indicates the formation of pus.

Treatment.—If the inflammation be reparative, constructive, or beneficially destructive, it should be left to do its work, and not interfered with. Otherwise there are two general lines of treatment to be pursued:—

1. *Remove the exciting cause*, mechanical, chemical, or vital irritants, any dead part of the tissue or morbid product, such as extravasated or putrid blood, sloughs, sequestra, decomposed excretions, &c.

2. *Remove* (*a*) the inflammation itself, (*b*) its local and constitutional consequences, such as the inflammatory fever.

The inflammation itself that is to be removed consists of:—

1. Increased temperature.
2. Too much tissue-forming action.
3. Too much tissue waste.
4. Too much vascularity.
5. Perverted nervous influence.

The local and constitutional treatment calculated to remove these conditions is called "antiphlogistic."

Local Antiphlogistic Measures.

1. *Rest to the part*, procured by preventing or restraining its normal action, as by splints in the case of a joint.

Cold, by evaporating and cooling lotions, ice applied in an india-rubber ice-bag containing pounded ice.

Heat, fomentations, bread-and-water poultices and spongiopiline soaked in warm water.

Blood-letting, by leeches and scarification.

Incisions to relieve tension.

Counter irritation, blisters, or substances that will raise blisters, setons or skeins of thread drawn through a fold of skin and left there; issues, made by cutting a hole in a piece of plaister, putting it on the part and filling the hole with a strong caustic and making an ulcer, which is kept from healing by touching the edges with caustic potash, iodine paint, and caustics. The object of these remedies is to deflect the perverted

blood-flow from the inflamed part, to a new, artificially caused centre of inflammation, as it were to distract its attention. The actual cautery is a powerful counter irritant, the neighbouring surface being seared with a hot iron.

Astringents, certain acids, nitric, hydrochloric, sulphuric, tannic, &c.

Elevated position in a Salter's swing, or some such apparatus.

Pressure, by bandages, &c.*

The constitutional methods of alleviating and removing inflammatory symptoms, are as follows :—

Blood-letting by venesection ; the veins of the lower arm are caused to swell by a bandage placed *above* the elbow, an incision is then made in the median basilic vein ; when enough blood has flowed the bandage is removed, and replaced over the point of incision. Cupping is another method ; the skin is scarified with a lancet, and a glass from which the air has been exhausted is clapped over the wound, the blood immediately fills the empty glass.

Purgatives relieve the constipation, and lower the temperature.

Diaphoretics are drugs which cause the patient to perspire freely, and relieve the hot dry skin.

Diuretics remedy the scanty, high-coloured urine, by

* The last three remedies are employed especially in chronic inflammation.

promoting a free action of the kidneys ; this is somewhat accomplished by diluent cooling drinks, as barley-water, &c. Thirst is relieved by ice to suck, and cooling drinks.

If the fever is high, antimony and mercury will reduce the system ; if the fever is low, wine, brandy, and ammonia and other stimulants will raise the tone, and enable the patient to shake off the morbid condition. Cod-liver oil and nutritious diet, and tonics will work in the same direction. The diet must be slop-food, that is, broth, beef tea, &c., at first, to rest the stomach (in acute inflammation).

These remedies are various, and sometimes apparently contradictory. This is because the process of inflammation presents many varieties, each of which requires different treatment, that which is judicious in one case being often quite the opposite to that which is required in another. The principal clinical varieties of inflammation are :—acute, sub-acute, and chronic, sthenic and asthenic, phlegmonous, congestive, erysipelatous, diphtheritic, and certain specific inflammations, such as syphilitic, gouty, rheumatic, or gonorrhœal.

Sthenic Inflammation, means strong, or vigorous inflammation. The pulse is strong and hard, the fever high, the prominent inflammatory symptoms actively developed, the effusion plastic. It occurs in robust subjects, who are more easily able to shake off the effects of disease. It requires prompt and vigorous treatment blood-letting, purgatives, antimony and mercury.

Asthenic Inflammation is the opposite variety to sthenic. The pulse is perhaps, frequent, never strong, and sometimes not affected. Fever, if present, is slight, low, and remittent: effusion not plastic. This form occurs in weakly subjects.

Reducing measures and drugs must be avoided. Early recourse to stimulants is advisable; tonics, nutritious diet, bark, quinine, ammonia, brandy, wine, and animal food are indicated.

Acute, Sub-acute, and Chronic.—These terms refer to the duration of the inflammation. Acute inflammation runs a rapid course; the fever is high, and the symptoms sthenic in character. It ends quickly by resolution, effusion, suppuration, or gangrene, in from three days to three weeks. If it last to six weeks, it is called sub-acute. If longer still, it is chronic, and presents asthenic characters.

Phlegmonous Inflammation seen in a common boil. The focus of inflammation is circumscribed by an effusion of plastic lymph. It usually takes place in cellular tissues, and is sthenic in character and treatment.

Congestive Inflammation, attended by an obstruction to the return of blood from the part, as the name implies. The colour is deep red, the heat slight, the treatment that of sthenic inflammation.

Erysipelatous Inflammation, peculiar in its great tendency to spread, and the infectious character of its

attendant fever. The effusion is not plastic, but serous, and perhaps purulent.

The treatment is depletion, by purges, &c., but without blood-letting. Tonics may be resorted to early, sesquichloride of iron having proved very efficacious. The patient must be isolated, the ventilation free, disinfectants should be freely used, and the surgeon should be particular in his ablutions after seeing the case.

Diphtheritic Inflammation is diffused and spreading, of asthenic type, with low fever, little swelling, soreness rather than pain. The inflamed spot is of a deep red colour, and covered with a film of grayish albuminous matter, which is fœtid. This exudation is typical of the character of the inflammation.

The treatment resembles that indicated in the erysipelatous variety, and must not be reducing. Stimulants, astringent lotions (solution of nitrate of silver, gr. x, to $\frac{z}{3}$ 1), and in throat inflammations borax gargles are indicated.

The specific forms will be referred to later.

Abscess.

An abscess is a circumscribed collection of pus. If the pus is not circumscribed, it is called "diffused suppuration." The minute changes in both cases are the same, those described under the head of inflammation of connective tissue; the only difference being that in the abscess the spreading of the destructive pro-

cess is soon limited, or at any rate partially restrained by the conversion of the neighbouring tissues into a layer of granulation tissue.

Course of an Abscess.—The capillaries dilate, and allow the escape of white blood-corpuscles through their altered walls, the connective tissue is therefore crowded with young cells; the part consequently swells, the tissues become tense, pressure causes stagnation of the blood at certain points (possibly involving much death of tissue), the cells increase by proliferation, while the fibrillar intercellular substance disappears and dies, and becomes dissolved and fluid. So far the whole inflamed spot has become pus. This process extends in all directions, most rapidly in that direction where there is least resistance, and most blood to assist it. Thus in a subcutaneous abscess it tends towards the surface, perforates the cutis, the pus escapes, and, perhaps, the process ceases; this is called "pointing," or "bursting." The tissue surrounding the exuded cells and fluid (the pus in fact) is still exuding cells; the capillaries that first of all dilated, and set loose the leucocytes, are strangled by pressure, dead and dissolved, but their next-door neighbours are in turn dilating, and letting out leucocytes, and they will in turn be squeezed to death by those very leucocytes as they double and treble their numbers by proliferation. So the active layer of vascular dilatation is gradually moved back, increasing the size of the abscess, and at the expense of the surrounding tissue.

This vascular layer is identical in structure with granulation tissue (the pyogenic membrane of old surgery), and when once the pus has escaped, the walls of the cavity come together and unite with rapidity, the excessive cell-production is absorbed, any breaches of tissue restored by new connective tissue, and the process is at an end.

An abscess may be acute, sub-acute, or chronic, according to its duration; phlegmonous, if surrounded by a very marked layer of plastic infiltration.

The contained pus may vary much; it may be:

Laudable—healthy, sweet, and creamy.

Putrid—decomposed, full of bacteria.

Sanious—bloody.

Ichorous—thin and acrid.

Strumous—curdy, with flakes of lymph floating in it.

Serous, or Watery—when excessively thin.

Symptoms of Abscess.—Signs of inflammation; pain, first dull, then throbbing, fever symptoms. Then comes a rigor, the swelling becomes defined, fluctuation is perceived, that is, the hand resting on one side of the abscess, feels the sac bulge when the other side is pressed, and the fluid contents also conduct the impulse across the abscess from one hand to the other when the side of the part is percussed. Later a point in the middle of the red surface becomes pale, then yellow (pointing), and it is here that the pus will burst out if left to itself.

The abscess may be absorbed, or may end by degeneration, caseous, or calcareous, or by organisation, or the contents being evacuated, the cavity may heal up by granulation.

Treatment.—At first the process may be arrested, and absorption promoted by painting round with iodine (counter irritation). The wisest course, however, is to open at once; even if the inflammation has not gone so far as the formation of visible pus, you may stop the process by a free incision. In making the incision, superficial veins and nerves, and of course deep vessels, should be avoided. The opening should be dependent, so that evacuation may be complete (this is less important in antiseptic surgery where putrefaction does not occur). A superficial abscess may be opened with a lancet; the opening being free to allow easy escape of the matter, and prevent its re-collecting; as soon as once the air has been allowed to come in contact with the pus, putrefaction will set in if the fluid is allowed to collect. Escape of pus may be facilitated by the introduction of drainage tubes (india-rubber tubes with holes cut in the sides) of appropriate size. The fluid may be withdrawn without the admission of air by means of an aspirator. This instrument consists of a bottle with two elastic tubes passing through the cork; at the end of one of these is a hollow trocar, the end of the other is open, both tubes may be shut off by stop-cocks. The bottle is exhausted of air through the open tube, which is then closed by the

stop-cock. The trocar is then plunged into the abscess, the bottle fills with pus, the trocar end is then shut off, and removed from the wound, which is covered by lint and bandages. In deep-seated abscesses in the neighbourhood of large vessels, as in the axilla, Mr. Hilton recommended introducing a pair of scissors along the groove of a director into the abscess, and then opening the handles, thereby opening the blades and tearing the sac open, thus avoiding the dangers that would attend cutting in such situations.

The after treatment of abscesses consists mainly in tonics and good feeding, and sedatives when required.

Sinus.—The connection between a morbid cavity, the result of inflammation, and the surface, is called a sinus.

Fistula.—An unnatural connection between a normal cavity or canal, and the surface or another normal cavity or canal, is called a fistular. Thus there are rectovesical fistulæ in the male, and vesico vaginal and recto-vaginal fistulæ in the female.

The treatment of fistulæ depends upon the nature of the parts involved; if the contraction of muscles tends to keep the fistula open, as the contraction of the sphincterani in anal fistula, the division of the muscle is indicated. If the natural outlet of the secretion is interrupted, as in salivary fistula, it must be reunited If a foreign body or sequestrum tends to keep open a sinus it must be removed. The best treatment when the

exciting causes are removed, is to lay open the sinus from end to end, and by keeping the sides apart with lint soaked in carbolic oil, to ensure its healing from the bottom. The injection of stimulating fluids, such as iodine, may rouse the indolent surfaces to a healthy inflammation, and in a recent sinus pressure with pads and bandages may be serviceable.

Ulcers.

An ulcer is a superficial destruction of tissue due to molecular death thereof.

A rapidly spreading ulcer is called *phagedenic*; one in which the tissue dies in patches or sloughs, is called *sloughing*.

Ulcers may be *healthy* (or tending to heal), *inflamed*, *irritable*, *weak*, on *indolent*.

Ulcers may be caused by mechanical irritation (as a blow or pressure), chemical irritation (as nitric acid, caustic potash), vital irritation (as a burst abscess). They may also be due to constitutional causes as *syphilis*, *scrofula*, *cancer*, or *scurvy*.

There are also *varicose* ulcers, due to congestion, caused by the presence of varicose veins, *rodent* or *lupus* ulcers.

While an ulcer is increasing, it is surrounded by a zone of dusky red inflamed tissue; the products of this zone of inflammation are not becoming organised, but

simply forming pus and destroying tissue. In an ulcer that is getting worse, "the ulcerating surface is abrupt, looking jagged, or eroded, dusky, brownish or yellowish, mottled, without granulations, ready to bleed." The more active its progress, the more marked its characteristics. As soon as progress ceases and healing begins, this zone of inflammation round the ulcer becomes converted into "granulation tissue," that is the continually escaping leucocytes organise instead of simply proliferating. "The healing of an ulcer differs in no material point from that of an open wound with loss of substance. It is healing by granulations . . . there is no known difference in the process of repair" (Holmes). This form of healing has been described in Chapter V.

To describe an ulcer properly, certain leading features must be examined, points wherein it may differ from other ulcers, and by which it may be diagnosed:—

Its *locality*; some ulcers preferring certain tissues and parts for their seat. Its *shape*; it may be round, kidney-shaped, or irregular. Its *size*. Its *number*; whether multiple or single. The nature of its *base*, whether depressed or raised, or level, whether hard or soft. The *edges* may be hard or soft, elevated, shelving; ragged, overhanging, clean cut.

The *granulation*, if present, may be fluid, healthy, or too exuberant, dark red, and ready to bleed, or weak and flabby. The *discharge* may be of any kind of pus, from healthy to putrid.

Lastly, the state of the surrounding tissues, whether inflamed or not.

We shall now describe, briefly, a few of the more important forms of ulcer.

A common, healthy, or healing ulcer, such as might result from the removal of a piece of skin in a healthy individual. The place, shape, size, and number depend on the injury. "The base is level, slightly depressed (the less so, the more nearly its healing is completed), uniformly covered with small florid granulations which feel soft, pliant, and elastic, and though highly vascular, do not readily bleed, and are not painfully sensitive. The edges of the common ulcer shelve gently down to its base, and feel scarcely harder than the adjacent healthy skin. At their junction with that skin they are generally opaque white, with a very slight thickening of epidermis; within this they have a pale purplish blue tint, where the new formed epidermis veils the colour of the healing granulation; and yet within this the granulations have a deeper hue than those nearer to the centre of the ulcer, being most vascular where the cuticle is being most actively developed. The pus from such an ulcer is 'healthy,' or 'laudable.' The parts immediately beneath and around it are somewhat more vascular than is natural, but are not otherwise changed. Such are the characters by their deviation from which all other ulcers are distinguished, and by their approaches to which they indicate their tendency to healing" (Holmes' System, vol. i.)

Treatment.—Rest, water-dressing, raised position, and if the loss of surface be very extensive, Reverdin's operation of skin-grafting; that is, nipping off little bits of skin from some other part of the surface, and placing them on the sore, where they create new centres of epidermis formation, and hasten the cure.

Inflamed Ulcers.—Usually found on lower half of leg, single, less than an inch in diameter, and of irregular shape. Bases level, ragged, and flocculent without granulation, deep red, or ash-gray colour. Edges abrupt and irregular, pus ichorous, or sanious, surrounded by zone of painful, burning, dusky red, inflamed tissue.

Treatment.—Restore general health (it may be necessary to lower or to raise the tone). Locally rest in raised position, leeches at a proper distance (three to four inches) from the ulcer, lead lotion applied warm, and poultices; bandages, ointment, and plaister to be avoided till signs of healing appear (Paget).

Irritable Ulcers.—There is no surrounding zone of inflammation, but the pain is neuralgic, and often produces sleeplessness; the granulations are few, the pus sanious, with edges sharp and irregular.

Treatment is to remove the cause of irritation, touch the surface with nitrate of silver, and apply lead or opium lotions to it.

Œdematous Ulcers.—These are often of strumous origin. They are often multiple, oval, and about one

inch in diameter when single, but by coalescence may be any size or shape. Edges undermined and overhanging. Bases soft, and covered with large pale granulations, which bleed readily, and often project above the surrounding skin-level. Pus, strumous. These ulcers are not sensitive or painful. The diagnosis is corroborated by the existence of other evidences of a strumous diathesis (see Struma).

Treatment.—For constitutional treatment, see Struma. The local treatment must be stimulant ointments with iodine, lead, or mercury, lotions of nitrate of silver, or other astringent metallic salts. If the adjacent skin be much undermined, it should be destroyed with caustic potash. When the ulcers are so deep as to involve a bone or joint, amputation may be necessary.

Scorbutic Ulcers are ulcers whose peculiarities are due to scurvy. Their chief peculiarity is an effusion of a fibrinous exudation of a deep colour, imperfectly organised and permeated with newly-formed vascular channels. This same effusion, peculiar to scurvy, causes the tumefaction of the gums (spongy swelling), scorbutic nodes, or other characteristic swellings. The edges of the ulcers are irregular and swollen, the surface "is covered with a spongy, dark-coloured, strongly adherent, fœtid crust, whose removal is attended with free bleeding, and is followed by a rapid reproduction of the same material" (Mr. Busk).

The *treatment* is that of scurvy.

The Indolent or Callous Ulcer —A very chronic form, generally found in the outer side of the knee. It is deep and excavated, covered with irregular and badly formed granulations. The edges are hard, raised, and callous, irregular, and ragged; the pus thin and sanious, surrounding tissue congested and hard. No pain or sensitiveness.

Treatment.—Pressure and stimulation. Erichsen advocates—" 1. Painting the whole surface of the ulcer, and the neighbouring callous parts with ethereal solution of cantharides; 2. Applying carbolised water-dressing, or oakum poultice for a few days; 3. When granulations have sprung up, transplanting a row of skin-grafts within the edge of the sore; 4. Continuing antiseptic dressing and pressure with elastic bandages."

Varicose Ulcers.—Ulcers caused by varicose veins. The skin over the large and tortuous veins degenerates and breaks down. If the enlarged veins are penetrated, considerable hæmorrhage may occur, which is however easily stopped by pressure.

Treatment is to cure the varicose veins, and the ulcer will cure itself.

Hæmorrhagic Ulcers occur in women who are not menstruating properly. The sore is dark and purplish, and oozes with blood at each "monthly period." It is generally of an irritable type.

Treatment.—The natural flow must be re-established.

As soon as the patient is "regular" again, the ulcer will disappear with the amenorrhœa.

Syphilis and cancer will both be considered elsewhere.

CHAPTER VII.

HÆMORRHAGE AND DISEASES OF ARTERIES.

Hæmorrhage.

This subject is of great importance, and demands special consideration by itself.

Hæmorrhage means an escape of blood from the circulatory system. If it accumulate in an organ or tissue, it is called an *extravasation*. Immediately beneath the skin it is called an *ecchymosis* (as in a black eye). Bleeding from the nose is called *epistaxis*; from the lungs, *hæmoptysis*; from the stomach, *hæmatemesis*; from the bowels, *melœna*; from the urinary tract, *hæmaturia*; from the female genital organs, *menorrhagia*. The blood may escape from the arteries, *arterial* hæmorrhage; from the veins, *venous* hæmorrhage; or from the capillaries, *capillary* hæmorrhage.

Hæmorrhage may result from a wound, *traumatic*

hæmorrhage; or it may arise without a wound, *spontaneous* hæmorrhage.

Traumatic Hæmorrhage.

Causes.—A vessel may be injured in five ways.

It may be :—

1. Contused.
2. Partially lacerated.
3. Completely lacerated.
4. Partially divided.
5. Completely divided.

Contusions.—Little is known about these injuries, except that they tend to produce gangrene.

Partial Laceration.—The inner and middle coats are torn, the outer coat remaining intact. The injury to the artery is exactly like that resulting from ligature, without the irritation of the ligature. Probably a clot will form, and the vessel become obliterated at the point of injury, the circulation being carried on collaterally.

Complete Laceration —If subcutaneous in the case of a large vessel, a quantity of blood is extravasated, the temperature of the part falls, the pulse ceases. Gangrene will ensue if the limb is not amputated at once. If the artery is exposed, it does not bleed much (as when a limb is torn off by machinery). The twisting of the vessel stops the bleeding on the same principle that torsion performed by the surgeon effects the same result. (See Torsion *infra*).

Incomplete Division.—If the vessel is cut transversely,

the wound gapes, and blood continues to flow until the artery is quite cut through. This gaping is due to the longitudinal tension of the vessel by the surrounding tissues, and not to muscular contraction, the phenomenon occurs in the dead subject (Savory). The best way to stop such bleeding is to cut the vessel completely across. If the vessel is cut longitudinally, the wound does not gape, there being no great tension; there is, therefore, not much bleeding.

Complete Division.—A divided artery *retracts* by reason of the sudden relief of longitudinal tension. The ends also *contract* owing to the irritation of the circular muscular fibres. There is relatively much more muscular substance in the small than in the large arteries, and more elastic tissue in the large than in the small: therefore the large arteries retract most; the small ones contract most. The fenestrated membrane of Heule, or elastic layer of the internal coat curls up. This curling up of the internal coat, and contraction of the muscular fibres of the middle coat tends to block up the opening, and diminish the calibre of the vessel, thus assisting the formation of a clot and preventing the further escape of blood, nature's method of arresting the hæmorrhage.

Injury of Veins is much less important as far as hæmorrhage is concerned than injury of arteries. The thin coats collapse, the weaker circulation is more easily arrested, and ligature is seldom necessary, except with very large veins.

The entrance of air into veins has been considered a very fatal event, but some doubt has been thrown lately upon the gravity of the accident.

Injury to Capillaries never causes serious hæmorrhage.

Symptoms —The symptoms of traumatic hæmorrhage are local and constitutional.

1. *Local*, consist in the obvious escape of blood If the blood be arterial it is bright scarlet in colour, and escapes by jets or saltatim ; these jets coincide with and are caused by the pulse. If from a vein the colour of the blood is duller and darker and the flow continuous.

2. *Constitutional.*—If the loss of blood is great, rapid fainting or syncope ensues. If not sufficient to cause immediate fainting, pulse and temperature fall To quote Mr. Holmes, "the patient feels weak and faint, languor, yawning, noises in the head, throbbing of the temples, and flashes of light before the eyes precede the access of syncope. When syncope occurs the bleeding as a rule stops." This is due to the lessened force of the heart diminishing the blood force. If it does not stop, whether because the vessel is very large, or something is keeping it open, "the patient must die unless the bleeding is stopped by surgical treatment. When the fainting fit is over, the patient is generally sick. Mr. Holmes describes the results of repeated or habitual hæmorrhage thus : "Repeated or habitual hæmorrhage produces a general pallor, or rather a waxy appearance

of the whole body, fainting on slight exertion, restlessness, emaciation, sometimes partial or complete amaurosis,* and frequently constant and extreme drowsiness. As it goes on, the patient becomes more and more weak and exhausted, sometimes entirely unconscious, pulseless, and livid. Death takes place usually in a very sudden manner, or is caused by some slight exhaustion."

The treatment consists in a variety of methods of enabling nature to arrest the blood-flow. The blood-flow cannot be said to be permanently stopped till the cut end of the vessel is permanently sealed. The natural arrest must therefore be described before the methods of assisting it are touched upon.

After an artery is cut a certain amount of blood is shed, and coagulates in the wound. This clot is partly absorbed, partly organised; some think it is wholly absorbed—this, however, is still a moot point.

The elastic tissue of the inner coat or fenestrated membrane of Henle curls up, the irritated circular muscular fibres contract, and the end of the vessel is shut. The blood between the wound and the nearest branch coagulates, the current of the circulation passing on by the last branch nearest the cut end, which branch enlarges to meet its new stress of work and becomes part of the collateral circulation. This clot is concave on the side

* Amaurosis = partial or complete loss of vision.

of the circulation, being hollowed out somewhat by the incessant beating of the blood-stream against it before it takes its new direction up the nearest branch. The clot is convex at the end next the wound, being therefore shaped like a bullet, slightly hollowed out on its flat surface This clot subsequently organises into fibrous tissue, and finally dwindles into a narrow fibrous cord.

The syncope renders this process easier by lessening the frequency and force of the heart's contractions, and therefore diminishing the force of the blood-current in the vessels.

It is plain that neither the curling up of Heule's elastic coat, nor the circular contraction will take place if the artery is only partly cut through, and that therefore the blood will not cease to flow until it is quite cut through Again, in the case of very large vessels, these phenomena are not sufficient to stop the great rush of the large column of blood, and artificial assistance is required, or the patient will bleed to death.

The treatment, then, of traumatic hæmorrhage consists in a variety of methods of enabling nature to permanently block the mouth of the bleeding vessel.

It is sometimes difficult to determine whether the blood is coming from a large artery or one of its branches The diagnostic sign is the state of the pulse in that portion of the vessel farthest from the heart. The pulse will be lost if the trunk be divided; if only

a branch be severed the pulse will only be affected in the distal portion of that branch.

Having discovered the source of the bleeding, there are three main divisions of the remedial methods :—

1. Pressure.
2. Astringents.
3. Ligature.

Pressure may be applied at the cut end by the hand or a pad or plug of lint.

Pressure alone will sometimes effect the desired result, the temporary occlusion of the cut end by the plug of lint will give time for a clot to form. Still more effectual is pressure applied to the artery above the wound. The main artery may be compressed, either with the finger or a tourniquet,* against some point of bone over which it is known to pass. In a wound of one of the branches of the facial on the face, the main artery may be compressed against the lower jaw at the anterior inferior angle of the attachment of the masseter, and in a wound of the femoral the artery can be compressed against the iliopubic line with a tourniquet.

Astringents —These are local applications which tend to cause contraction of the open ends of the cut vessels, such as—

Heat.—The actual cautery, or even boiling water, is

* Tourniquet is a mechanical apparatus for compressing a vesse by means of a pad or a screw.

very efficient in stopping hæmorrhage. Mr. Holden prefers hot water to cold for sponging the surface of an incision.

Cold.—Ice is a most powerful styptic. In post partum hæmorrhage (flooding) or bleeding from the nose it is very useful. Cold air admitted to the surface of an oozing wound will often stop bleeding that is due to the warmth of the bedclothes.

Styptics.—The best of these is perchloride of iron, a piece of lint soaked in tinct: ferri perchlor. placed on the bleeding surface. Matico leaf powdered, or rolled into the shape of cigars, and pressed into a socket that is obstinately continuing to bleed after the extraction of a tooth is a good hæmostatic; also nitrate of silver, nitric acid, styptic colloid, powdered tannin, and tannic and gallic acids.

Ligature.—When the vessel is too large to stop bleeding without being tied, the bleeding end is seized (together, usually, with some surrounding tissue) with a pair of dressing forceps. A silk ligature is passed round the vessel and tied in a reef-knot. One end of the silk is cut short and left in the wound, the other is left long and hanging out. The silk should be waxed before use. Carbolised catgut is often used.

The bleeding end may be controlled by torsion, *i.e.* seizing it in a pair of forceps and giving it a twist round, or by nipping the end in a pair of bull-dog forceps and leaving them clinging to it for a short time.

It may be necessary to cut down upon the artery and tie it at some point in its course above the wound. This is notably the case in some wounds of the palmar arch where the vessel cannot be found, and it is necessary to tie the brachial.

The artery may also be controlled by *acupressure*, or causing a needle to compress the vessel by passing it through a little pinched-up piece of adjacent tissue, over the artery, and through a piece of tissue the other side. This method avoids the irritation caused by sutures.

Finally, when the patient is obviously dying from exhaustion due to loss of blood, as a last resource transfusion may be practised. That is, blood may be transfused from a healthy individual into the veins of the patient. This operation is, however, so rare and so dangerous that it scarcely calls for notice in the present work.

Hæmorrhage is not always traumatic, it may be spontaneous, in which case it may be due to—

1. *Congestion*, as in hæmorrhage into the stomach when the over-loaded vessels give way, or in "vicarious menstruation" when a woman's menstrual blood is not able from some cause to escape by the natural outlet, the vagina, and the congestion is relieved by an abnormal escape of blood from some other part, as the nose or ears.

2. *Weakness of the vessel walls*, especially where the

vessels do not receive much support from the surrounding tissues, as in the brain.

3. *Abnormal states of the blood*, as in scurvy, purpura, certain low fevers (especially typhus and small-pox). The hæmorrhagic diathesis, or hæmophilia, "where excessive bleeding occurs spontaneously or from very slight causes; in this affection there is a marked deficiency of fibrinogenous elements, with an excess of red corpuscles" (Roberts).

Age has an effect upon the locality of spontaneous hæmorrhage. Thus Roberts says: "In the young epistaxis is frequent, in young adults hæmoptysis; later on hæmatemesis, melœna, and hæmaturia; . . . . in old age cerebral hæmorrhage."

Collapse.

To quote Mr. Holmes, collapse is a condition "of total suspension of some and extreme weakness of others, of the functions of the nervous system, together with great disturbance of the circulation." It follows on great mental or physical shocks, blows on the testicle or female breast, or prolonged hæmorrhage. The patient may die at once, or gradually recover. The phenomena are briefly the following. The individual lies helpless; almost (not usually quite) unconscious; deadly pale, the lips quite colourless; the skin cold and moist: the nostrils dilated; temperature low; pulse

irregular and very feeble, perhaps imperceptible; breathing feeble or gasping. The longer the duration of the collapse the less the probability of ultimate recovery.

Reaction is attended with a revival of the pulse, hot dry skin, hurried sighing respiration, thirst, vomiting, restlessness, and sometimes delirium, and sleeplessness.

Exhaustion again brings on the cold sweating, and pale face, and irregular pulse, followed in fatal cases by convulsions, coma, and death.

Treatment.—The first thing to do is to ward off instant death. Warmth (by means of towels wrung out in hot water) to the head, epigastrium, and extremities; galvanism over the heart; small quantities of brandy by the mouth or rectum; or ammonia to the nostrils; finally, failing all other means, transfusion.

The administration of alcohol must be guided by a careful watching of the pulse. During the stage of reaction the main object of the surgeon is to get the patient to take nourishment; to treat the restlessness with injections of morphia, or the administration of opium or chloral to keep up the warmth; and to attend carefully to the nursing. Warmth is a very essential point, as, the blood being the medium for distributing heat to the body, loss of blood means loss of heat.

The internal administration of hæmostatics is resorted to in long cases, gallic acid being most commonly used in 10 gr. doses three times a day.

Diseases of Arteries.

Hæmorrhage is frequently due to a diseased state of the vessels, and therefore a brief account of the principal affections to which arteries are liable will be a necessary addition to this chapter.

Atheroma is a degeneration of the walls of arteries associated with inflammation. The elastic layer of the internal coat of the vessel is the starting point of the mischief. It becomes full of young cells, rapidly proliferating, and causing therefore a thickening of the internal coat. If the inflammation be acute an abscess forms beneath the epithelium, bursts and leaves an ulcer. More chronic inflammation leads to the gradual fatty and caseous degeneration of the tissues, which often afterwards calcify, leaving calcareous plates in the vessel wall. Very chronic cases may end in fibrous thickening of the walls mixed with the fatty degeneration.

In all these cases it is plain that the coat of the vessel is weakened at the particular point by the changes of its two inner coats. The formation of an ulcer and the destruction of the inner and middle coats, or the fatty changes attending the chronic form, cause a great liability to an *aneurism* at that point; that is, that the external coat, unable alone to resist the continual pressure of the blood-column, yields and stretches and bags out at that point till a regular dilatation is formed. The calcareous changes, of course, render the

vessel brittle; it cannot stretch or bend as it used, and therefore often breaks or gives way, and hæmorrhage results.

Atheroma is often the result of syphilis, often of continued use of alcohol, but the cause is equally often obscure.

The calcareous change, if extensive, can be plainly felt by the finger in superficial vessels.

Aneurism.—An aneurism, strictly speaking, is "a tumour formed by the enlargement of an artery" (Holmes).

Effusions of blood in cellular tissue communicating with a ruptured artery are sometimes called "diffused aneurisms," a confusing term.

Anything which weakens one point in the coat of a vessel may cause an aneurism; for instance, atheroma, a bruise, or a cut.

Aneurisms have been classified according to the number of coats divided, as "true" if all three coats are entire, "false" if only the external is left, or "diffused" if the surrounding structures form the sac, all the coats having given way; according to their shape, as "tubular" and "sacculated"; according to their cause, as "spontaneous" or "traumatic"; or when the current of blood penetrates between the coats and separates them, as "dissecting aneurisms." There are other rarer forms to which it is unnecessary to allude here.

Symptoms.

1. The tumour is soft and obviously contains fluid (*i.e.* it fluctuates).

2. It pulsates, keeping time with the heart's beat.

3. There is a "bruit" or rasping sawing sound with each pulsation, caused by the passage of the blood current.

4. The pulsation and bruit cease when the artery is compressed nearer the heart than the aneurism.

Diagnosis.—The symptoms may be absent if the blood should have consolidated in the sac, or may be present from other causes than aneurism, as when an abscess lies over a large artery and shares its pulsation (in which case the pulsation will be up and down only, and *not lateral*), or in a very vascular malignant growth.

Termination.—Aneurism may consolidate by coagulation of the contents of the sac and subsequent organisation of the clot (the natural cure), or it may burst and cause death by repeated hæmorrhage, or it may press upon some vital organ (as the æsophagus).

Treatment.—The artery supplying the sac may be tied or compressed with a tourniquet on the heart side to arrest the flow of blood and lead to coagulation of the contents of the sac, or if this be impracticable, the distal end may be tied to divert the current. Low diet and perfect rest are necessary to assist the operative measures, and drugs may be administered to regulate

the heart's action. It is needless to say that it lies quite beyond the scope of a dental licentiate to deal with such formidable conditions, and it is therefore unnecessary to enter into the details of treatment.

The dangers of the disease lie mainly in secondary hæmorrhage, and gangrene of the limb consequent on interference with the blood-supply.

CHAPTER VIII.

SURGERY OF FRACTURES, SPRAINS, AND DISLOCATIONS GENERALLY.

A FRACTURE is a forcible solution of the continuity of a bone.

If the fracture do not communicate with the external air it is called *simple*. If the soft parts and skin are severed or pierced and the air have access to the fractured ends, the fracture is called *compound*. If the bone be broken up into small pieces, fragments, or splinters, the fracture is called *comminuted*.

If the injury be attended with the wound of a large vessel or joint, the fracture is called *complicated*.

Again, the line of fracture may completely divide the bone—*complete* fracture; or it may partly divide the bone—*incomplete*, or *green stick* fracture.

The line of fracture may be *transverse*, *oblique*, or *longitudinal*.

Lastly, the compact part of one end may be wedged into the cancellous part of the other—*impacted* fracture.

In infancy or youth, that is, before the epiphyses are united to the shaft by bone, these two parts may be forcibly separated—*separation of the epiphyses.*

Causes of Fracture.

1. *Predisposing Causes*—*Age*: The older the patient the more likely he is to break his bones, as they are more brittle, the proportion of the lime salts to the organic matter being greater. *Bone diseases*: If the bone be softened or weakened by disease it is more liable to be broken. Rickets, syphilis, cancer, scrofula, and scurvy produce a tendency in the bones to be easily fractured.

2. *Exciting Causes.*—Violence, a blow or a fall, the commonest causes of all; muscular action. Where the muscles are very powerful they sometimes break the bone to which they are attached by contracting with too great violence. This is often a cause of fracture of the humerus and patella, &c.

Symptoms.

1. The *crack* heard by the patient.

2. *Deformity.*—The limb is not the same shape as normally, there may be unusual lumps and unusual depressions; the one half of the limb may form an angle

with the other, instead of a continuous line (*Angular* deformity) there may be *shortening*.

3. *Preternatural Mobility.*—The two fragments move upon one another at the point of fracture, as if there were a joint there.

4. *Crepitus.*—When the two surfaces rub against each other there is a rough grating noise heard, and a grating sensation is felt by the person moving the fragments.

5. *Loss of Power.*—The patient loses control over the distal fragment.

6. *Pain.*—Movement causes pain.

Diagnosis of Fracture.

The difficulties of diagnosis arise from two facts, first, that any of these six symptoms may severally be absent; secondly, that all of them (except preternatural mobility) may be caused by other lesions besides fracture.

Circumstances under which the Symptoms may be absent.

The *crack* may not be heard, for the patient may be unconscious at the time; the *pain* may be absent for the same reason. The *deformity*-fracture may occur without displacement of the fragments. The *preternatural mobility* is absent in the case of impacted fracture, where the wedging of one fragment into another fixes them

firmly together. *Crepitus* is absent, both in impacted fractures, and when soft tissue, such as a bit of muscle, intervenes between the broken ends. *Loss of power* is absent, under the same circumstances as preternatural mobility, namely, in impacted fractures.

Circumstances under which the Signs may be present from other Causes.

Preternatural mobility of the fragments one upon another can only be caused by fracture; it is the only certain sign. For the rest *crepitus* may be felt in a sprain, when it is caused by the rubbing of a tendon against its inflamed sheath; this is called *false* crepitus. The *deformity* may arise from disease, rickets, mollities, ossium, dislocation, or a tumour, or it may be congenital. The *pain* may obviously result from many causes.

Therefore no sign but the mobility can be depended upon alone; but the concurrence of the other signs, their presence, taken collectively, establishes the diagnosis.

Treatment.—The general objects in treating a fracture or solution of continuity of the hard parts are the same as those to be followed in a wound or solution of continuity of the soft parts, namely:—

1. To get the parts in apposition.
   "Setting" the fracture.
2. To keep them there.
3. To treat complications.

Setting the Fracture.—The patient should be gently removed to bed ; any jerking might cause some pointed fragment to wound adjacent tissues or vessels, or even render the fracture compound by piercing the skin. Stimulants may be necessary to recover the system from the effects of shock.

The limb being disposed in such a position as will least conduce to the keeping up of the displacement by the action of neighbouring muscles, the distal fragment should be steadily pulled in the direction of the long axis of the limb (extension), the proximal fragment being kept still and prevented from following it (counter-extension) until the two fractured surfaces are in the same line. Judicious manipulation will then easily place the fragments in their normal position in relation to each other.

It is hardly necessary to point out that where there is not displacement there need be no coaptation, and that in fracture of the spinal column any attempt to set the fracture is forbidden.

Maintenance of Apposition.—It is necessary for the maintenance as well as the production of a good apposition that the muscles acting upon the fragments should be as far as possible relaxed This end is best attained by moderate flexion of the limb, in which position the extensor and flexor muscles balance each other (it is the position naturally assumed in sleep). The constant apposition of the fragments is maintained

by a stiff apparatus, called a "splint," and a calico bandage.

Splints are made of wood, iron, paste-board, gutta-percha, leather, straw, and many other materials. In the lower extremities, where strength is an object, wood and iron are generally used. In those situations, where adaptability of shape is important, as in the lower jaw, paste-board and gutta-percha are useful.

In some fractures, as in fractured clavicle, apposition can be maintained by bandaging alone, and splints may be dispensed with.

The inside of the splint is padded with wool to prevent it rubbing the skin, and maintained in position by a suitable bandage.

It may be necessary where the muscular power, tending to produce displacement, is very great, as in the thigh, to maintain the extension after the application of the splint. This may be done by weights (varying from two to three pounds) attached to the extremity of the limb.

When the swelling has gone down, and soft union is established, and all muscular spasm has ceased, the splints may be exchanged for a stiff immovable bandage, such as a starch or a plaster-of-paris bandage, applied in the following manner :—

Cotton wool is wrapped round the limb, short splints of softened paste-board are adjusted to the seat of fracture. A bandage soaked in starch is applied, and, when

applied, painted over with starch; then another similar bandage is put on over the first. The starch bandage dries and sets in a day or two, when it may be divided lengthways, in front and behind, and used as two closely fitting splints.

The most important complications that may attend a fracture are—

1. Access of the air to the seat of fracture through an external wound, rendering the fracture compound.

2. Wound of a neighbouring joint, blood-vessel, nerve, or organ by a splinter of bone.

2. Unfavourable union.*

1. *Compound Fractures*

Heal by suppuration and granulation; the inflamed portions of bone often die, and are exfoliated as sequestra; ostitis and periostitis may occur, and the matter may burrow in various directions. There is a liability to pyœmia and septicœmia, gangrene, and erysipelas. The union takes about twice as long as that of a simple fracture.

If, however, the wound be treated anti-septically soon enough after the accident, in scrupulous accordance with Professor Lister's directions in every minute particular, it will be practically rendered "simple."

* I have not mentioned comminution of the fracture, as this condition alone is unimportant, the most extensive crushes healing quite satisfactorily if the vessels and joints are not hurt, and the fracture is simple.

Recent experience shows that there is but little risk of any of these unfavourable conditions supervening.

2. *Lesions of Neighbouring Structures.*

Wound of a large joint, such as the knee, is a very serious complication of a fracture, the resulting constitutional disturbances being very great. If a large vessel be wounded by the broken bone, the resulting hæmorrhage may be so serious as to endanger the patient's life. Tetanus may ensue from the wound of a nerve. Furthermore, the various internal organs may be injured in fracture of the neighbouring bones, as the brain in fracture of the skull; the pleura or lungs, diaphragm or peritoneum in fracture of the ribs; the bladder in fracture of the pelvis.

3. *Unfavourable Union.*

Irregular Union.—The fragments may unite in bad apposition, even overlapping each other, the provisional callus remaining and permanently uniting the *sides* and not the *ends* of the fragment. This produces permanent deformity and shortening. It may be necessary to artificially reproduce the fracture, and having placed the fragments in proper apposition, promote a new union.

Delayed Union.—Owing to tight bandaging or ill-health, and sometimes without apparent cause, a fracture may take too long to unite. In such cases if the cause of the delay can be discovered, and removed or counteracted, this must be done. Gentle friction or regulated

pressure upon the fragments may excite a little action, and induce the necessary bone-formation.

Fibrous Union —Where the fragments are much separated by the action of muscles, the union sometimes takes place by fibrous tissue instead of bone. This is often the case in the patella, where the upper fragment is pulled up by the quadriceps extensor; in the olecranon where the triceps acts on the fragment; in the coronoid process of the jaw, &c.

False Joint.—Continued movement of the parts during the healing process may produce a false joint; that is, the two fragments may acquire the permanent power of moving upon one another. The ends of bone become polished, and connected by a capsular ligament, and between them a new synovial membrane is formed.

Non-union.—The ends may not unite at all This is usually on account of the advanced age of the patient, and consequent feebleness of his tissue-producing powers. Bad nutrition contributes to this condition, also certain blood-diseases, notably rickets, syphilis, cancer, scrofula, scurvy, &c.

Liberal diet and plenty of exercise in the open air may produce a satisfactory result; if not, various operations may be performed, having all of them the same object of stimulating the indolent surfaces to activity—excision, scraping, the introduction of ivory pegs and wires, anything in fact which will incite the requisite activity.

Sprains and Dislocations.

Sprains.—The ankle and wrist-joints are most often sprained. A sudden wrench is followed by severe pain, sometimes fainting, the joint rapidly swells, and becomes stiff or inflamed, any attempt at movement producing acute pain. Passive movement may elicit a false crepitus, due to effusion in the sheaths of the tendons.

The treatment is simple *if prompt*; if neglected, nothing is more difficult to deal with than a sprain. Absolute rest; warm or cold applications, followed, when the swelling has subsided, by stimulating applications, and the support of careful strapping and bandaging, or better still, a starch bandage, are the indications. The neglect or repetition of a sprain may leave permanent weakness and liability to dislocation behind it, and it may be necessary to keep the joint in an immovable apparatus for many months.

Dislocations.

A dislocation is the abnormal displacement of the articular end of a bone. It is accompanied by more or less injury of the surrounding structures, ligaments, tendons, &c.

It may be the result of violence—*traumatic*, or the result of disease—*spontaneous*. It may, like a fracture, be *simple*, *compound*, or *complicated*; it may be *congenital*; lastly, it may be *complete* or *incomplete*.

Symptoms.

1. *Deformity.* The natural outline of the joint is is altered, also the relation of the neighbouring bony eminences to one another. The limb may be shortened or lengthened.

2. *Loss of power.* The control of the patient over the movement of the joint is modified. This is very noticeable in a dislocation of the lower jaw.

3. *Absence of mobility.* There is no preternatural mobility as in fracture; in fact the reverse condition, preternatural stiffness or immobility, soon supervenes.

4. *Absence of crepitus*, except *false* crepitus.

Diagnosis.—A dislocation may be confounded with a fracture near a joint; but if the nature of the deformity be considered, this mistake is not very likely.

Causes.—The predisposing causes of dislocation are any conditions that may weaken the natural supports of the joint. Destructive disease of the ends of the bones or articular cartilages; relaxation or destruction of the ligaments of the joint. The exciting cause is always a strain upon the joint greater than it can bear, whether sudden or continuous.

Union is a simple process if the dislocation be soon reduced. Any exuded materials and extravasated blood are absorbed; the torn ligaments reunite by first intention; the inflammation of the joint, if there is any, subsides.

Treatment.—The indications are the same as those of fracture :—

1. To get the parts into apposition. "Reduction" of the dislocation.
2. To keep them in apposition.
3. To watch for complications.

1. *Reduction* should be performed as soon as possible, as every hour that elapses renders the operation more difficult. Extension and counter-extension are the means of effecting reduction, the obstacle to be overcome being the antagonistic contraction of certain muscles. The head of the dislocated bone should be made to retrace, as far as possible, the course by which it arrived at its abnormal position. The various methods of manipulation and apparatus for extension differ according to the seat of the dislocation. Reduction is announced to the operator by a snap or click as the head of the bone slips into its old home.

2. *Maintenance of apposition* is easily attained by a judiciously applied bandage.

3. *Complications.*—Complete rest will prevent any further inflammation, and favour the healing process. Some months may elapse before the patient is again allowed free use of the joint.

Unreduced dislocation and false joint may be attended with the gradual obliteration of the original cavity, in which case it is of no use to interfere. This state of things is probable when the movements of the false

joint are free and easy. Sir Astley Cooper placed two or three months as the limit after which reduction should not be attempted.

The reduction of dislocation has been attended with the rupture of nerves. Congenital dislocations do not admit of treatment, and those dependent on disease must be dealt with by treating the disease on which they depend.

In compound comminuted fractures of the lower limb, where the whole thickness of the limb is involved in the injury, or a joint and large vessel opened, or when true traumatic gangrene has set in, it is necessary to amputate the limb; likewise in compound dislocations involving the whole substance of the limb, where life is in danger, amputation must be had recourse to. The circumstances under which this last course is to be adopted are fully discussed in the leading works on surgery, and do not call for mention here.

CHAPTER IX.

INJURIES OF THE HEAD, FACE, NECK, AND CHEST.

Injuries of the Head.

No injury of the head is too slight to be of importance, and hardly any so severe as to be despaired of.

Injuries of the head are divided by Mr. Holmes into—

1. Simple contusion of the soft parts.
2. Scalp wound (*a*) without exposure, and (*b*) with exposure of the bone.
3. Extravasation of blood beneath the skull-cap.
4. Fracture of the skull, simple or compound, with or without depression of the bone.
5. Injury, *i e.* contusion or laceration of the brain and its membranes.
6. Injury to the nerves.

These injuries may be complicated with "erysipelas, diffuse inflammation of the soft parts, suppuration within the skull, inflammation of the brain and its membranes, and hernia cerebri."

Mr. Holmes describes three peculiarities in the surgical anatomy of the scalp as having a direct clinical importance :—

1 The intimate connection between the skin and the occipito-frontalis tendon.

2. The position of the large vessels, between the skin and the tendon instead of under the fascia, as in other parts.

3. The tendon of the occipito-frontalis muscle is loosely united to the pericranium by very extensile cellular tissue, and is perforated by small vessels going to the pericranium.

Consequently,—

1. Wounds of the skin almost always involve the tendon.

2. Bleeding from the large arteries is easily commanded, because of their superficial position.

3. In diffuse inflammation of the scalp the thickness of the part is often enormously increased by extravasated lymph, which may strangulate the small vessels nourishing the pericranium.

Contusions.—When the bump disappears the blood-clot may assume a ring shape, and feel like a depressed fracture. In fracture, however, the ridge is level with

the rest of the skull; it is hard and sharp, and the depressed fragment is more or less loose. A stimulating lotion will hasten the absorption of any extravasated blood; if the hæmorrhage is persistent the vessel must be tied, but such accidents usually heal themselves.

Scalp Wounds.—All foreign bodies must be removed, such as dirt, hair, bits of cloth, &c., the bleeding stopped, and the parts adjusted with strapping. Sutures have been considered very dangerous in the scalp (being supposed to cause erysipelas), but under aseptic conditions they do not modify the healing process at all.

If erysipelas supervenes, lotio plumbi or poppy-head fomentations should be applied; and, if the œdema resists other measures, incisions should be freely made down to the bone to relieve tension.

If the bone be exposed and consequently inflamed matter is effused between it and the periosteum, forming "Pott's puffy tumour," the inflammation may spread inwards, involving first the diploe, then the inner table, and lastly causing suppuration inside the skull between any of the membranes. Such a condition readily gives rise to pyœmia, starting from the numerous veins of the diploe. The intercranial collection of pus *may* be successfully removed by trephining, but this is rarely the case.

Antiphlogistic remedies should be employed. Free incisions, leeches and ice to the shaven scalp, and small

and frequent doses of mercury. The prognosis of such cases is not favourable.

Extravasation between the bone and dura mater causes symptoms of compression followed by hemiplegia. In such cases it is best to trephine over the middle meningeal artery (an inch above the zygoma and half an inch behind the external angle of the frontal bone) as this is the artery usually injured.

Fracture of the Skull.

Fractures of the skull are divided into fractures of the vault and fractures of the base.

Fractures of the skull derive their importance from the fact that the skull contains the brain, and the consequent liability of the brain to share in the injury. Apart from this complication they are harmless accidents and heal readily. It is by brain symptoms that the diagnosis is made; it is the brain disturbance that is the object of the surgeon's care.

Fractures of the Vault may be simple fissures, starred and comminuted fractures, with sometimes depression of the whole thickness of the skull, sometimes the outer table only, and rarely the inner table only. These fractures may be simple or compound. Depression of the outer table alone takes place usually over the large air cells, such as the frontal sinus.

Fracture by contre coup is an old expression meaning that the fracture is opposite the point where the blow

was inflicted; but there is no particular point in the name, as there is always a resisting body against which the skull is placed and which causes the fracture; for instance, if the skull be pressed against a wall and struck with a hammer on the opposite side, the fracture may be on the wall side, but in this case it was obviously the wall that produced the injury.

Diagnosis of simple fracture can only be made by feeling the depression; if there is no depression the fracture cannot be diagnosed at the time.* A compound fracture can of course be seen and therefore easily diagnosed.

Treatment.—In undepressed fractures there is nothing to do but promote the healing of any wound, if there is one, and watch for and allay cerebral symptoms. Simple depressed fractures must not be interfered with unless there are symptoms of compression of the brain; when these symptoms are present the depressed portion must be elevated.

In compound depressed fractures some surgeons always raise the fragment. But in the absence of brain symptoms, where the depression is not deep and its extent is considerable, Mr. Holmes advises leaving it alone.

Fractures of the Base are usually caused by indirect violence; sometimes by direct violence, as in wounds of the orbit.

* Subsequent brain symptoms will clear the matter up.

Symptoms.

The main symptoms are—(*a*) brain symptoms; (*b*) the escape of the cranial contents, blood, cerebrospinal fluid, and even brain substance; (*c*) the injury of the nerves issuing from the base of the skull.

The extravasated blood may escape through the orbit and appear beneath the conjunctiva; or through the sphenoid bone into the nose, causing *epistaxis*; or, in fracture of the middle fossa, through the ear.

The most decisive symptom, when present, is the escape of cerebrospinal fluid from the ear (in rare cases from the nose). If the serous fluid come away soon after the injury it can only come from the subarachnoid space; later on a much thicker serous fluid may be discharged from the lining membrane of the meatus itself. Paralysis of the nerves issuing through the base confirms the diagnosis.

No treatment is necessary save such as is called for by the brain symptoms.

Brain Lesions.—These are usually divided into *concussion* and *compression*. The great difference between the two is, that in compression there is paralysis and in concussion there is not. This leads to various distinctive phenomena; thus, in compression the paralysed condition of the muscular fibres of the iris prevents the pupil from responding to light; paralysis of the sphincter-ani causes the fœces to be voided involuntarily, while

the urine dribbles away through the urethra, not forced out in a stream, because the paralysed coats of the bladder are not contracting upon its contents; the paralysed velum palati flaps over the larynx, causing stertor or snoring during breathing, while the paralysed lips puff and blow just as they do in paralysis of the portia dura; paralysis of the vessel walls causes a full pulse; lastly, there is paralysis of the limbs, sometimes on one side (opposite to the injury), sometimes on both. The coma is complete; the temperature is maintained or only falls very slightly.

In concussion the absence of paralysis produces the opposite of those conditions that depend upon paralysis. The coma is not so complete but that the patient can be roused by violent stimuli, such as bawling at him or shaking him; the temperature falls to about 96° F.

The diagnosis depends chiefly upon a few symptoms, which will appear clearer in the form of a table, where they may be easily contrasted:—

Compression.	*Concussion.*
1. Pupils dilated and *insensible* to light.	1. Pupils sensible to light; may be either contracted or dilated, or one contracted and the other dilated.*

* 2nd Edit. of *Gant's Surgery*.

2. Pulse slow and full.	2. Pulse rapid and feeble.
3. Breathing stertorous, laborious, slow, prolonged, with puffing and blowing of the lips.	3. Breathing quiet, feeble, shallow, rapid, no stertor, no puffing of lips.
4. Little or no fall of temperature.	4. Fall of temperature sudden and considerable.
5. Paralysis of limbs on one or both sides.	5. No paralysis of limbs at all.
6. Coma complete.	6. Coma incomplete.
7. Fœces passed involuntarily, owing to paralysis of sphincter.	7. Fœces passed sometimes, owing to increased peristaltic action.
8. Urine dribbles owing to paralysis of bladder.	8. Urine passed sometimes in a stream, owing to contraction of bladder.

The second stage of concussion is that of reaction; pulse and temperature returns to normal; patient vomits and has a headache. He may then recover or undergo a third stage, namely, traumatic inflammation of the brain and its membranes.

Treatment of Concussion.—Rest, warmth, and mustard plaisters to the stomach and limbs. No stimulant unless the collapse is very alarming. During reaction slop food, gentle purging, quiet in a dark room, ice to the head.

Treatment of Compression.—The head should be shaved and examined; if a depressed fracture be found, the fragment should be raised with the elevator or removed by the trephine. If the compression be due

to an extravasation of blood, ice to the head, and a turpentine enema as a purgative (℥j turpentine to a pint of gruel, Gant) cupping to the nape of the neck or even venesection.

Traumatic Inflammation of the Brain and its Membranes.—This may be a consequence either of concussion or compression.

Symptoms.—Pain in the head, starting from the seat of injury and spreading all over the cranium, sleeplessness, contraction of the pupils, intolerance of light and sound, fever with rapid bounding hard pulse, and hot, dry skin, followed by sickness, delirium, restlessness, tossing, and convulsions. throbbing carotids, flushed face, and injected conjunctivæ. A second stage follows, very different from the first, evidenced by drowsiness and coma, dilatation of the pupils; slow, laboured pulse; stertorous breathing, paralysis—in fact, compression symptoms. Suppuration is attended with rigors The prognosis is unfavourable.

Treatment.—Ice to the head, purges, and bleeding. Aconite (Fleming's) in drop doses, and antimony Calomel in small doses with opium. During recovery, tonics and generous diet.

Injuries of the Face.

Wounds heal readily, owing to the great blood supply. Erysipelas is not uncommon, but is rarely serious. Sutures should be avoided, if possible, both for fear of

erysipelas and because of the scar they leave ; and when employed they should be withdrawn as soon as it is safe. If Stenson's duct be divided there will be a *silivary fistula*, the saliva escaping through the wound on to the cheek. A thin silver probe should be passed up the duct from the buccal opening, and, when it emerges in the wound, inserted into the end of the duct on the other side ; the ends can then be united, and the wound will probably heal without further trouble (see *Monthly Review Dental Surgery*, April 1880, p. 217).

Foreign bodies in the nose and ear sometimes cause great annoyance, which, however, subsides on their removal

Fractures of the facial bones heal readily, whether compound or simple, owing to the free blood-supply. They are always caused by direct violence.

Fracture of the Nasal Bones causes an ugly deformity, and sometimes troublesome hæmorrhage ; the septum is often involved, and it has happened that the brain has been injured through the cribriform plate. A female catheter may be introduced into the nostril to adjust the fragments, and even kept there for a day or two, but it is not advisable to keep a foreign body in the nostril if it can be helped. The union is usually rapid.

Fracture of the Malar Bone or *Zygoma*, diagnosis is obvious. Treatment consists in cold lotions, adjustment of the fragments by manipulation, if necessary ; main

tenance of apposition by compresses. Mastication or speaking are extremely painful, which fact compels the patient to rest the parts. Any fragments sticking into the adjacent structures should be removed.

Fracture of the Upper Jaw.—The nasal process, the malar eminence, the antrum, or the alveolar process may be broken. The swelling must be reduced by cold lotions, and the fragments adjusted by any suitable contrivance. There are innumerable ingenious apparatuses that have been devised for the purpose. None of the fragments should ever be removed, as union is quick and generally satisfactory.

Fracture of the Lower Jaw.—A common accident, which may occur at any part of the bone, most often in the neighbourhood of the canine; the *body*, especially between the symphysis and the attachment of the masseter; the *ramus*; the *coronoid*, or *alveolar processes*; and has even been known at the symphysis. It may be on one side or on both; it may be *transverse* or *oblique*; it may be *simple* or *compound*; it is often rendered compound by laceration of the thin mucous membrane that covers it.

Symptoms.—Unevenness along the line of the teeth and the base of the jaw; mobility of the parts and crepitus; dribbling of the saliva, perhaps mixed with blood. When the condyle is fractured it will be dragged forwards by the external pterygoid, and the coronoid process, if displaced at all, is dragged up by the tem-

poral, but the low attachment of the latter muscle often prevents any displacement at all. It is a fact worth noticing, that the inferior dental nerve frequently escapes without injury.

In fractures of the body of the jaw a pasteboard or gutta-percha splint should be adjusted to the base, the upper jaw serving as a splint above. A four-tailed bandage, with a hole cut for the chin, should then be applied, and the nourishment conveyed in a fluid form between the teeth. Any tooth that hinders apposition should be removed. Five or six weeks will suffice for union to take place. Wire ligatures through the bone or round adjacent teeth may be valuable for maintaining apposition, and innumerable arrangements have been employed, at various times, by every surgeon, with good results. For a detailed account of such apparatus the reader is referred to Mr. Heath's exhaustive work on the subject.

Dislocation of the Jaw.—This accident having once occurred is very liable to occur again. If, as is usual, both sides are dislocated, the mouth is wide open, the chin pushed forwards, a depression can be felt in front of the ear where the head of the bone ought to be, and a lump near the malar eminence, which is the coronoid process in its new position. Speech is unintelligible, and the saliva dribbles away from the open mouth. If the dislocation is on one side only, the chin is turned to the opposite side. "If the dislocation be left un-

reduced, the patient recovers the power of closing the mouth and articulating after a time. Reduction may be attempted as late as four months after the injury.

Reduction.—The thumbs, protected by a cloth, are placed on the angle of the jaw, inside the mouth, behind the last molar teeth; the chin is seized with both hands and pushed backwards and upwards, while the thumbs depress the angle; the condyle is thus freed from its unnatural position, and the temporal and masseter muscles contract and replace the bone with a loud click.

The are two opinions as to the cause of the obstruction which is overcome in reducing this dislocation. Nélaton considered that it was due to the locking of the tip of the coronoid process in front of the zygoma, and could therefore only occur in persons with a very long coronoid process. Maisonneuve and Weber maintain that this locking never takes place, and that the condition is wholly due to muscular tension. The arguments for and against each view are given in extenso in Mr. Heath's work.

Lastly, Sir Astley Cooper describes an accident in which the condyle is dislocated, but the interarticular fibro cartilage remains in situ (the cartilage accompanies the condyle ordinarily). The jaw is locked slightly open. A very little manipulation serves to reduce this condition.

Injuries of the Neck.

Cut Throat.—Owing to the number of large arteries in the upper part of the throat, it happens, sometimes, in stabs in that region, that the surgeon cannot distinguish the source of hæmorrhage; under such circumstances he must tie the carotid.*

People usually cut their throats over the larynx, with the object of severing the windpipe. The carotid is seldom reached, but if either or both carotids are wounded, death soon follows. The first thing to do is to stop the bleeding. The lingual artery is most commonly cut, sometimes the superior thyroid or the facial; these vessels must be tied. The veins can generally be commmanded by pressure, but Mr. Holmes sees no harm in tying them. The wound may pass partly or completely through the windpipe, perhaps with laceration and hacking of the cartilage; it may divide also the æsophagus, or cut through the epiglottis into the mouth. If the windpipe is not wounded, a little strapping and a bandage to fix the head with the chin downwards will be all that is needed.

If the windpipe has been opened, the rule is to avoid sutures for fear of asphyxia due to accumulation of blood. If the obstruction to respiration is very formidable, tracheotomy may be performed lower down,

* I believe in St. Thomas' Hospital reports the results of tying the ext. carotid are shown to be very successful.

to enable the surgeon to adjust the parts with more ease and certainty. If the æsophagus be wounded, Mr. Holmes thinks no harm would follow the use of a few carbolised gut sutures. No other kind of suture may be used on any account. A tube must be passed down the æsophagus past the wound, care being taken not to let it take a wrong direction, and food injected down it twice a day. It is very important to feed the patient well. It may be noted that if the tube should, by mistake, be passed into the trachea, the results of the introduction of food into the lungs would be obviously fatal. Mr. Holmes quotes a case in which a plaster-of-Paris injection was forced into the lungs, with what results it is scarcely necessary to say.

Recovery may be complicated with a fistula, either of the æsophagus or the trachea. In the case of the trachea the fistula may be cured by operation; in that of the æsophagus the patient must be content to be fed with a stomach pump.

Fracture of the hyoid bone may be caused by any form of direct violence. Movements of the tongue cause great pain, so that deglutition and articulation become impossible. The parts must be adjusted with one finger in the mouth and the other outside, and a fortnight's rest will generally see the patient on the fair road to recovery.

Foreign Bodies in the Air Passages.—This accident is often very serious indeed. A mass of food may

obstruct the upper aperture of the larynx and cause death if not quickly removed. Foreign bodies may stick at any point in the air passages; above the rima glottidis, between the vocal cords, in any part of the trachea, in one of the bronchi (generally the right, because its aperture is right under the trachea; that of the left bronchus being more at the side, the object generally passes by it).

The accident is evidenced by violent coughing and dyspnœa, the patient turns red, then purple, or in less complete obstruction the breathing is "whistling or stridulous."

If the foreign body is too far down to be reached from the mouth, an opening in the windpipe will both relieve the urgent dyspnœa and enable the surgeon to make a thorough exploratian and get at the object. At all risks it must be removed, as though it may be accidentally in such a position as not to cause great discomfort, yet the slightest shake might, by changing its position, prove instantly fatal. Sometimes when the object cannot be reached with forceps, it will drop out if the patient be turned upside down and shaken. This happened in the case of Sir J. Brunel.

If the foreign body be allowed to remain, apart from the ever present danger of sudden asphyxia from a change in its position, it is liable to cause ulceration of the parts with which it is in contact.

Scald of the Larynx is a very fatal and a common

accident. The attachment of the mucous membrane to the true vocal cords prevents the œdema from passing lower, and thus limits the mischief to the parts above them, but the consequent swelling of the parts about the upper aperture often causes fatal dyspnœa. Leeches to the throat and frequent small doses of antimony and aconite afford relief, but perhaps prompt tracheotomy gives the best chance to the patient.

Foreign Bodies in the Æsophagus. — Innumerable foreign bodies have stuck in the gullet. When people swallow a small or rounded foreign body it generally traverses the intestinal tract and escapes at the anus without causing much disturbance. If this is not the case however, and the surgeon is sure the object is sticking in the gullet, it may generally be fished up with a probang, an instrument better understood by seeing one than by reading a description of it.

Finally, æsophagotomy may be attempted when other means fail. That is, the æsophagus may be cut down upon and opened. This operation has been very successful. An incision is made between the carotid and the trachea in the left side (because the æsophagus inclines to that side). The middle of the incision should be opposite the cricoid cartilage, avoiding the superior laryngeal nerve above, and the inferior thyroid artery below. The foreign body having been removed, the wound should be closed without sutures (or with

only carbolised catgut ones) and the patient fed with a tube for a few days.

If the foreign body be allowed to remain it may ulcerate its way into the aorta, or the air passages, or even the spinal column or heart.

Injuries of the Chest.

Fracture of the Ribs may be caused by direct or indirect violence. The fragments may wound the pleura, lung, heart, diaphragm, peritoneum, liver, or stomach.

When the accident is the result of direct violence the fragments are generally driven inwards; when it is the result of indirect violence, as, for instance, the compression of the chest wall in a crush, the fragments are forced outwards and tend to pierce the skin.

Fractures of the ribs may be divided into those which are attended with a wound of the lung, and those which are not.

Simple uncomplicated fracture of the ribs, when only a few are broken, is not a serious accident, and does not present much difficulty to the surgeon.

The first two ribs, being protected by the clavicle and the pectoral muscle, are less often broken than those below them. The floating ribs usually escape on account of their mobility. The lungs are more likely to be wounded in fracture of the upper than of the lower ribs. The posterior parts of the ribs, being more

thickly coated with muscle-tissue, are less liable to fracture than the middle and anterior portions.

Symptoms.—The history of the accident, and a sharp pain attending deep inspiration or coughing, and crepitus; the crepitus is often obscure. A simple fracture may heal in a month or six weeks, and owing to the extensive unavoidable movement of the parts the union is generally attended with a good deal of provisional callus.

Treatment.—Strapping and a broad bandage (six inches broad) should be accurately applied to the whole thorax, with the object of procuring as much rest as possible to the parts. The bandage must be worn about a month.

Wound of the Lung generally takes place in fractures by direct violence; the air contained in the lung-tissue escapes through the hole, both into the pleural cavity (pneumothorax) and into the surrounding cellular tissue (emphysema). Emphysema is evidenced by a peculiar crackling sensation to the touch. The only possible cause of the phenomenon is a wound of the lung. Authorities differ about the propriety of bandaging these cases; the sensible rule laid down by Mr. Holmes is to be guided by the patient's feelings: if steady hand-pressure over the seat of injury is grateful to him, apply the bandage; if it causes dyspnœa or pain, do not. In any case avoid the bandage when the tearing and comminution of the chest-wall is very great. Rest and low

diet form the rest of the treatment. Increasing dyspnœa, rusty-coloured sputa, and a hacking cough show the commencement of inflammation. If the pulse is strong ten or twelve ounces of blood may be removed with advantage. The emphysema generally disappears of its own accord. If the pneumothorax or collection of air in the pleura be so great as to cause dyspnœa it may be drawn off with an aspirator; the same measure may be resorted to in excessive hæmothorax or collection of blood in the pleura.

Fracture of the sternum and dislocation of the ribs rarely occur without fracture of the ribs, and are treated in exactly the same way.

Wounds of Chest are called penetrating when they go as far as the pleura, or farther. If the lung be wounded a bloody froth oozes out of the wound. The danger of such wounds lies in the loss of blood at first (Le Gros Clark). The wound should be closed at once, and ice applied over the strapping. The patient should not be roused from the collapse; and when with reaction the pulse rises, venesection may be practised. Foreign bodies should be removed at once, as their presence either in the pleura or the lung is obviously fraught with danger to life.

Paracentecis thoracis, or tapping the chest, may be performed with an aspirator, or better with a knife under the spray. The object of the operation is to remove fluid from the pleural cavity. The points to be

avoided are (*a*) the admission of air containing germs into the cavity; (*b*) the wounding of the intercostal vessels, the lung, or the diaphragm.

The presence of the fluid is diagnosed by—

1. *Dulness in percussion*, because air is more resonant than fluid. This dulness is always at the lowest part of the cavity, whatever position the patient may assume; fluid gravitating down, while a solid tumour would retain its position unaffected by the movements of the patient.

2. *Absence of respiratory sounds in auscultation*; the fluid interferes with the conduction of the breath sounds to the chest-wall.

3. *Bulging of the intercostal spaces.*

4. *Displacement of the viscera* towards the opposite side by pressure of the fluid.

The opening is generally made in the axillary line between the fifth and sixth ribs, close to the upper border of the sixth, because the larger intercostal vessel runs along the *lower* border of each rib If the opening be made lower down in the thorax there is a risk of wounding the diaphragm. The patient should be held sitting up at first, and lowered to a lying-down position as the fluid escapes.

FIG. 1.

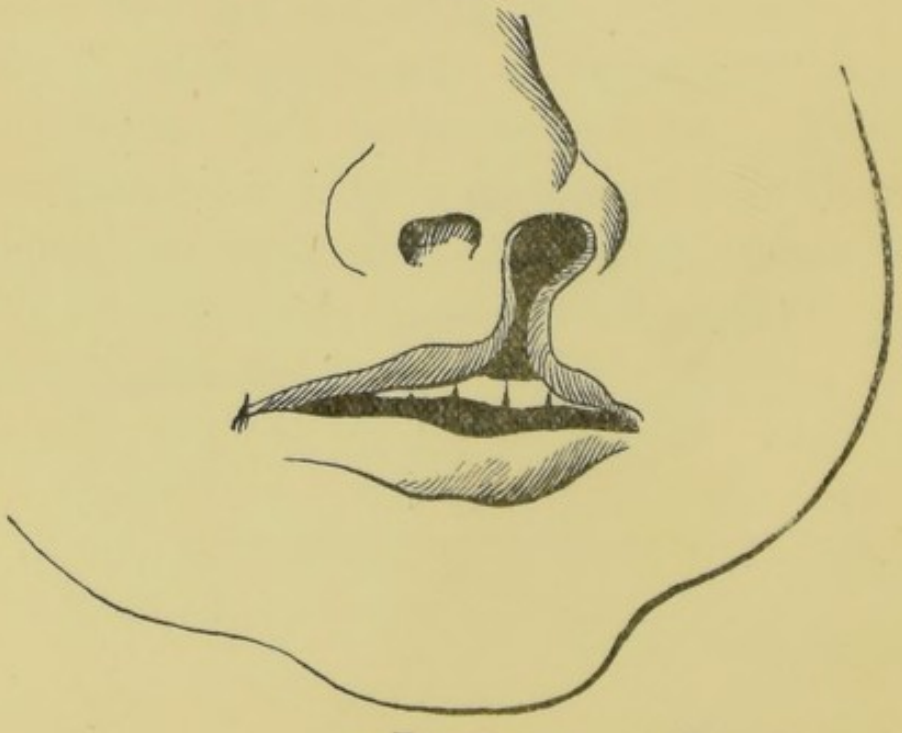


FIG. 2

[*To face p.* 135.]

CHAPTER X

DISEASES OF THE HEAD AND NECK.

Congenital Malformations.

Harelip is a congenital cleft through the upper lip; it may be *simple*, *double*, or *complicated*.

Simple harelip is a cleft on one side only (the left side usually), sometimes reaching to the nostril. The nostril is broader on the affected side.

Treatment.—In very simple cases all that is required is to pare the edges of the cleft and bring them together, fixing them in position with two harelip pins and a figure of 8 suture. Any adhesions between the lip and the jaw should be divided first. The pins should be passed close to the mucous membrane, for two reasons—first, in order that they may control the coronary artery which is just beneath the mucous membrane, and, secondly, that the *whole* thickness of the raw surfaces

should be in apposition, to ensure union through the entire thickness of the lip, as a partial union is apt to be torn asunder afterwards by the orbicularis muscle.

It is best to wait two or three months after birth before operating, to see that the child is healthy; sickly children should not be operated on till they have become stronger.

Anæsthetics do no harm, unless it be that the blood is more likely to get down the throat; it is quite easy to dispense with them. The child may sit in its nurse's arms, its head on the surgeon's knee. The bleeding can be controlled by an assistant holding the lips on each side. The sutures or pins should be kept in 48 hours, and then oiled and withdrawn, after which a few strips of plaister will suffice to keep the parts quiet. "The child should be put to the breast as soon as the operation is over."

If the gap be great there are more elaborate ways of dealing with the difficulty.

M. Clémot's operation is performed thus:—An incision is made through the thickness of the lip on each side, commencing half-way up the cleft, and continued outwards and downwards to within a quarter of an inch of the margin of the lip, as if intended to nearly cut the corners off; the free ends of these detached corners of lip are then drawn down till their points meet, thus completing the upper lip and leaving a diamond-shaped wound, which is sewn together.

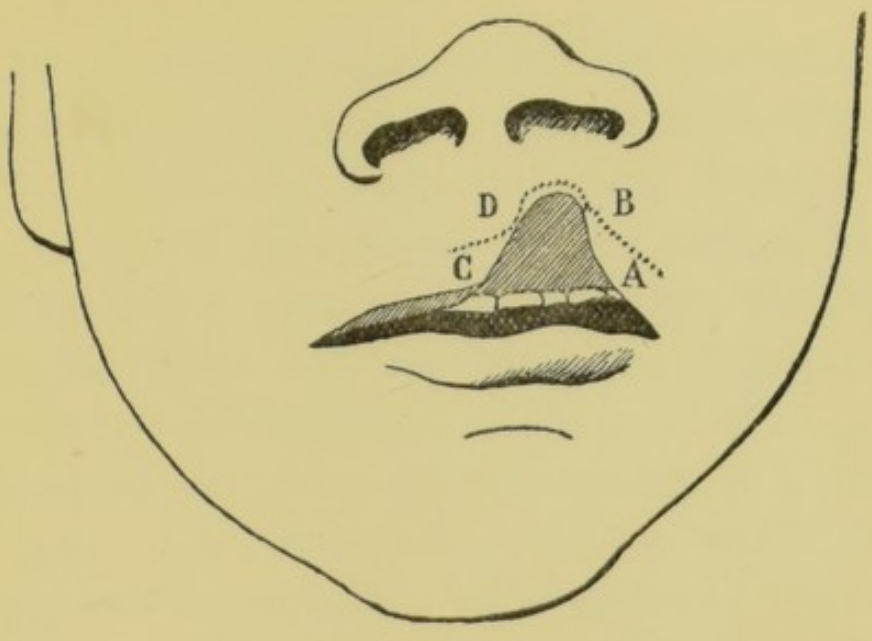


FIG. 3.

Explanation of Figs. 3 and 4.

Fig. 3.—The dotted line represents the line of the incision. Flaps A and C are drawn down till their points meet; a gaping wound is thus left on each side, between D and C on one side, and between B and A on the other; both together forming the diamond-shaped wound shown in Fig. 4.

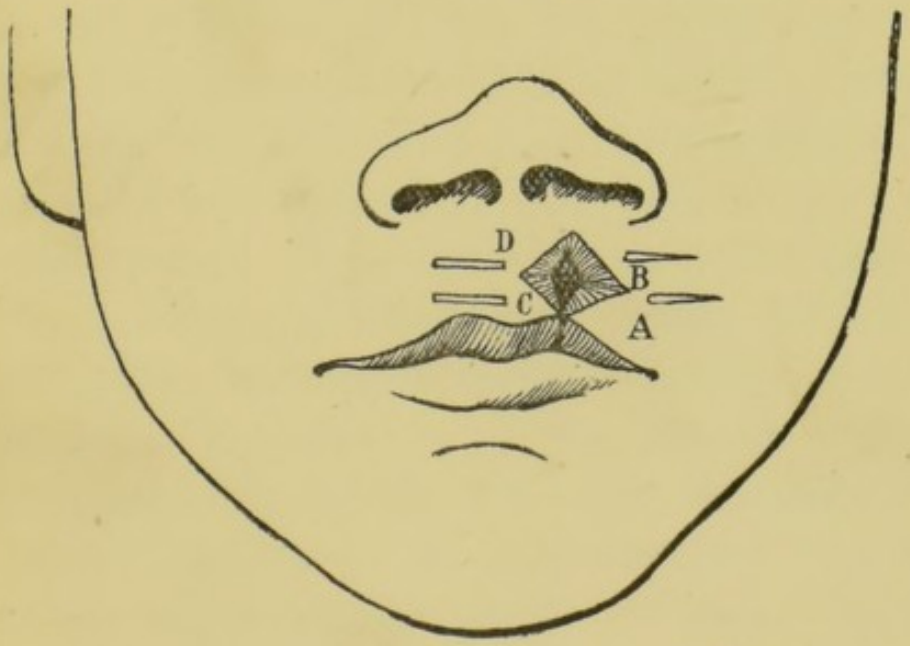


FIG. 4 [*To face p.* 136.]

M. Mirault thought this operation left too much protuberance where the cleft had been, and modified the operation thus:—He made the outer incision like Clémot's, but on the side nearest the median line he simply pared the edge, and, pulling down the flap on the outside of the cleft applied its raw surface to the raw surface of the pared edge on the inner side.

Uncomplicated Double Harelip consists of a cleft on each side of the intermaxillary bone, of which one or both may reach the nostril. It is dealt with by paring and applying the edges on both sides, but the deformity left is usually greater than in single harelip.

Complicated Harelip.—Harelip may be complicated with cleft palate. When this happens in double harelip the intermaxillary bone carrying the four incisor teeth often projects, and seems to hang from the septum nasi. If the cleft be on one side, but the gap be very extensive, Giraldes' operation should be performed. Incisions are made so as to leave the flap on one side attached by its lower end, and that on the other by its upper end. The flap attached by its lower end is pulled down, so that that portion of it which before formed the border of the cleft comes to form the border of the lip; while the opposite flap is pulled up so that its raw surface is adjusted to the raw surface of the first one, and the two are stitched together. The intermaxillary bone of it projecting very much is sometimes cut away. Its loss, however, gives an under-hung look, and it is best to save

it if possible. It may be broken away from the septum and pushed back between the maxillary bones. Blandin cut out a piece of the septum to render its reduction more easy. Langenbeck fastens the bone to the maxillæ with sutures, but it generally remains rather loose. It is, perhaps, best to extract the incisor teeth and fit a plate to the upper jaw to keep it firm. A Hainsby's truss is useful to keep the parts in apposition during the healing process.

Cleft Palate may exist with or without harelip. It may be confined to the soft palate; it may extend partly or completely through the hard palate. It causes a conspicuous and familiar defect in articulation, and allows the passage of fluids from the mouth into the nose.

Cleft of the Soft Palate only is easily dealt with; the edges of the velum are pared and brought together with waxed silk sutures; it is necessary to divide the muscles which produce lateral traction on the azygos uvulæ, to prevent them from tearing open the wound, particularly the levator palati. Sir W. Fergusson did this *before applying the sutures* with a rectangular knife, which he passed through the cleft, and then with a vertical incision cut all the muscles that produced any tension on the sides of the cleft; this is the best way of getting at the muscle. Mr. Pollock's plan is to divide the muscles from the front, the advantage being that it requires less dexterity and can be put off till after the sutures are applied. The sutures are passed in the

following manner :—On one side the needle is threaded double, so that it carries four threads through the palate ; the free ends are left in front of the palate while the looped end is carried right through, and freed from the needle when it emerges behind the palate, and the needle withdrawn, leaving the loop hanging towards the pharynx and the two free ends in the operator's hand. On the other side the needle is threaded single and freed as before, leaving one free end in the operator's hand ; the pharyngeal end of this latter suture is passed through the loop of the first, which is then drawn out through the hole it went in by carrying with it the pharyngeal end of the second suture ; the first suture is then removed, and the two ends of the second tied in a surgeon's knot. The mouth must be kept open by a suitable gag (Smith's gag is usually employed). The unavoidable constant sponging away of blood is the chief source of difficulty in this operation. The sutures can be removed after five or six days. Until union is effected, the food should, of course, be given in a fluid form.

Cleft of the Hard Palate.—There are two methods of dealing with this malformation, one of which goes by the name of Langenbeck, and the other by that of Sir W. Fergusson.

Langenbeck's Operation.—The edges of the cleft are pared ; an incision is then made on each side parallel to the cleft a sufficient distance from it, dividing everything down to the bone. The instrument is then passed in at

the lateral incision, and the strip of mucous membrane, between it and the edge of the cleft, *together with the periosteum* underlying it, is dissected free from the bone. This having been done in each side, the two resected flaps of mucous membrane and periosteum are united in the middle line by sutures: the cleft is thus covered in, and a raw place left on each side denuded of its periosteum; new bone is generally thrown up and fills the cleft, but if it is not, the tough mucous membrane forms an excellent covering for the cleft.

Fergusson's Operation.—The edges having been pared, holes are bored with a bradawl in a row (on each side of the cleft) through the bony palate. Sutures are then passed through these holes and loosely tied in front. An incision is next made on each side,* not only through the soft tissues, but through the bone also, and the two lateral masses of bone forced together in the middle line, and the sutures tied tight. This is a much more formidable operation than the other, but offers a greater certainty of a bony substitute for the gap.

Diseases of the Lips and Mouth.

Herpes is a common affection of the lips. It consists of an irruption of vesicles in small groups on slightly inflamed skin. The vesicles become pustular, break, the crusts fall off, and in a few days there is no trace left of

* This incision is made by boring a second row of holes outside the others and uniting them with a chisel.

their presence. It may be due to cold, dyspepsia, or no apparent cause.

The bowels should be opened, the diet regulated, and a mild mercurial ointment applied.

Fissures are often very obstinate and painful. If there be a constitutional cause, such as syphilis or struma it should be dealt with, and the fissure touched with nitrate of silver.

The upper lip is often enlarged in strumous young women, and this enlargement may be taken for a tumour.

Cancer of the lip is almost always found in the lower lip. It is usually epithelioma, often painless, and usually followed with secondary affection of the submaxillary glands if not removed soon enough. It should be removed as soon as seen ; the knife cutting wide of the disease.

Chancre of the lip is generally the result of lascivious practices. It is less warty and hard than cancer, the glands (lymphatic glands) are sooner affected than the submaxillary are in cancer. The appearance of "secondaries," and the effects of a course of mercury will clear up the diagnosis.

Stomatitis, or inflammation of the mucous membrane lining the mouth, is rather common in childhood. There are five recognised varieties :—

1. Simple stomatitis.
2. Thrush.
3. Follicular stomatitis.
4. Ulcerative stomatitis.
5. Gangrenous stomatitis.

Simple Stomatitis appears in little raised red patches, which may coalesce; sometimes the dead epithelium forms white patches over the red ones. There is some fever usually. Any irritation may cause it, as for instance, first dentition, or too stimulating food or drink. Attention to the bowels, and a chlorate of potash mouth-wash will be the best treatment.

Thrush resembles simple stomatitis at first, but there is a typical exudation soon thrown out over the inflamed patches, very adherent, and readily replaced if removed. It is contagious. On microscopical examination a fungus called the oidium albicans is found in the exudation. The surfaces should be touched with nitrate of silver, and an astringent mouth-wash given. Mr. Tomes advises sulphurous acid.

Follicular Stomatitis, also called aphthous. The mucous follicles of the mouth inflame and ulcerate. The ulcers are small, sharp-edged, and painful, and the surrounding tissue is inflamed. These are commonly situated under the tongue and round the frænum, or between the lips and gums. They generally yield to an aperient, and locally, nitrate of silver and an alum wash. Mr. Tomes recommends glacial carbolic acid in lint applied to the surface. This form of stomatitis is not confined to children.

Ulcerative Stomatitis begins usually near the edge of the gums in the lower jaw, whence it may spread all over the mouth. A point of gum becomes swollen and red,

and ulcerates deeply into the tissues. The surface of the ulcer is covered with a dirty white slough, under which are a few bright-red granulations. The edges are ragged, sharp, and overhanging, the surrounding tissues are congested, the lymphatic glands are often swollen. It usually attacks ill-nourished sickly children, and is sometimes very persistent.

The best treatment is three to five grains of chlorate of potash every four hours The bowels must be kept open, and nutritious food and tonics administered. Nitrate of silver applied locally will relieve the tenderness, and any teeth which cause irritation should be removed.

Gangrenous Stomatitis is a rapid phagedœnic ulceration of the cheek, due to great exhaustion of the vital powers. It usually follows some eruptive fever, and attacks ill-nourished children. The cheek becomes red and hard, a black spot appears, followed by ulceration and gangrene; the soft tissues and the bone are alike destroyed, and death usually ensues. It is analogous to noma vulvæ, a similar affection of the external organs of generation of little girls, due to dirt and neglect. As soon as seen, the diseased parts should be destroyed completely with fuming nitric acid or the actual cautery.

In this connection it will be as well to describe the effects of mercury, given internally, upon the gums, salivation, or ptyalism. A delicate red hue is seen along

the margin of the gum, followed by pulpy thickening of the parts between the teeth. The gum then becomes loose and movable, and retracts from the teeth. Then the secretion of saliva becomes increased in quantity and very thin, and the breath foul and fœtid.

In lead-poisoning also the appearance of the gums testifies to the condition; a thin blue line appears along the free margin of the gums, consisting of minute dots, and due to a deposition of lead on the mucous membrane. This is succeeded by colic and wrist-drop,* and pain in the muscles of the arm.

Ranula is a cyst in the floor of the mouth under the tongue. The cyst may be due to an obstruction of a salivary duct, or to an independent cyst forming. It may grow rather large and show underneath the jaw. A piece of the wall of the cyst should be cut out and the contents squeezed out, when it will generally heal up from the bottom. If obstinate, the inside may be touched with nitrate of silver. Sometimes pieces of salivary calculus are found obstructing the opening of Wharton's duct; they are easily removed.

Tonsillitis, inflammation of the tonsils, may be *acute* or *chronic*.

Acute tonsillitis or quinsy may be caused by exposure to cold, strumous and rheumatic persons being specially liable to it, and most so between puberty and 25.

* Wrist-drop is paralysis of those muscles supplied by the musculo-spiral nerve.

The symptoms are rapid swelling and redness of one tonsil, soreness in swallowing, tenderness at the side of the neck, increased flow of saliva, and nasal tone of voice. There is sharp fever. As the inflammation subsides in one tonsil the other becomes affected. It may end by resolution or suppuration.

During the first twenty-four hours gnaiacum and aconite given internally have a specific action in cutting short the disease; locally, hot fomentations outside and ice to suck. The inhalation of hot steam and a mustard emetic sometimes does good. As soon as fluctuation can be felt the abscess should be opened with a knife wrapped in lint nearly up to the point; the cut should be made *towards the middle line*, to escape any chance of wounding the carotid artery (which is just the other side of the constrictor muscle). The diet should not be lowering.

Chronic Enlargement of the Tonsil may be the result of repeated acute attacks, or it may depend on a scrofulous constitution. It is painless, but causes deafness, and snoring at night, due to a constant habit of keeping the mouth open to relieve the difficulty of breathing. This condition tends to produce a V-shaped jaw (see *Tomes' Surgery*).

General tonic treatment should be pursued; cod-liver oil, iron, bark, nutritious diet, and sea bathing.

Excision is the best local treatment. It may be performed with a blunt-pointed bistoury and a pair of

vulsellum forceps, or with a guillotine. It is not at all necessary to remove the whole tonsil. If the surface is freely removed the retained secretion is allowed to escape, and the swelling subsides.

Hypertrophy of the Uvula may cause great inconvenience, nausea, and spasmodic coughing. It is usually due to chronic catarrh or over-exertion of the voice. Local astringents (glycerine of tannin or solution of nitrate of silver) and tonic treatment generally reduces the trouble, but, if obstinate, the uvula may be snipped off with a pair of scissors.

Pharyngitis.—Acute inflammation of the pharynx may result from the spreading of neighbouring inflammation, as from the soft palate. It is often diffuse in character, and may result in purulent infiltration. The treatment is tonic and stimulant. If œdema or spasm of the glottis should endanger breathing power, laryngotomy may be performed.

Chronic Pharyngitis, or "granular pharynx," or "clergyman's sore throat," is a distension and thickening of the mucous glands of the pharynx. The diseased glands must be destroyed with nitrate of silver.

Post Pharyngeal Abscess, an abscess in the cellular tissue behind the pharynx, usually idiopathic, but sometimes due to disease of the vertebræ. The symptoms are difficulty in breathing and swallowing, and a nasal voice. The abscess may be seen and felt from the mouth, and should be opened at once.

Diseases of the Tongue.

Tongue-tie is very common, and may cause some impediment to sucking. The edge of the frænum may be nicked with a knife, and the rest of the obstruction torn through. This method precludes the possibility of wounding the ranine artery.

Ulcers.—There are four kinds of ulcer of the tongue:—

1. Irritable;
2. Dyspeptic;
3. Syphilitic;
4. Cancerous (epithelioma).

1. Irritable ulcers are generally caused by some rough edge of a tooth, which should be filed down. They are very painful, but are distinguished from cancer by the fact that they are multiple and the absence of induration.

A brisk purge, nitrate of silver to the spot, and removal of the source of irritation, will do all that is necessary.

2. The dyspeptic ulcer is the result of psoriasis, due to dyspepsia. It is usually in the middle of the tongue (unlike cancer), and there is no induration. The treatment must be directed to the indigestion.

3. The syphilitic ulcer greatly resembles cancer. It has raised edges and a sloughing surface. The diagnosis greatly depends on the history and the effects of treatment (mercury, &c.). There is not so much indu-

ration, the glands are less likely to be affected, as the syphilis is most likely tertiary, but if the glands are affected they will be the chain of lymph-glands along the edge of the trapezius in syphilis, the submaxillary in cancer.

4. The cancerous ulcer is usually at the side of the tongue. There is a hard deposit at the base spreading into the tongue, with acute pain, salivation and cachexia. If the glands or palate be greatly affected, nothing can be done. Short of this, the disease must be removed as completely as possible, though it will most likely recur.

If a small portion of the tongue only requires to be removed, a clamp and a pair of scissors will effect the operation. After the piece has been cut away the vessels are tied and the clamp removed.

Larger pieces may be removed with the écraseur.

Removal of the whole tongue may be effected in a variety of ways, the most effectual of which is, perhaps, by division of the symphysis of the lower jaw.

An incision is made in the middle line dividing the soft tissues from the lip to the hyoid bone. The jaw is then sawn through at the symphysis, and the muscles connecting it with the tongue cut through on each side; the tongue is then pulled forward and cut away from the hyoid bone, the lingual artery being tied, and any other vessels that may be bleeding. The bleeding having been stopped, the jaw is united by silver wires

passed through holes drilled on each side, the wound united with sutures, and the patient kept under morphia and fed by the rectum. After this operation, however extensive, the patient still retains the power of speech to a certain extent.

Another method is to force the écraseur into the mouth through a hole under the lower jaw. The gustatory nerve has been divided to relieve the pain of cancer. This is accomplished by an incision from the last molar tooth to the angle of the jaw, taking care to cut right down to the bone. The lingual artery has been tied, with a view to deprive the growth of nutrition and stop the hæmorrhage, but with doubtful success.

Besides the ulcer already alluded to, there are other syphilitic affections of the tongue; mucous tubercles, a secondary symptom, superficial secondary ulcers and fissures, which are very painful, and spread from the mouth and cheeks and leave white scars; Gummata generally about the septum; these are masses of tissue resembling granulation tissue, which often break down into ulcers, they are tertiary symptoms; a heaping up of dead epithelium called psoriasis.

Glossitis.—Acute inflammation of the tongue, caused sometimes by injuries or mercurial poisoning, sometimes without apparent cause. The swelling often causes great difficulty in breathing. Free incisions relieve this condition, care being taken not to wound the lingual artery, which is sometimes forced up towards

the dorsum of the tongue. For the rest astringent mouth washes (alum gr. v.—℥j &c.) and supporting diet are indicated.

Abscesses may be found in the tongue, and should be treated in the usual way.

Macroglossia, or congenital hypertrophy of the tongue, may require a plastic operation for removal of the central part of the tongue, a simple and successful operation.

Diseases of the Larynx.

These more strictly belong to the province of the physician, but the assistance of the surgeon is sometimes required.

Acute laryngitis is always dangerous and often fatal. It may be due to cold (catarrhal), to any of the eruptive fevers, as scarlet fever and small-pox, or to erysipelas, croup, or diphtheria. It begins with sore-throat and general fever, difficulty of inspiration, and cough. If spasm of the glottis takes place, death may rapidly ensue, with all the phenomena of asphyxia; or gradual suffocation, preceded by coma, may terminate the attack. Scarification of the congested parts, and small and frequent doses of antimony and aconite, and the inhalation of hot steam, are the best treatment. Prompt and early laryngotomy may save the patient's life. In laryngitis of fevers neither the scarification nor the

depressing drugs should be employed, but in these and in the erysipelatous variety prompt tracheotomy may save the patient's life by averting suffocation.

Croup begins with fever and metallic cough, dyspnœa, cough, and expectoration. The trachea often becomes involved, and the child dies of asphyxia. The larynx is at first coated with a fibrous exudation or "false membrane," which afterwards, if not checked, extends down the trachea or bronchi to the lungs. At first emetics, antimony, and leeches to the chest, soothing liniments to the throat, and a warm moist atmosphere may arrest the disease. Later, when breathing becomes very difficult, tracheotomy is the only chance. Mr. Holmes prefers the high operation, as more practicable in children.

Laryngismus Stridulus is a spasm of the glottis leading to "crowing" inspirations, without fever or exudation; the knife and depressants should be avoided Chloroform during the spasm, or even a warm bath is all that is needed.

Chronic Laryngitis may be due to tubercle or to secondary or tertiary syphilis Such constitutional affections must be treated constitutionally. If accompanied by painful dyspnœa, tracheotomy may relieve this condition. The most common symptom is hoarseness of voice. Sometimes the mucous follicles are chronically inflamed in clergymen and singers, and those who over-exert their voices. Various astringents,

attention to the general health, and rest to the over-used organs constitute the line of treatment.

Tumours of the Larynx are mostly warts or papillomata; fibrous, and even sarcomatous, growths do occur. Epithelioma and encephaloid cancer also affect the larynx sometimes. The symptoms of any tumour of the larynx are at first hoarseness and cough, and afterwards dyspnœa, which of course increases with the growth. The exact diagnosis can be made with a laryngoscope, the rough principle of which is, that the surgeon has a round mirror about two inches diameter on his forehead, he holds a mouth-mirror over the upper aperture of the patient's larynx; by means of the mirror on his own forehead he reflects the light of a lamp on to the mouth-mirror, which in turn illuminates and reflects the larynx.

The danger of suffocation may be averted by tracheotomy, and the tumour may generally be removed or destroyed with an escharotic from the mouth.

When the windpipe is opened by the surgeon to prevent suffocation, he has the choice of three situations for making his cut:—

1. Between the thyroid and cricoid cartilages (laryngotomy).
2. Above the isthmus of the thyroid body; laryngotracheotomy, or the "high operation."
3. Below the isthmus; tracheotomy proper, or the "low operation."

Laryngotomy is the easiest and quickest, wherefore it is chosen in cases of instant emergency, as sudden choking at table.

If the cut is fairly in the middle line no accident can happen; the skin and fascia and the cricothyroid membrane are all that is cut, the tube follows the knife, and there is hardly any bleeding to speak of. It answers the purpose in all cases where the mischief does not extend below the vocal cords, as spasm of the glottis, or a foreign body stuck in the glottis.

Laryngo-tracheotomy.—Incision through the soft parts from the bottom of the thyroid cartilage to three-quarters of an inch below the cricoid, in the middle line, between the sterno-hyoid muscles; the knife is then entered just above the isthmus (with the cutting edge upwards and the back to the isthmus), and with an upward cut the two upper rings of the trachea and the cricoid cartilage divided.

This incision is chosen in children, as the shortness and thickness of their necks and the smallness of their windpipes render the deeper operation dangerous.

Tracheotomy.—Incision through the soft parts one and a half to two inches long, from the cricoid cartilage downwards. The sterno-thyroid muscles must be separated and held apart with hooks, and any bleeding vessel tied. The three rings of the trachea below the isthmus are cut through (cutting from below upwards).

The great thing in all these operations is to keep in

the middle line, to keep the head steady and well back, to stop the bleeding before opening the windpipe. It is hardly necessary to point out that the tracheal end of the tube should point *downwards*; the other end of the tube should be secured with tape.

Diseases of the Parotid Gland.

Mumps, or parotitis, is a fever which is always attended with acute inflammation of the parotid gland, generally spreading to the submaxillary and sublingual. It attacks first one side and then the other, and sometimes secondarily affects the testicle or the female breast. The gland swells and movement of the jaw becomes painful; the deformity caused by the swelling is familiar to most. It may arise from infection or from cold and damp, and generally subsides without suppuration.

Warm fomentations and poultices, saline aperients, and afterwards tonics, constitute the treatment.

Glandular Parotid Tumour consists of hypertrophied gland-tissue and fibrous tissue, and sometimes cartilage and cysts. It is generally an affection of the lymphatic glands in and around the parotid, rather than of the parotid itself. It may affect hearing and mastication, and cause facial paralysis by pressure on the portio dura.

All that can be done is to remove it, and this, considering the important vessels and nerves in the parotid gland, is excessively dangerous.

Other tumours occur here, but do not present any peculiarities.

The diagnosis of any of these tumours from mumps depends upon the febrile symptoms and inflammatory nature of the latter disease.

CHAPTER XI.

VENEREAL DISEASES.

Two diseases result from sexual intercourse—gonorrhœa and syphilis.

Gonorrhœa may be divided into four stages :—

1. Premonitory.
2. Inflammatory.
3. Decline.
4. Gleet.

Premonitory.—Usually a few days after sexual intercourse a little itching is felt round the corona glandis, and the lips of the meatus are seen to be swollen and red.

Inflammatory.—This stage is attended by inflammation of the meatus, a thick purulent discharge, scalding in making water, painful erection at night and sometimes chordee (a curved erection owing to an effusion of

lymph into the corpus spongiosum); this stage lasts from one to three weeks.

Decline.—The painful symptoms subside, the discharge ceases to be purulent and becomes simply mucous, and either disappears or passes into the stage of gleet.

Gleet is the continuation of the discharge in a thin watery form.

Complications.—The prepuce may share in the inflammation and become so swollen that it cannot be retracted (phimosis), or if forcibly retracted may continue to swell till it cannot be returned to its ordinary position (paraphimosis); the inguinal glands may inflame (bubo); inflammation of the testicle, or orchitis, may supervene.

Gonorrhœa may follow sexual intercourse with women who are suffering from the disease, or who have leucorrhœa, or who are menstruating, in fact any irritating discharge in the female passage may inflame the male urethra.

Treatment.—The great mistake is to make the treatment too active; purging, complete rest, low diet, and abstinence from all stimulants, are the main indications. Injections of tepid water with a little Condy's fluid in it, and frequent ablutions of the parts, do much to assist the cure. During the decline copaiba is much relied on as a specific drug, but it frequently does more harm than good.

The treatment of gleet consists in the administration of tonics, the passing of bougies, and the injection of astringents.

There are many difficulties and complications that often render the treatment of gonorrhœa most difficult, but the subject lies so completely beyond the province of the dental surgeon that I feel justified in omitting all details.

Syphilis.

Syphilis is divided into two varieties :—

1. *The Chancroid*, or soft non-infecting sore, a purely local disturbance entailing no constitutional sequelæ.
2. *The Hunterian or Hard Chancre*, followed by a constitutional infecting disease.

The soft sore appears a few days after connection as if a small piece of skin had been punched out; there may be more than one sore; it may heal in three or four weeks, with no affection of the lymphatic glands, or it may be attended with a soft suppurating bubo. With regard to this sore, rest, simple diet, slight purging, and the constant application of iodoform is all that need be done.

The hard or Hunterian chancre is the true syphilitic lesion. It is a constitutional disorder and is followed by the sequelæ called "secondaries" and "tertiaries."

The sore appears between a week and six weeks after

connection, usually about three weeks, either as a small vesicle which cracks and forms an ulcer, or as a little pimple, or as an abrasion. A very common site is close by the frœnum.

The characteristics of the sore are the hardness of its base, which feels as if a little piece of cardboard had been slipped in under it; the absence of pus from the secretion; and Mr. Holmes points out that the character of the accompanying bubo is perhaps the most reliable sign of all, it is hard like a bullet, affects several glands, and is indolent and will not suppurate; while the bubo of chancroid is soft, irritable, suppurating, generally affecting only one gland.

It is often, however, almost impossible to decide upon the nature of a sore until the appearance, or non-appearance, of secondaries within the prescribed time (about six months) shall have settled the question.

The reasons why the diagnosis is often difficult are:—

1. The true hard chancre may be covered with a soft one, and so escape observation.

2. The hard sore may be caused to suppurate by some irritation.

3. A certain amount of inflammatory deposit around a soft sore may give it a puzzling likeness to a hard one.

4. Infecting sores have been observed in which there has been no induration.

Treatment of Hard Chancre.—There is a good deal of dispute about when it is advisable to administer mercury, but I think it is the general opinion that this drug is a sovereign remedy against syphilis, and that if given promptly and thoroughly it may eradicate the disease and prevent the occurrence of secondary or tertiary symptoms. Mr. Holmes considers the mildest and least irritating form of administering the drug is three to five grains of blue pill twice a day, combined with quarter to half a grain of powdered opium to prevent the irritation of the bowels. This should be continued until the sore is quite gone and the bubos have lost all hardness, from five to seven weeks.

The mercury, if pushed too far, tends to produce ptyalism, or salivation, that is a profuse flow of saliva, foulness of the breath, spongy swelling of the gums and periostitis causing looseness and tenderness of the teeth.

The first sign of this state is a coppery taste in the mouth and a blue line along the gums, and directly this is noticed the drug should be diminished, as all that is necessary is to keep the patient slightly under its influence. Loss of weight and loss of appetite, and depression of spirits usually follow the prolonged use of mercury.

Mercury is also administered by inunction or fumigation.

Secondaries.—At any time during the first six months

that follow the appearance of the chancre (usually about six weeks after the chancre), what are called secondary symptoms may set in, and their appearance proves that the attack was one of true infecting syphilis. Sometimes this second demonstration is preceded by feverish symptoms. The "secondaries" consist of a sore throat, due to ulceration of the tonsils, or velum palati, or pharynx, or tongue; skin eruptions, usually a rosy rash; mucous tubercles, or flat raised oval patches found where the skin joins the mucous membranes, *i.e.* the lips, mouth, the anus, and the vulva; warts, or condylomata; baldness, or alopecia. These are the commonest forms. There are many other rarer demonstrations of the taint which must be passed over.

Secondary syphilis is highly inoculable, and probably is the commonest source of infection.

Treatment.—There is no doubt at all about mercury being the indication here, but the course must be kept up for a longer time and so must the patient's health. The fumigation of the ulcers, or covering them with powdered calomel, will cause them to disappear rapidly when combined with a mild internal course of mercury. When the state of the patient is very low, or the suppuration extreme, mercury is contra-indicated and iodide of potassium may be given instead, the best results generally following large doses. I have frequently seen gr. xxx three times a day produce no unpleasant results.

Tertiaries.—After an interval of immunity varying from months to years, or following the "secondaries" with no interval at all, the tertiary or gummatous symptoms set in. These consist generally in the ulceration and destruction of the deeper structures, such as the bones, &c., and the formation of gummata. A gumma is a mass of tissue resembling granulation tissue, which suppurates, breaks down, and ulcerates its way through any tissue to any depth. Any part of the body may be affected, and to almost any extent. In the museum of the College of Surgeons, there is a collection of bones riddled and worm-eaten by syphilis, which amply testifies to the extent of its ravages.

The treatment must be the same as before, excepting that, as Mr. Holmes points out, the lengthened period during which the mercury must be continued (from six months to a year), makes it necessary to use the mildest preparation and in the most moderate doses, with periodical intermissions and frequent changes of form.

Congenital Syphilis.—This is a constitutional form transmitted to the child in the womb "through the blood of the mother, or the semen of the father, or both" (Holmes). It resembles "secondaries" without the previous chancre, and its chief feature is persistent coryza (snuffles), a rosy or brownish rash, mucous tubercles in the lips, mouth, vulva, or anus, and a worn, thin appearance.

The earlier children are more deeply tainted than the

later ones, as the disease seems to become milder and wear itself out.

The common irruptions due to dirt and neglect must not be confused with syphilitic eruptions; the latter are present in the soles and palms and cheeks, while the results of dirt are generally in the folds of the skin about the pudenda, thighs, and perinæum generally.

The syphilitic teeth, with which dentists are so familiar, are fully described in Tomes' dental surgery; they are the result of stomatitis, and are always permanent teeth.

Tertiary symptoms occur in congenital syphilis, attended often with considerable destruction of tissue.

A course of mercury is the only treatment. Mr. Holmes advises that it should not be given by the mouth, and recommends that the child should wear a piece of flannel wrapt round its arm smeared with ung: hydrrg:

The preceding remarks are very slight, but upon such an extensive subject, about which so much has been written, nothing but the most superficial notice can be given in these notes.

CHAPTER XII.

INJURIES AND DISEASES OF NERVES.

NERVES are subject to the same injuries as other tissues; they may be bruised, cut, torn, irritated, or pressed upon. They may also be inflamed, and they may be the seat of growths which are not inflammatory (neuromata).

The results of any interference with a nerve are such as might be expected from a consideration of the normal functions thereof.

If the nerve be completely divided, or sufficiently compressed or bruised, it is obvious that its connection with the brain will be cut off at that point, and in the case of a sensory nerve, the tract beyond the lesion will no longer be able to communicate its sensations to the brain, which will therefore remain ignorant of them. This state is called "loss of sensation," or "anæsthesia."

If the nerve be motor, the brain will no longer be able to excite contraction in the muscles supplied by that nerve beyond the point of injury; this is called "paralysis," or loss of motor power. If the nerve be mixed, that is, contain both sensory and motor fibres, of course both powers will be lost, and the parts beyond the injury will become both senseless and powerless.

Again, the nervous tract may be injured, not in its course, but at its end or periphery. The injury may be transient and cause no further disturbance than a transient or momentary pain, as when the exposed nerve of a tooth is touched with a probe; or it may be sufficiently prolonged to cause inflammation of the neighbouring nerve tract (neuritis), as when continuous exposure of the nerve to cold air or water causes toothache, which subsides when the irritation is removed by a protecting stopping.

Again, the irritation may be sufficiently excessive and prolonged to cause the inflammation to proceed from one nerve-tract to another, as, for instance, when neuritis, commencing in the inferior dental nerve, involves one after another the second and first divisions of the fifth nerve, demonstrating its presence whenever a branch emerges from a bony canal, as at the infra orbital, supra orbital, and mental foramina, and the point where the subcutaneus malæ issues from the malar bone; this is true neuralgia (Trousseau). The cause of the localisation of the pain is very likely that

compressed inflammation is always more painful than inflammation where expansion is easy (compare the pain of whitlow with that of superficial abscess in loose connective tissue).

Lastly, the mischief may spread still further, and involve the whole nervous system, as when a peripheral irritation, even when apparently slight in itself, results in tetanus, epilepsy, or chorea. In such cases, though the injury appeared slight, the nerve itself must have been exposed to prolonged irritation.

Of course the degree of evil result depends not only on the extent of the injury to the nervous system, but also upon the state of the nervous system when it receives the injury. If the education, physical or mental, of an individual be of such a kind as to render his or her nervous system abnormally excitable, the secondary results of an injury to it will be proportionally great. Much has been said upon this point by Dr. Erb (*Zeimsen's Cyclop.*), and by no means too much. We are certainly only on the threshold of a knowledge of diseases of the nervous system, and perhaps do not think enough of the importance of such elements as overwork and unwholesome trains of thought in the production of a liability to such disorders. Dr. Erb certainly puts this matter in a very clear light. Furthermore it is necessary to add that a proper working of the nervous system is as dependent upon a healthy state of the alimentary tract as any other

function of the body; one function in fact depends greatly upon another, and if an individual's digestion be deranged, bowels constipated, or if the menstrual function be out of order, or the urinary tract is not doing its work, all or any of these states may result in neuralgia. In fact, the constitutional or predisposing causes of neuralgia are just as important as the local exciting ones. It is not uncommon for syphilitic enlargements to form round and encircle a nerve, giving rise to neuralgia, anæsthesia, or paralysis that will only disappear under syphilitic treatment. Nervous affections are very common among the sequelæ of syphilis, so that this possible cause should not be overlooked, especially in an individual whom mental anxiety or sexual excesses shall have predisposed to nervous disorders. Nodules of secondary dentine forming in the pulp cavity of a tooth and dental exostoses often give no other sign of their presence than acute and obstinate neuralgia, and the irritation caused by a pivoted tooth has been known to produce tetanus.

Whether the irritation be mechanical or the result of disease, it is none the less an irritation, and I think the general opinion is that there is really no such thing as idiopathic neuralgia or idiopathic tetanus, this word idiopathic having been used simply in obscure cases where the irritating cause had escaped observation.

If the lesion has produced no effects beyond the branch which has been injured, and no other branches

are implicated, as in the case of an ordinary toothache, the removal of the irritating cause will probably be attended with a subsidence of the pain. It is not generally very difficult to discover the cause in such a case; anything pressing on the periphery of the nerve, any stopping which conducts sensations of heat and cold to the nerve, the absence of a stopping leaving a nerve wholly unprotected. An enumeration of the possible causes of each disturbance would be endless and, I think, useless.

When the irritation involves other nerves besides the one first injured, the case is one of neuralgia.

The symptoms of neuralgia are very simple. The nature of the pain is the great guide; it is variously described as shooting, stabbing, lancinating, &c. It is intermittent, that is, while the irritation is continuously present the pain is not continuous but periodic, and when the irritation has been removed the pain may continue for some time. In these two respects it differs, as has been pointed out, from exaggerated common sensation.

The locality of the pain is also a sign: it always appears in the course of some known nerve. The neuralgia of the fifth nerve, or tic douloureux, affords a good example of this, and it is the most familiar form of neuralgia to dentists. The pain maps out with more or less completeness the distribution of the fifth nerve, appearing at the supra-orbital notch, the

infra-orbital foramen, the mental foramen, and the foramen on the malar bone, which transmits the terminal branches of the temporo-orbital branch of the second division.

Not much is known about the pathology of neuralgia. Whenever any changes have been observed they have been those of inflammation, viz. swelling, hyperœmia, inflammatory exudation, and thickening of the neurilemma, dilatation and tortuosity of the vessels, and adhesions between the nerves and the surrounding tissues. These appearances have led some observers (Erb) to suggest that neuralgia is always due to neuritis, which neuritis is, however, often so transient as to leave no traces of its presence.

Accompanying the pain, Dr. Lauder Brunton has pointed out that there is pretty constantly a state of vascular colic, or tension in one place and relaxation in another of the vessels, and Trousseau and Nussbaum have tied the carotid for facial neuralgia with very good results.

Treatment.—The first thing is to discover, if possible, the exciting cause, and remove it. This cause is very often a carious tooth, or even a tooth apparently healthy, with an exostosed fang or a nodule of abnormal dentine in its pulp cavity.

After the removal of the cause the bowels must be regulated, a brisk purge having not unfrequently dispelled the neuralgia by itself. Any of the constitutional

or mental causes should be attended to. Lastly, various drugs have a very powerful effect.

Arsenic Dr. Erb thinks the best, in Fowler's solution from three to ten drops several times a day (Dr. Erb, vide *Ziemsen's Cyclopedia*; quinine from three to eight grains of sulphate three times a day; chloral and croton chloral hydrate; chloride of ammonium, ten grains every hour; morphia injection and opium. As local applications, cantharidine liniments, leeches, blisters, acupuncture, cautery, and galvanism.

In cases which defy all therapeutic agents, the nerve may be divided (neurotomy), a piece cut out (neurectomy), or it may be stretched. Many wonderful and complete cures of the most terrible cases have resulted from all these operations, and not a few failures. For further details about these operations I would refer the reader to a memoir by M. Létiévant upon neurotomy, and M. Blum upon nerve-stretching.

One more word remains to be said, touching hysteria. This mysterious disorder is less understood and more difficult to discuss than almost any other. It mimics almost all diseases in turn. The diagnosis of hysterical disorders generally depends on their inconsistency, upon the absence of visible causes, and the presence of emotional ones, the age and sex of the patient, young females being most commonly the subjects. Such patients often give a great deal of trouble during the administration of anæsthetics, but a little firmness and

common sense on the part of the operator will generally be sufficient for the emergency.

Nervous disorders, especially with reference to their possible dental causes, have been frequently and very fully discussed at the Odontological Society's meetings during the last year (1879–80), and much new and interesting observation may be gleaned from a reference to the "transactions" during that period.

CHAPTER XIII.

ANÆSTHETICS.

Anæsthetics and Asphyxia.

The pain and shock attendant upon an operation are now-a-days obviated by the administration of anæsthetics. The patient is caused to inhale a vapour which robs him, first of consciousness, then of voluntary motion, and lastly of involuntary (or reflex) motion, thus depriving him of the power of feeling the pain incidental to the operation, and also by his struggles interfering with the surgeon. At the same time the vital centres in the medulla oblongata, which preside over respiration and the heart's action, are not interfered with, so that up to a certain point life is not endangered.

The anæsthetics most commonly in use are chloroform, sulphuric ether, nitrous oxide gas, bichloride of

methylene, and lately dichloride of ethydene (for particulars of the latter see Mr. Clover's lecture published in the *British Medical Journal*, May 1880).

Chloroform is the anæsthetic most in use and most suited to *long* operations. Its use in dental operations has been superseded of late years by gas and ether, for reasons that will be stated hereafter.

Chloroform causes suspension of the functions of the nervous centres, first of the brain, then of the spinal cord, and lastly, if pushed too far, of the medulla. This sedative action is preceded by a period of excitement, of more or less length and severity, attended by struggling and twitching, and sometimes incoherent singing and talking. The stage of anæsthesia follows, during which the patient is profoundly insensible, with contracted pupils. The brain is anæmic, the heart's action depressed, the pulse slower, and the arterial tension lowered, the respiration deep and slow. Lastly comes the stage of narcosis, evidenced by a congested face, dilated pupils and stertorous breathing, reduction of the temperature, and final paralysis of the respiratory centre.

Chloroform may cause death by interfering either with the heart's action or with respiration. Its effects upon the heart have been much overrated; valvular disease does not counter-indicate its administration, but fatty degeneration renders it dangerous. Dr. Brunton has shown that the danger to the heart lies in operating

before the patient has fully reached the stage of anæsthesia. It may cause death from asphyxia in three ways:—

During the *first stage* by mechanical obstruction of the wind-pipe, owing to the falling back of the tongue. This danger is removed by pulling the tongue forwards by a pair of forceps.

During the *second stage* by approximation of the arytenoid cartilages towards the epiglottis. This accident may also be remedied, as Professor Lister has shown, by forcibly pulling forward the tongue against the teeth with sharp-toothed forceps, which proceeding will induce a reflex contraction of the paralysed muscles.

The rationale of this proceeding is not quite understood, but its practical results are obvious. All that is certain about it is, that the relief is *not* due to mechanical raising of the base of the tongue, as this may remain unmoved.

During the *last stage* by paralysis of the respiratory centre; this can only be met by artificial respiration. Galvanic stimulation of the phrenic nerve has produced successful results in apparently hopeless cases.

Artificial respiration, and turning the patient upside down, should always be tried.

Mode of Administration.—Mr. Clover's bag is no doubt the most perfect apparatus there is for ensuring the greatest immunity from risk, and the most complete anæsthesia. Mr. Clover considers that more than five

per cent. of chloroform to ninety-five of atmospheric air is dangerous; three per cent. is quite enough.

Failing Clover's apparatus, the simplest and safest way of giving chloroform is on a piece of lint held a little way from the patient's nose and mouth and gradually approached to it. The stage of anæsthesia is announced by insensibility of the conjunctiva to touch. The patient should never be in a sitting position. All constrictions round the neck and waist should be removed. No food should be taken for two or three hours before the operation. Age has no influence on the effects of chloroform. It may be well to add that as experience on the part of the administrator is the only element that can ensure the best chance of safety to the patient, it is strongly urged that only those who specially devote themselves to this branch of surgery should be trusted to administer anæsthetics; and that no proceeding can be more deprecated than that dentists should both administer the anæsthetic and perform the operation themselves, as it is quite impossible to attend properly to both departments at once, and the patient's life is exposed to unnecessary risk thereby.

Ether is more suitable for dental operations that are likely to be rather long. Mr. Clover frequently combines the ether with nitrous oxide. The after-effects are much slighter and of shorter duration than those of chloroform. It increases the arterial tension, and acts as a tonic to the heart, therein differing from chloro-

form It involves the nerve centres in the following order :—

1. Cerebrum.
2. Sensory centres of the cord.
3. Motor centres of the cord.
4. Sensory centres of the medulla.
5. Motor centres of the medulla.

The heart continues to pulsate after the arrest of breathing. The smell of the drug is rather disagreeable.

Nitrous Oxide Gas.—This anæsthetic is the best for very brief operations. The anæsthetic is very quickly induced, and the recovery is almost immediate. The air is absolutely excluded, as when mixed with air nitrous oxide induces a peculiar state of excitement that earned for it the vulgar name of laughing-gas. The insensibility though brief is very perfect, and is attended with a very marked lividity and expansion of the nostrils. The insensibility is due to a condition of modified asphyxia, as during narcosis only two-thirds of the normal amount of carbonic acid gas is given off, and immediately after recovery only one-third.

Asphyxia.—The symptoms of asphyxia are—strong contractions of all the respiratory muscles, accompanied by stertorous breathing, the heart's action becomes faint and the pulse imperceptible, the face livid and turgescent and the eye-balls seem to protrude from their sockets. These phenomena are due to the circulation of venous

blood through the nervous centres. The right side of the heart is distended, the left comparatively empty.

Cardiac syncope occurs suddenly ; the patient becomes pale and faint, the pulse and heart cease, though respiration may continue.

Coma resemples asphyxia without the failure of the heart's action ; lividity, stertorous breathing, and convulsions. This takes place in cases of epilepsy and kidney disease.

Treatment of an Overdose of Anæsthetic.

1. Discontinue the anæsthetic.
2. Open windows and keep away bystanders.
3. See that the patient's head is not higher than his body.
4. Forcible traction on the tongue.
5. Bare the chest and flip it with a wet towel.
6. Artificial respiration, rhythmic compression of the thorax, and raising and lowering of the arms.
7. Galvanism ; one pole of the battery applied to the spinous process of the upper cervical vertebra, the other over the heart.
8. Turning the patient upside down.

These attempts should be continued perseveringly even after the patient is apparently dead.

CHAPTER XIV.

CONCLUSION.

I FEEL that a few explanations are necessary to those who may read this book, as to why I have omitted so much that I might have said, and still further why, seeing that there is scarcely anything contained in it which cannot be found elsewhere, I should have ever written it at all. The reason is very simple: Having been engaged for some time in the preparation of candidates for the various examinations for the L.D.S. diploma, I have found that, while I could refer them to excellent handbooks, neither too long nor too short, upon all the other departments of their study, I could discover no book on general surgery which did not give a great deal too much information for their requirements or the time at their disposal. Each candidate had to search amongst lengthy works, reading a little here and

there of each, and as the time at the disposal of a future L.D.S. for preparing himself is limited, it was a serious difficulty. I have therefore attempted to collect from current authorities such information upon the subject as I hoped might enable them to avoid dangerous ground in practice, and to be able to give a fair account of themselves at the examination. The book, if book it can be called, does not pretend to add anything to literature, beyond a convenient collation for dental students. If the little that it does say is intelligible, it will be no small matter for self-gratulation to the author. If it enables those for whom it is written to learn what they want without learning a great deal of other matter which, the examination over, they will straightway proceed to forget, it will succeed beyond my expectations. I have followed such unquestionably standard authorities, that what statements it contains are true. The pathology comes in the main from Bilroth and Green, the general surgery from Holmes, Gant, and Erichsen.

It is too small to require either preface or apology, and must either serve its purpose or be of no use whatever. It must, in fact, submit to the test implied in the old proverb, that "the proof the pudding is in the eating."

A. S. U.

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APPENDIX.

VOBEDIX

APPENDIX.

EXAM. PAPERS GIVEN AT LONDON COLL. SURG.

JUNE 1872.

Dental Anatomy.

1. What are the specific characters of cell nuclei in the formative organs respectively of dentine, enamel, and cementum ?
2. Describe anatomical condition of lower jaw in relation to teeth, both temporary and permanent, in a child of five years of age.
3. In what direction does calcification take place in dentine, enamel and cementum ?

Dental Surgery.

1. What symptoms, local and general, would lead you to diagnose between inflammation of pulp and inflammation of the investing membrane of a root or roots of the teeth ?
2. What condition gives rise to chronic closure of jaws ? how would you treat such closure and the condition giving rise to it ?
3. Describe casts.

JANUARY 1873.

Dental Anatomy.

1. State in what order the papillæ of the deciduous teeth make their appearance in the dentinal groove, and describe the mode of formation of the "cavities of reserve" for the papillæ of the ten anterior permanent teeth and the succession in which they are formed.

2. Describe the membrana preformativa, mention the chief theories which have been advanced as to its functions, and give your reasons for supporting any one of them which most coincides with your own views.

3. Describe the microscopic anatomy of the surface of the dentine where in contact with the enamel and cementum respectively, and state what relation, if any, the dentinal tubes have to the ultimate structure of the hard tissues surrounding the dentine.

Dental Surgery.

1. Give the symptoms of unhealthy or retarded first dentition, and their appropriate treatment; also state what are the conditions which would lead you to adopt or desist from the use of the lancet.

2. Enumerate the different forms of cleft or perforate palate, and describe the mechanical appliances adapted for their relief.

3. Enumerate and describe the several morbid changes that occur in the adult tooth pulp, and state the issues to which they tend.

JUNE 1873.

Dental Anatomy.

1. Describe the dental sacculus of the deciduous teeth.

2. At what age are there the greatest number of teeth

in the jaws, and what is their number? Describe their relative position to one another.

3. Describe the structure of cementum.

Dental Surgery.

1. Describe different varieties of tumour termed "Odontome"; explain fully their pathology and method of development. Why is it so important to diagnose an odontome from other tumours connected with the maxilla, and how is the diagnosis effected?

2. In decay of the teeth, which structure is the first to undergo alteration, and by what agency are the constituents of the hard structure of dentine altered in character and consistence? State also what constitutional conditions predispose teeth to decay.

3. Describe the various tumours met with in connection with the gums; explain their pathology, and their appropriate treatment.

JANUARY 1874.

Dental Anatomy.

1. Describe fully the structure of osteo dentine in the human subject, and its mode of development.

2. Describe the growth of an incisor tooth, and the method of increase of several tissues.

3. Describe the processes of an odontoblast, and the parts which they respectively fulfil in the formation of dentine.

Dental Surgery.

1. What are the cases of oral disease or lesion, whether in connection with the teeth, gums, or alveoli, in which the following drugs may be useful,—carbolic acid, sulphuric acid, tannic acid, morphia, arsenic, spirits of wine, matico, ferri perchlor., and chlorate of potash?

2. What is meant by necrosis of tooth? state its causes and treatment.

3. In what conditions of the pulp is it advisable to employ other than gold fillings in stopping the cavity of a carious tooth?

JUNE 1874.

Dental Anatomy.

1. Name and describe the microscopical appearances of the tissues concerned in the formation of enamel and dentine.

2. State the ages at which, and the succession in which, the members of the deciduous and permanent sets of teeth are respectively erupted.

3. What are the various purposes fulfilled by cementum in man and other animals?

Dental Surgery.

1. Explain the symptoms respectively of irritation and acute inflammation of the pulp, respectively. Describe the mode of formation, and characteristics of secondary dentine, and the symptoms associated with its development.

2. Describe fully the forms of impaction of third molar teeth, and the consequences frequently resulting from their retarded and difficult eruption; state the treatment of such cases.

3. What is an alveolar abscess? Describe its causes and the changes which occur in its development, with the several issues to which it may lead.

JANUARY 1875.

Dental Anatomy.

1. Explain fully the different theories concerning the formation of dentine, especially in relation to the tubuli.

Of what do their contents consist, and how may they be pathologically affected by disease?

2. State the ages at which the eruption of the deciduous and permanent sets of teeth commence, and the ages at which they are respectively completed; describe the characteristics by which you would distinguish between the first and second molar of the deciduous set, and the first and second lower molar of the permanent set.

3. Explain the several circumstances which conduce to the protrusion of the chin and the shortening of the face in old people, and describe the ways in which artificial teeth restore such conditions.

Dental Surgery.

1. Draw a distinction between toothache arising from a diseased condition of the teeth, and pain in the teeth arising from constitutional causes. Name the constitutional conditions and diseases which principally affect the teeth.

2. Describe the conditions under which certain of the permanent teeth in the adult may be wanting from the mouth when none have been extracted. Point out the particular teeth most frequently absent, and state the circumstances which probably explain such deficiencies.

3. What are the different varieties of united teeth, and the nature of the union? State the probable causes of such union between contiguous teeth, and the consequences to which that condition may lead.

JUNE 1876.

Dental Anatomy and Physiology.

1. Explain the meaning of the following terms in relation to tooth development:—Papilla, groove, follicle,

loculus, enamel germ, membranous sac, pedicle, cavity of reserve, dentine cap, and eruption.

2. Describe the typical characters of an incisor, canine, molar, and premolar tooth. How would you distinguish an upper from a lower canine, an upper from a lower premolar, and the right from the left tooth in each case? What is there distinctive between the crowns of the first and second lower premolar, and the fangs of the first and second upper premolar?

3. Describe the development and structure of the alveolodental membrane, and give the different views respecting the nature of the cuticula dentis.

Dental Surgery and Pathology.

1. State what you know respecting necrosis of teeth.

2. Describe concisely the operation of pivoting teeth; name the teeth which admit of this operation, and the circumstances to be specially regarded in its performance.

3. Describe the physical and chemical characteristics with the microscopical appearances of carious dentine. What are the physical phenomena that occur during the process of decay?

FEBRUARY 1876.

Dental Anatomy and Physiology.

1. Describe the mode in which the deciduous teeth are shed, and mention the different theories advanced to explain the process.

2. What is meant by the term Calcification? State the peculiarities of this process, as it occurs in the formation of the primary dentition.

3. What is the chemical composition of enamel? Describe its minute structure and mode of development;

describe also the histological characters of the enamel organ.

Dental Surgery and Pathology.

1. What injurious results to the teeth and contiguous structures may arise from the wearing of regulating plates and artificial teeth? How would you avoid or remedy such results.

2. Name the salivary glands. State the constituents of normal and abnormal saliva, and how the latter may affect the teeth.

3. A child ten and a half years of age presents himself with a general crowded state of the teeth. There is no such absolute deformity as to make immediate extraction unavoidable, but sufficient to render it almost certainly necessary at some time in the progress of the case. State what permanent teeth you would expect to find cut at the above age, and on what general rules you would proceed in the treatment of the above case.

FEBRUARY 6, 1877.

Dental Anatomy and Physiology.

1. Describe the various kinds of vaso-dentine; and mention the chief difference between human dentine, osteo-dentine, and vaso-dentine.

2. Describe the methods by which the union of contiguous teeth may be effected.

3. Describe the form in the lower jaw of a child at birth, at the age of eight years, an adult at twenty-five, and an edentulous old person at seventy years of age; enumerating, as regards the two first, the number and condition of the teeth, mature and immature.

Dental Pathology and Surgery.

1. Enumerate and describe the congenital defects in dentine and enamel.

2. State the composition and uses for dental purposes of the following substances :—Amalgam stoppings, osteo-plastic and gutta-percha stoppings, vulcanite pink, red, and black, arsenical paste.

3. Enumerate the several methods that are adopted in excluding saliva from teeth during the process of stopping; and state the reasons why such precautions are necessary.

JUNE 22, 1877.

Dental Anatomy and Physiology.

1. Describe specimens 1, 2, and 3 under the microscope.

2. Sketch the history of the development of, and changes in, the osseous and dental portions of the inferior maxilla from the period of birth to the age of seven years.

3. Give the chemical composition of enamel, cementum, and dentine. Describe the chemical changes which occur in the latter during the progress of caries, and state how they are probably effected.

Dental Surgery and Pathology.

1. Enumerate all the circumstances under which the extraction of sound temporary and permanent teeth may be necessary.

2. What are the conditions of the pulp which would induce you to endeavour to preserve or destroy it? Describe the treatment in both cases.

3. Describe the form and structure of (*a*) syphilitic teeth, and (*b*) teeth with rocky or honey-combed enamel, pointing out the distinctions between the two.

October 26, 1877.

Dental Anatomy and Physiology.

1. Describe specimens 1, 2, 3 under the microscope.

2. (*a*) Describe and contrast the appearances of the temporary and permanent teeth generally. (*b*) How would you distinguish between the superior and inferior permanent canine teeth? (*c*) Describe the crowns of the permanent incisor teeth immediately after protrusion through the gums.

3. What are the principal features which distinguish the teeth and jaws of man from those of the orang?

Dental Surgery and Pathology.

1. What is meant by the impaction of permanent teeth in the substance of the maxillary bones? Which of the teeth most frequently exhibit this condition? What is the common course of such cases, and what evil results may arise?

2. What (1) do you consider to be the best anæsthetics for dental operations? Describe (2) the usual effects upon the patient in the order of their occurrence, and also those which you would consider alarming, and their treatment. Mention (3) the reasons which would induce you to prohibit the use of anæsthetics; and give (4) the probable theory of their action.

3. Describe the characteristic symptoms of ulcerative stomatitis, of chronic inflammation (false scurvy) and true scurvy of the gums.

February 8, 1878.

Dental Anatomy and Physiology.

1. Describe, in relation to human and comparative anatomy, the chief methods by which teeth are fixed in their place; and give examples.

2. Mention the changes which the lower jaw undergoes during the development of the teeth from birth to puberty, and account for its elongation backwards.

3. Describe the structure of the tooth-pulp in its earliest stages of formation, and in the adult tooth.

Dental Surgery and Pathology.

1. Describe, and give the reasons for the manner in which the operation of extraction should be performed on different teeth; and mention the chief reasons which may necessitate the operation.

2. State the symptoms, sequelæ, and treatment of dental periostitis; and explain in what respects they differ from those of inflammation of the dental pulp.

3. Enumerate the different irregularities in position which the inferior dentes sapientiæ may exhibit. State the symptoms which such irregularities occasion, and what treatment you would adopt.

JUNE 1878.

Dental Anatomy and Physiology.

1. Describe the structure of an incisor tooth of a horse, and a molar of a cow; also the morphological arrangement of the developmental organs in each.

2. Describe the terms calco-spherite and calco-globulin, and give an account of the researches of Rainie and Harting into the nature of calcification.

3. Specimens under the microscope.

Dental Surgery and Pathology.

1. Describe the experiments performed for the production of artificial dental caries; give the results and name the authorities.

2. Enumerate the different forms of cleft and perforate palate, and state the treatment which they would

receive at the hands of a dentist. What are the characteristic differences as to the results of treatment in congenital and accidental cases?

3. Describe the appearances to the naked eye, and also under the microscope, of the cementum and of the peridental membrane of a tooth extracted on account of exostosis. Mention any other maladies likely to be mistaken for it, and the symptoms by which you would distinguish it.

OCTOBER 25, 1878.

Dental Anatomy and Physiology.

1. Describe the nature of a tooth-germ, and the mode of its formation; and also the sources of origin of the germs of the different permanent teeth.

2. Explain the terms "monophyodont," "diphyodont," "homodont," and "heterodont," illustrating them by reference to comparative dentition.

3. Describe specimens 1, 2, and 3, under the microscope.

Dental Surgery and Pathology.

1. What is salivary calculus? Give its chemical composition; state where it is usually deposited, and its effects.

2. What are the varieties of fracture to which the teeth are liable? State the consequences that may arise from them respectively, and the necessary treatment.

3. Give a full description of supernumerary teeth, and of the treatment to be pursued in respect of them.

FEBRUARY 21, 1879.

Dental Anatomy and Physiology.

1. Describe specimens under microscope.

2. Why are teeth called "dermal appendages"?

Give an example, taken from Comparative Anatomy, of the meaning of the term.

3. Describe how the movements of mastication are effected, and the physiological action of the saliva?

Dental Surgery and Pathology.

1. Describe the various methods of applying artificial teeth, and mention the important surgical and mechanical points to be regarded.

2. Enumerate the abnormal conditions of the dental organs which may give rise to neuralgia?

3. What are the chief causes of inflammation of the peridental membrane? Describe the formation and progress of an alveolar abscess.

JUNE 20, 1879.

Dental Anatomy and Physiology.

1. Specimens under microscope.

2. Enumerate and describe the varieties of dentine in the teeth of man and the lower animals, and give examples.

3 What is meant by "dental formula"? Give the typical mammalian formula and also that of man and of any other mammals which may occur to you. Which are the teeth usually absent from the typical formula?

Dental Surgery and Pathology.

1. Describe the symptoms and effects of phosphorus and mercury on the gums and alveoli.

2. Mention the principal irregularities of the permanent teeth; the causes and treatment of them.

3. What are the most usual nervous affections having a dental origin? Mention the nerves which are respectively implicated in their production.

OCTOBER 24, 1879.

Dental Anatomy and Physiology.

1. Describe microscopic specimens 1, 2, 3.
2. Give examples of birds having teeth, and describe them.
3. What are the processes by which the temporary teeth are removed and replaced by the permanent? Give the histological characters of the structures involved.

Dental Surgery and Pathology.

1. Describe, in the order of occurrence, the symptoms and results, local and general, arising from caries extending to the pulp in a third molar and permanent central incisor.
2. Mention the affections of the gums—whether arising from local or general causes—which it is desirable that the dental surgeon should recognise. Describe briefly their chief characteristics.
3. What are the mechanical injuries to which teeth are liable, the consequences arising from them, and the treatment to be adopted in each kind?

FEBRUARY 19, 1880.

Dental Anatomy and Physiology.

1. Describe the specimens under the microscope No. 1, 2, and 3.
2. What relation have the teeth to the function of speech? Describe the effects on articulate sounds occasioned by the loss of the several teeth respectively.
3. What are the anatomical and histological peculiarities of the teeth in marsupial animals?

Dental Anatomy and Pathology.

1. In what manner would the dental surgeon employ the following substances:—Arsenious acid, carbolic acid, chlorate of potass, chloride of zinc, permanganate of potass, nitrate of silver, and nitric acid?

2. Enumerate and describe the various forms of Cystic disease connected with the teeth.

3. Enumerate and briefly describe the several affections of the nervous system that may arise from diseases of the teeth.

JUNE 21, 1880.

Dental Anatomy and Physiology.

1. Describe specimens under the microscope 1, 2, 3.

2. Describe the anatomical conditions which would be displayed by a vertical section across the lower jaw through the second temporary molar at the age of six years.

3. Describe the dentition of the proboscidea, and the structural difference between the molars in the two existing species of *elephas*.

Dental Surgery and Pathology.

1. What are the causes and characteristics of hæmorrhage after tooth extraction, and what treatment should be adopted in such cases?

2. Describe a dentigerous cyst, the causes which may lead to its formation, its diagnosis, and treatment.

3. Mention the materials employed for filling teeth, and the various forms in which they are used; and describe the methods and advantages of their respective employment.

OCTOBER 25, 1880.

Dental Anatomy and Physiology.

1. Describe the specimens 1, 2, and 3 under the microscope.

2. Give a concise account of the development of a human tooth.

3. Describe the teeth of the edentata.

Dental Surgery and Pathology.

1. What is dental caries? Explain its supposed causes, and state the physical and chemical changes in the tissues of the teeth to which it gives rise.

2. Describe the different varieties of united teeth, and the methods by which the unions are effected.

3. How would you extract a first molar of the upper jaw that has been fractured at the neck, the contiguous teeth still standing? Name the instruments to be employed and the processes of the operation.

JUNE 1872.

Anatomy.

1. Describe the process of mastication, enumerate the muscles that are concerned in it, and state their respective functions.

2. Describe the structure of the salivary glands, their situation, and relative size, the course and termination of their ducts, and the influence of saliva on the food.

Surgery.

1. Describe the situation, pathology, and treatment of an epulis.

2. What are the local symptoms of pereostitis of the lower law? And what are its effects?

JANUARY 1873.

Anatomy.

1. Describe the blood-vessels which supply the teeth of the upper jaw, and trace their origins and course.

2. Describe the vertical ramus of the lower jaw, the temporo maxillary articulation, and the ligaments connected with it.

Surgery.

1. Describe the local symptoms of necrosis of a portion of the lower jaw, its common causes and usual treatment.

2. How would you distinguish between malignant and non-malignant growths of the tongue? and how would you treat them respectively.

JUNE 1873.

Anatomy.

1. Describe the soft palate and uvula, their uses, and the muscles by which they are moved.

2. Mention the nerves which supply the tongue, describe their distribution, and state their respective functions.

Surgery.

1. Supposing a portion of either maxillary bone to have been broken during the extraction of a tooth, state how you would treat the injury, and explain the process by which it may be repaired.

2. Describe the symptoms, consequences, and treatment of acute inflammation of the antrum.

JANUARY 1874.

Anatomy.

1. Describe the connections of the superior maxillary bone, and the arrangement of the mucous membrane, covering the lateral wall of the nostril.

2. Describe the distribution of nerves concerned in the special sense of taste.

Surgery.

1. What is cancrum oris? at what age and under what circumstances does the disease usually occur? and how would you treat it.

2. Describe the nature, diagnosis, and treatment of ranula.

JUNE 1874.

Anatomy.

1. Give the anatomy of the temporo maxillary articulation; describe its several movements; and mention the muscles by which they are severally effected.

2. Describe the various changes of form which the runa glottidis undergoes; state how and for what purpose these variations are produced.

Surgery.

1. In what forms does syphilis affect the interior of the mouth; describe the characteristics and treatment of each form.

2. Describe the alteration in tissue which exists in chronic enlargement of the tonsils; and state the inconveniences resulting from the condition and how they are to be remedied.

January 1875.

Anatomy.

1. Describe the attachment of the buccinator muscle; how is it engaged in mastication? and whence it derives its vascular and nervous supply.

2. From what sources is the fluid of the mouth derived? State the principal causes which influence the amount formed, and explain how those causes act.

Surgery.

1 Describe the origin and development of a cyst in the lower jaw; how would you distinguish it from other tumours in this region? and what does it usually contain? and state how you would treat it.

2. Describe the treatment you would adopt in continued hæmorrhage after excision of a portion of the tonsil.

February 1876.

Anatomy.

1. Describe the origin, course, and insertion of the temporal muscle, and give its relations and action; and state the sources from which it receives its vascular and nervous supply.

2. Enumerate the glands pouring their secretion into the mouth, and describe their structure and the nature of the secretion of each.

Surgery.

1. From what part of the jaws may exostosis grow; describe this structure.

2. How is fracture of the jaw usually produced? State what parts may be broken, and how you would treat each form of fracture.

JUNE 1876.

Anatomy.

1. Describe the articulation of the lower jaw, and mention the structures in immediate relation to it.

2. Describe the action of deglutition, and mention the muscles concerned in it.

Surgery.

1. Mention the causes of necrosis of the inferior maxilla, and describe the symptoms and course of the disease.

2. State how you would distinguish and treat syphilitic ulcers of the tongue.

FEBRUARY 1877.

Anatomy.

1. Describe the position and relations of the submaxillary gland, and the character and functions of its secretion.

2. Describe the antrum, and the characteristics of its lining membrane, and state how it is supplied with vessels and nerves.

Surgery.

1. How is dislocation of the lower jaw usually produced? Describe the appearance of a patient suffering from this accident, and how would you reduce the dislocation.

2. Describe the diagnostic characters of epithelioma of lower lip, and its treatment.

JUNE 1877.

Anatomy.

1. Describe the outer wall of the nose, and name the sinuses in immediate relation with it.

2. Describe the distribution of the third division of the fifth pair of nerves, and state what are the functions of its branches.

Surgery.

1. What are the most common causes of necrosis of the lower jaw? Describe the process of exfoliation of a sequestrum.

2. Describe the appearance of those diseases of the tongue which most resemble epithelioma, and state the causes which give rise to them.

OCTOBER 26, 1877.

Anatomy and Physiology.

1. Mention the bones which articulate with, and the nerves which pass through the foramina of the superior maxillary and palate bones.

2. Describe the functions of the tongue.

Pathology and Surgery.

1. Describe the growth, structure, and treatment of simple epulis.

2. How would you recognise and treat abscess of the antrum? What are the exciting causes of this disease?

February 1878.

Anatomy.

1. Describe the eustachian tube, its relation to surrounding parts, and its functions.

2. Describe the acts of mastication and deglutition, mentioning the muscles concerned therein, and the nerve centres by which these muscles are controlled.

Surgery.

1. Describe the process of separation of a sequestrum in necrosis of the lower jaw, and the mode in which the repair is effected.

2. Describe the characteristics of the chief forms of ulcer affecting the various parts of the mouth, and their treatment.

June 1878.

Anatomy.

1. Describe the thyroid cartilage, and give an account of the mechanism by which voice is produced.

2. From what sources does the tongue receive its nerve-supply? Describe how each nerve leaves the skull, and to which part of the tongue each is distributed. State what are their respective functions.

Surgery.

1. What is traumatic trismus? State what muscles and nerves are involved in this disease, and how it is produced.

2. Describe the process by which a wound is healed after loss of texture, as in a case of cancrum oris.

October 1878.

Anatomy.

1. What bones enter into the composition of the chest? and how are they articulated with each other.

2. Describe the course and mechanism of the circulation of the blood through the body generally, and through the lungs.

Surgery.

1. Explain how death may be caused by the inhalation of chloroform, and what steps you would take to avert a fatal result if threatened.

2. What are the pathological changes which occur in the healing of an acute abscess (viz. of the tonsil).

February 1879.

Anatomy and Physiology.

1. Describe the course of the aorta through the abdomen, mentioning its relations and enumerating in order the branches it gives off in that region.

2. What are the constituents of the atmosphere and their relative proportions. Describe the changes which occur in respired air.

Surgery.

1. State what are the signs and immediate consequences of fracture of a long bone, and mention the principles on which the treatment of such an injury is to be conducted.

2. Define what you mean by an ulcer, mention in what respects the discharge from an ulcerated surface varies under different circumstances, and explain to what causes each variation is due.

JUNE 1879.

Anatomy and Physiology.

1. From what sources does the liver receive its blood? and how does bile find its way into the intestines?

2. How is arterial blood distinguished from venous? And in what does the difference depend.

Surgery.

1. Define what is understood by mumps, and state how you would distinguish this from other swellings of the face, both as regards the seat of the complaint and s signs and symptoms.

2. What means would you employ to arrest hamorrhage from an incised wound of the tongue.

OCTOBER 24, 1879.

Anatomy and Physiology.

1. Describe the curves of the spinal column. State generally how the vertebræ are articulated with each other.

2. State the composition of atmospheric air, and what changes are effected in it by respiration.

Surgery and Pathology.

1. Describe the characters of (1) a spreading ulcer, and of (2) a healing ulcer.

2. What are the signs of fracture of a bone? What are the general indications requiring attention in the treatment of fractures?

FEBRUARY 19, 1880.

Anatomy and Physiology.

1. By what forms of suture are the bones of the cranium united? Name these sutures and describe each form.

2. Describe the circulation of the blood, and state by what forces it is circulated.

Surgery and Pathology.

1. Mention the different forms of ulcer which are met with in the mouth; and describe briefly the characters and treatment of each.

2. What are the symptoms of periostitis? State how it may be produced, and what treatment you would adopt in its different stages.

JUNE 21, 1880.

Anatomy and Physiology.

1. Describe the superior maxillary bone, including its connections with other bones.

2. Describe the act of deglutition; and state how the larynx is protected from the intrusion of food.

Surgery and Pathology.

1. How would you treat a fracture of the horizontal ramus of the lower jaw?

2. Define what is meant by the word ulceration; and describe how an ulcer is treated.

OCTOBER 25, 1880.

Anatomy and Physiology.

1. Describe the ethmoid bone and its connections.
2. How is the food prepared for assimilation by the stomach, and what are the changes it undergoes?

Surgery and Pathology.

1. Explain the term "a granulating surface," describe the structure of a granulation, and mention the purpose of the process in the body.
2. What are the causes which give rise to the death of bone?

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