THE SCIENCE AND PRACTICE OF SURGERY

By

W. H. C. ROMANIS

M.A., M.B., M.Ch., Cantab., F.R.C.S. (Eng.), F.R.S. (Edin.)

Surgeon and Lecturer on Surgery, St. Thomas's Hospital. Surgeon to the Royal Masonic Hospital. Consulting Surgeon to the City of London Hospital for Diseases of the Chest. Examiner in Surgery to the University of Cambridge. Member of Court of Examiners, R.C.S., Eng., late Examiner to the Universities of London and Glasgow.

And

PHILIP H. MITCHINER

C.B.E., T.D., M.D., M.S. (Lond.), F.R.C.S. (Eng.), D.Ch.(Hon.), Durham

Hon. Surgeon to H.M. The King, Hunterian Professor, Royal College of Surgeons of England, Surgeon and Lecturer in Surgery, St. Thomas's Hospital. Member of Council, Royal College of Surgeons, Examiner in Surgery University of Sheffield. Lately Examiner in Surgery to the Universities of London, Liverpool and Birmingham, to the National University of Ireland, and to the General Nursing Council. Late Surgeon to the Royal Northern Hospital. Major-General A.M.S. (T.), D.D.M.S. Formerly Commanding Medical Unit, University of London, O.T.C.

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PREFACE TO THE SEVENTH EDITION

THE preparation of this present edition has been undertaken entirely since the declaration of war. This has led to certain difficulties as enemy action has rendered some illustrations and notes inaccessible. The problem of the discussion of war surgery is one which we have kept prominently before us, and we have introduced a short appendix on War Surgery at the end of the first volume. This is in no sense comprehensive, for many subjects which can be reasonably considered as coming under the heading of war surgery were already present in the text. The appendix must therefore be regarded in the nature of an amplification of these articles, while we have transferred into it from elsewhere in the book the discussion of the treatment of " gas cases " and of certain aneurysms which are largely seen as sequelæ of war injuries.

The whole of the book has been completely and carefully revised, and many subjects entirely re-written. In particular, large alterations and additions have been made in the sections on cleft palate, blood grouping and transfusion, sympathetic surgery and injuries. It has been thought advisable to remove some of the preliminary discussion of bacteriology and the description of amputations which are only of historic interest.

The authors feel confident that the work will still maintain its place in the field of surgical literature as providing enough material for the student to pass his elementary and advanced examinations. It will also serve as a book of reference to the qualified practitioner.

There remains the pleasant task of acknowledging our thanks and indebtedness to those friends and colleagues who have assisted us in the preparation of this edition. The sections on ear, nose and throat surgery, ophthalmic surgery and anæsthesia have been revised and re-written by Mr. Neilson, Mr. Gimblett and Dr. Potter. Dr. Fildes having retired, Dr. Bertram Shires has kindly undertaken the task of revising the section on X-rays. Dr. T. Anwyl-Davies, Physician in charge of the Venereal Department at St. Thomas's Hospital, has fully revised all the sections dealing with venereal disease, and provided some extra illustrations for this part of the work ; while the Surgery Departments of the Universities of Liverpool and Birmingham, and the Photographic Department at St. Thomas's Hospital have also supplied us with some excellent photographs.

Mr. Charles Rob, M.B., M.Ch. (Cantab.), F.R.C.S. (Eng.), Surgical Tutor and Registrar at St. Thomas's Hospital, has read all the proofs and to him we are indebted for several very valuable suggestions ; while to Messrs. J. & A.

Churchill Ltd. and to Mr. J. Rivers of that firm we must acknowledge our gratitude for their usual courtesy, helpfulness and patience.

We feel that we cannot let this edition go to press without alluding to the death of the artist, Mr. Thornton Shiells. His skill in preparing drawings for illustrating medical and surgical publications was well known, and he was responsible for most of the illustrations in our original edition.

W. H. C. R.
P. H. M.

HARLEY STREET,
LONDON, W.1.

PREFACE TO THE FIRST EDITION

In producing this work the authors have had two main objects in view, the first being to place before the student a book which is sufficiently comprehensive to provide him with all that he will require in passing both his ordinary surgical examinations and any higher examinations to which he may aspire, such as the Fellowship of the College of Surgeons ; and the second, to present a book which may be of value as a work of reference to the medical practitioner.

Surgery is now a vast subject, and it has always fallen somewhat naturally into the divisions of Surgical Anatomy, Surgical Pathology, Diagnosis and Operative Surgery, together with all their side issues. We have recently come across the following quotation in a work of fiction with reference to certain imaginary members of the profession who are there described as " Men who, led to take up surgery by the hope of gain and notoriety, have given themselves no time to learn its scientific principles ; showy operators who diagnose with the knife and endeavour to dictate to nature and not to assist her." Feeling that there might be a certain modicum of truth in this description, we have endeavoured, as far as possible, to give a full account of the surgical pathology and the scientific side of the subject as well as the more practical details, such as diagnosis and treatment.

Surgical after-treatment is a subject which is often greatly neglected in both text-books and bedside teaching, and though, of course, it can only be learnt really thoroughly by actually having to undertake it, we have tried, as far as possible, to place before the reader reasonable and accepted methods for the after-treatment of operation cases.

Modern medicine, and surgery also, are very much coloured by biological chemistry, and a multitude of chemical tests and laboratory examinations are now employed in connection with surgical cases. It is a deplorable fact that in many instances such methods are used to establish a diagnosis with complete neglect and disregard of the clinical aspects and personal subjective symptoms of the patient ; we feel that it cannot enhance the interests or the reputation of the profession if the clinical and human elements in surgery are lost sight of, and have therefore endeavoured to show that the practice of surgery is an art, and that it never can be an exact science, entirely relegated to the test tubes and appliances of a biochemical laboratory.

We have essayed as far as possible to give some account of the ways in which these various chemical processes and biological tests should be employed and of their relative values in diagnosis, but we have made no attempt to give in detail the methods of performing such tests. This is partly owing to limitation of space, but still more because we feel strongly that if the results of these complicated chapters in chemistry are to be of value in the diagnosis and treatment of patients. they must be performed by absolute experts, and it is not wise to encourage either the student or the practitioner to endeavour to perform them for himself.

We have made a practice throughout both volumes, where applicable, of prefacing each chapter with a short account of the applied surgical anatomy and physiology of the region or organ discussed. These sections are printed in small type, not in order in any way to detract from their importance, but

from considerations of space, and to differentiate them from the pathological and clinical portions of the work.

An account of the various operations in surgery is not essentially part of a work on surgery, and there are many excellent books dealing with the subject. We have, nevertheless, included a short account of the salient points of all the more important operations with their indications and difficulties, in the hope that, for the student at any rate, it will render the book complete and increase its value.

In many instances there are methods of treatment and operations which, though very seldom practised nowadays, are nevertheless worthy of consideration for their classical associations and because of the resulting tendency for them to be used as examination tests. We have, therefore, as far as possible referred to all such obsolete methods, but in the shortest possible fashion, giving the reasons for their gradual disappearance from modern practice.

With the added object of rendering the work as complete as possible we have included short chapters on diseases of the eye, diseases of the ear, nose and throat, on anæsthetics, on X-rays in diagnosis and treatment, and on the surgical aspects of obstetrics and gynæcology. In each instance these chapters have been written more with a view to assisting those who are studying or practising general surgery rather than the specialities therein contained.

There remains the pleasant task of acknowledging our indebtedness and thanks to those of our colleagues and others who have assisted us in the preparation of this work.

Mr. R. H. O. B. Robinson, B.A., M.B., B.Ch. (Cantab.), F.R.C.S. (Eng.), Surgeon in Charge of Out-patients to St. Thomas's Hospital and Assistant Surgeon to the City of London Hospital for Diseases of the Chest, has written part of the four chapters on Injuries of Bones, Injuries of Joints, Injuries of the Upper Limb, and Injuries of the Lower Limb. He has also read through the whole of the proofs for us and given us many valuable suggestions.

Mr. W. H. Battle, F.R.C.S. (Eng.), Consulting Surgeon to St. Thomas's Hospital, to whom we were both House Surgeons, has very kindly placed the whole of his very large collection of clinical photographs and pictures at our disposal, and we have drawn many of our illustrations from this source.

Mr. D. F. A. Neilson, B.A. (Cantab.), F.R.C.S. (Eng.), Assistant Surgeon to the Ear, Nose and Throat Department of St. Thomas's Hospital, Aural Surgeon to the Freemason's Hospital and London Fever Hospital, late Assistant Surgeon to the Ear, Nose and Throat Department of the Royal Free Hospital, and Registrar to the Ear, Nose and Throat Department of University College Hospital, has written the three chapters on Diseases of the Ear, Nose and Throat.

Mr. C. L. Gimblett, M.A., M.D., B.Ch. (Cantab.), F.R.C.S. (Eng.), M.R.C.P. (Lond.), Surgeon to the Royal Westminster Ophthalmic Hospital, and late Senior Ophthalmic Surgeon to the Royal Northern Hospital, has undertaken the whole of the chapter on Diseases of the Eye.

Dr. Geoffrey Fildes, M.B., Ch.B. (Vict. Manch.), D.M.R.E. (Cantab.), Physician in Charge of the Radiological Department at St. Thomas's Hospital, has written the chapter on X-rays in Diagnosis and Treatment.

Dr. A. F. Potter, Honorary Anæsthetist to St. Thomas's Hospital and to the Royal Albert Dock Hospital and late Hon. Asst. Anæsthetist to the Royal Dental Hospital, is responsible for the chapter on Anæsthesia.

We are also indebted to Mr. Richard Warren, M.D., M.Ch. (Oxon.), F.R.C.S.

(Eng.), for permission to use certain illustrations from his work, "A Text-Book of Surgery."

To Professor Dudgeon, Dr. Bamforth, Dr. A. L. Urquhart, and Dr. John Taylor we are indebted for the loan of microscopic preparations and pathological material, and to the Museum Committee of St. Thomas's Hospital we owe our thanks for permission to make use of the specimens in the Shattock Museum.

From Colonel Harrison and Dr. T. Anwyl-Davies we have derived much help in the matter of the treatment of venereal diseases, and to the former we tender our thanks for permission to use several illustrations.

Prof. De Wesselow, Physician to and Professor of Medicine at St. Thomas's Hospital, has kindly assisted us with regard to the various tests for renal efficiency.

Dr. Dore, Consulting Physician to the Skin Department at St. Thomas's Hospital, has helped us greatly with advice and illustrations relating to Diseases of the Skin, and to Messrs. Millward and Yule we tender our thanks for photographs which they have taken for us.

We are indebted to Messrs. Allen and Hanbury for the loan of certain blocks.

Messrs. Thornton Shiells and Ford have greatly assisted us by the painstaking way in which they have produced drawings of microscopic slides and specimens, at the skill of which we can only marvel. We are also much indebted to Messrs. J. & A. Churchill for their help and care in the publication of the work.

W. H. C. R.
P. H. M.

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CONTENTS

THE SCIENCE AND PRACTICE
OF
SURGERY

CHAPTER I

INJURIES AND DISEASES OF THE BRAIN AND ITS MEMBRANES

Surgical Anatomy and Physiology. The brain is surrounded by the three membranes which together constitute the meninges. The outer membrane, the *Dura mater*, consists of a tough, outer fibrous layer, which is really the periosteum of the inside of the skull, and a softer inside serous layer lined with endothelial cells. In places these two layers split and in between them run the big venous sinuses, while between the dura mater and the bone are found the meningeal vessels. The dura also splits to form the cave of Meckel. Beneath the dura is the subdural space, which is narrow and really only a potential space, the dura being more or less closely applied to the middle membrane, the *Arachnoid mater*. This is a thin layer lying close to the brain, but not penetrating into its sulci, and it is in its turn separated by the subarachnoid space from the innermost membrane, the *Pia mater*, which is a thin and very vascular layer, closely applied to the surface of the brain and insinuating itself into all its sulci. In the subarachnoid space, which is subdivided by a network of fibrous tissue, we find the cerebrospinal fluid, this space being, at the base of the brain, enlarged in certain situations into wide spaces, full of cerebrospinal fluid and known as *cisternæ*.

Circulation of the Cerebrospinal Fluid. The cerebrospinal fluid is secreted by the choroid plexuses of the lateral ventricles, and this fluid is greatly increased by venous congestion in the cranial circulation or by obstruction of the vein of Galen. It has the property of setting up a protective reaction in any soft tissues other than nervous structures with which it comes in contact, and around any leak of cerebrospinal fluid into other tissues a new dura mater is rapidly formed. The fluid fills the ventricles and passes out into the cisterna magna and the general subarachnoid space through the foramina of Majendie, Key and Retzius in the roof of the fourth ventricle. From the base of the brain the fluid passes forward and upwards over the cerebral hemispheres, while a small amount passes down the spinal meninges. It is finally absorbed into the intracranial venous sinuses by means of the Pacchionian bodies and small arachnoid villi. The brain and spinal cord are surrounded by this fluid on all sides, while the central spinal canal also contains it. The inner surface of the dura mater is a serous membrane like the peritoneum but with a very limited power of forming adhesions, so that infection very readily spreads underneath it.

Each cranial nerve as it leaves the skull drags out with it a tubular prolongation of each of these membranes, which gradually fuse with the fibrous sheath of the nerve.

The Cerebral Circulation. The vascular arrangements within the skull are peculiar in many ways. For inasmuch as the skull is virtually a rigid box containing what may be regarded as an incompressible semi-fluid substance, the amount of blood flowing into the skull must always equal that flowing out, and as the vessels of the brain have no vasomotor control, changes in the amount of blood supplied to the brain are entirely effected by alterations in the pressure of the general circulation. So that a rise of general blood pressure will send more blood to the brain, while obstruction of the internal jugular veins, by which most

of the blood leaves the skull, will diminish the circulation through the brain and increase the intracranial pressure. It is on these facts that the efficiency of injections of hypertonic saline in reducing intracranial pressure depends. The cerebrospinal fluid can flow backwards and forwards down into the spinal canal, and this can compensate to a slight degree for changes in pressure, provided they are gradual; thus a gradually increasing pressure on the brain may have little effect for some time, but a rapid increase of pressure cannot be compensated for and soon causes the brain to become anæmic. The arterioles of the brain are end-arteries, so that the blocking of any particular vessel threatens the vitality of the area which it supplies, though the main arteries anastomose freely before entering the brain. The effect of any general rise in the intracranial pressure is to force the cerebral hemispheres down upon the pons and medulla, and the latter structures in their turn through the foramen magnum and down upon the spinal cord. When cerebral pressure is very high, quite a marked cone may be produced by the forcing of the medulla and cerebellum down through the foramen magnum. The veins of the brain have no valves and are very thin: immediately on leaving the brain they enter the venous sinuses which are between the two layers of the dura mater, and thence most of the blood drains into the internal jugular veins.

The brain consists of an outer layer of grey matter, composed chiefly of nerve cells, while its inner portions consist of white matter, which is formed by long nerve filaments projecting from and connected with the nerve cells. The important nerve centres are therefore found chiefly in the outer layer of grey matter and also to a certain extent in masses of grey matter which are distributed in the deeper parts of the base of the brain.

Motor Centres and Tracts. The nerve cells which control the voluntary movements of the body are largely grouped together in one area known as the Motor Area, which is situated in the grey matter of the ascending frontal gyrus (precentral convolution), which lies immediately in front of the Fissure of Rolando; and this area passes right up to the mesial surface of the cerebral hemisphere where it is in contact with the Falx Cerebri (paracentral lobule), while it passes downwards as far as the Fissure of Sylvius. Every group of muscles is here represented by a regulating group of nerve cells, which are constant in position, the order of the groups of nerve cells in this convolution being roughly, from below upwards, those for the hand, arm, shoulder, trunk, hip, legs, and toes. Thus above the superior genu of this convolution are found the centres governing the leg, foot and perineum: the trunk centres are opposite this genu; the arm centres are immediately below it. Opposite the middle genu of the convolution lie the centres for the neck, while below it are those for the face, tongue and larynx. Movements of the eyes and head are represented rather further forward in the posterior part of the midfrontal gyrus. It must be remembered that certain neurologists hold that cerebral localisation is not as definite as this, and is a much more widely scattered phenomenon. The motor impulses pass down from the cortex by two tracts, the Pyramidal and the Rubrospinal, the latter carrying fibres which come from the cerebellum. The fibres for the *pyramidal tract* pass from the motor cells in the motor area through the centrum ovale to the internal capsule, where they are found in the anterior two-thirds of its posterior limb, the arrangement of the fibres at this point being, from before backwards, those for the face and eyes, those for the arm, and finally those for the leg. From here the pyramidal tract passes down the crus cerebri, the pons and the medulla, and in this part of its course many fibres pass away from the tract to communicate with the nuclei of the cranial nerves which lie in the pons and the medulla. In the lower half of the medulla the decussation of the pyramids is found, and here the greater part of the motor fibres cross to the opposite side and pass down the lateral column of the spinal cord to form the *crossed pyramidal tract.* A few fibres do not cross here, and these pass straight on down as the *direct pyramidal tract,* but these fibres also cross in the cord lower down.

The fibres of the *rubrospinal tract,* which are responsible for the preservation of muscular tone, originate in the cerebellum, where they form the efferent fibres of a reflex mechanism, the afferent fibres of which pass up from the cord into the cerebellum. From the cerebellum these fibres pass to the Red nucleus, and hence via the crus cerebri, into the rubrospinal tract itself in the lateral column of the spinal cord. It is thought that the rubrospinal tract controls the more automatic movements of the body, such as breathing and walking, while the pyramidal tract conveys impulses or the more skilled movements. In addition to this it is probable that the pyramidal tract conveys impulses which inhibit the muscular tone, while the rubrospinal tract

conveys the impulses which keep up and incite muscle tone. These filaments (axons) from the motor cells finally end at different levels of the cord by breaking up into dendrites in the ordinary way, and where this occurs a communication is formed either directly or indirectly with the motor cells in the grey matter of the anterior horns of the cord. The axons of these anterior horn cells pass out of the anterior nerve roots as the motor filaments in the spinal nerves and finally end up in voluntary muscles. The upper system of cell, axon and dendrite reaching from the cortex to the

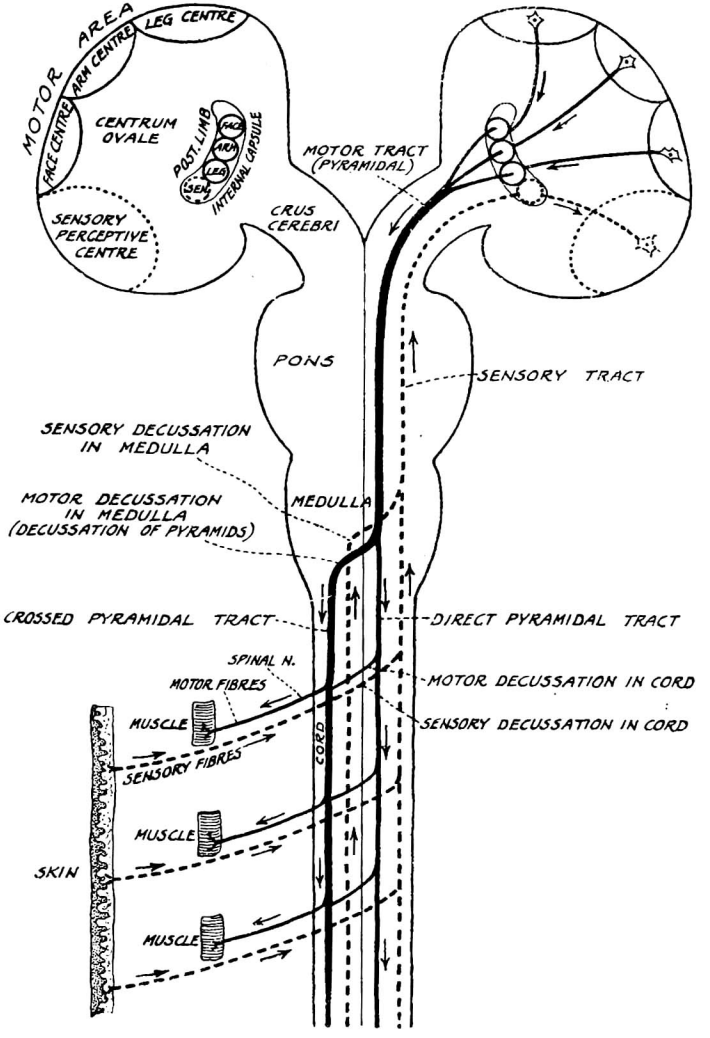

FIG. 1. A diagrammatic representation of the motor and sensory tracts in the brain and spinal cord.

grey matter of the cord is called the *upper motor neurone*, while the lower and similar system which leads the impulses on from where this upper neurone ends, as far as the voluntary muscle for which they are designated, is called the *lower motor neurone*. A destructive lesion of the upper neurone will lead to a spastic paralysis of the muscles concerned, with exaggerated deep reflexes, if the pyramidal tract only is involved. If the rubrospinal tract is also destroyed, as is seen in a total transverse lesion of the cord, the muscles will be flaccid and the deep reflexes lost, but in lesions of the upper neurone, whether spastic or flaccid, the nerve fibres do not degenerate, the nutrition of the muscles does not suffer greatly, only exhibiting wasting from disuse, nor do

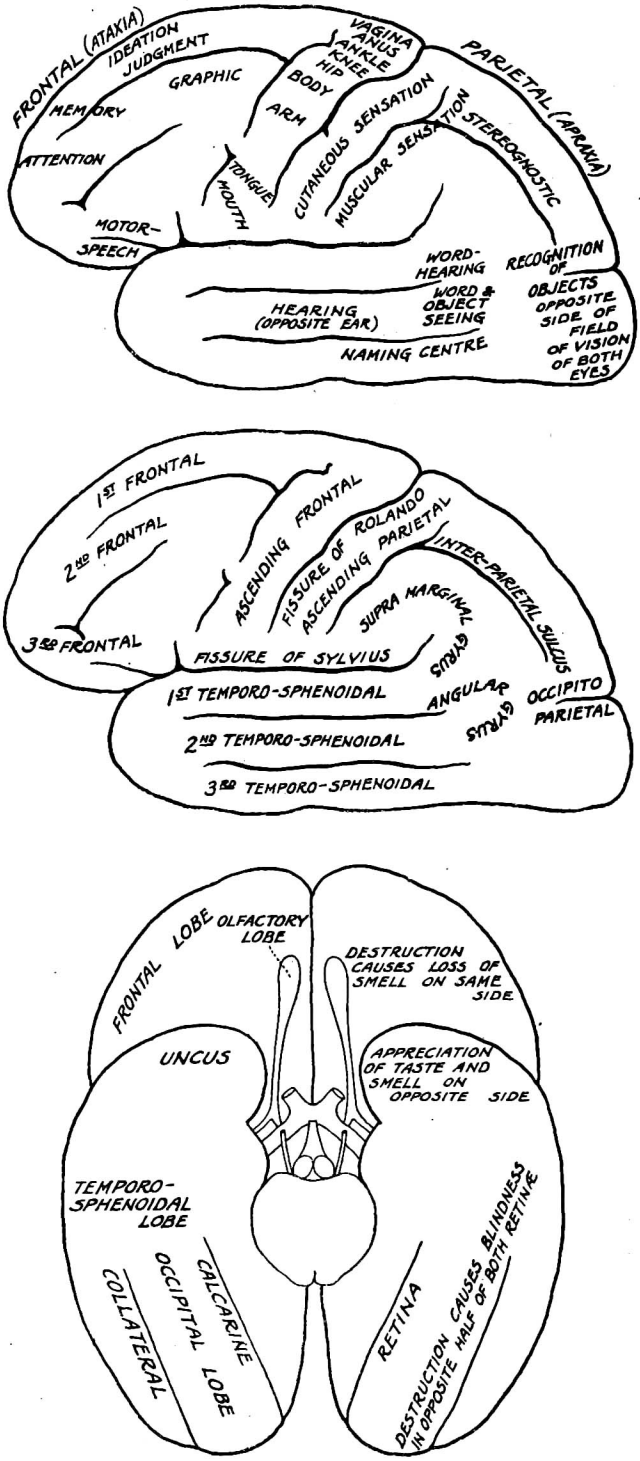

FIG. 2. Diagrams illustrating the position of important cerebral gyri and the localisation of certain important functions of the brain.

they develop the reaction of degeneration. If the lower neurone is involved by a lesion, the muscles are always flaccid and the deep reflexes lost, the nerve fibres degenerate, the muscles rapidly waste, and in a few days show the reaction of degeneration.

Sensory Centres and Tracts. There are several different kinds of sensory impulses which pass from the periphery of the body to the brain : they include the sensations of deep pressure, joint position, heat and cold, pain, light touch, discrimination of separate points close together and localisation of sensation. (For a fuller description of these see Vol. I., Chapter XII.) The fibres conveying all these sensations run up the peripheral nerves and pass into the posterior spinal nerve roots : here these fibres are connected with the cells in the ganglion on each posterior nerve root. From these ganglionic cells an axon proceeds into the spinal cord via the posterior root, and in the cord the main branch travels upwards, while one or two smaller branches are given off which pass downwards. The ascending fibres then pass up to the brain by two routes. Those conveying pain and temperature sense cross to the opposite side of the cord shortly after entering it, and then ascend in the *tract of Gowers*, passing through one or more secondary cell stations on their way : finally they pass by the Fillet to the Optic Thalamus ; while the fibres conveying muscle and joint sense and sensations of light touch pass up in the posterior columns of the cord in the *tracts of Goll and Burdach* to the nucleus gracilis and cuneatus and the medulla : there they also cross to the opposite side and pass on to the optic thalamus. In the optic thalamus these fibres communicate with the fibres of other cells, whence axons pass directly to the sensory centres in the cortex, which are situated in the post-central (ascending parietal) convolution immediately behind the Fissure of Rolando and also to a certain extent in the immediately adjoining portions of the parietal lobe. In this part of their course these sensory fibres are found in the posterior limb of the internal capsule immediately behind the motor fibres of the leg.

Effects of Lesions. It must be remembered that the results of lesions of the nervous system vary greatly according to whether the affected part is irritated and stimulated or destroyed and put out of action ; thus many lesions, such as a tumour or hæmorrhage, will affect the part of the brain concerned first of all by irritating it and only later on by destroying it. Irritative lesions of the motor system produce muscular spasms, twitchings, convulsions and rigidity, whilst in the sensory mechanism they cause pain, tingling and numbness. Destructive lesions of the motor system cause paralysis, which will involve the upper or the lower motor neurone as the case may be (see p. 3), while on the sensory side of the system such a destructive lesion will cause complete anæsthesia, loss of muscle sense, of pain, and of temperature sense. It must be remembered also that many lesions in the brain will cause destruction of one part of it and irritation of neighbouring parts, while the conditions of the circulation within the skull are unusual, so that the presence within it of an abnormal swelling, such as a tumour, may cause one portion of the brain to lose its function, owing to anæmla, and another portion to be hyper-excitable as a result of congestion. Irritative phenomena in the motor system are as a rule chiefly associated with lesions affecting the cortex : but they are also often seen in lesions affecting the tracts.

Special Centres. The cortical centres which control Vision are found in the occipital lobes around the calcarine fissure, being behind the parieto-occipital fissure which lies under the lambda, the centre on each side receiving fibres from the corresponding sides of both retinæ. Thus the destruction of the vision centre in one occipital lobe produces a homonymous hemianopia.

The Auditory centre is in the posterior half of the superior temporal convolution.

The centres for Smell and Taste are found in the uncus.

Speech and the understanding of speech, reading, its understanding, and writing are all methods of expression which are closely related to one another, and they depend upon the co-ordination of several different centres in the brain, namely the speech centre proper, the visual, the auditory and the writing centres. These centres are connected to each other by fibres known as association tracts which run in the white matter of the brain, and which pass just above the upper end of the Fissure of Sylvius, and it is lesions in this neighbourhood, and more especially on the left side, which give rise to Aphasia.

The frontal lobe has been called a silent area, as here sometimes extensive lesions will produce no symptoms, though in other instances they will be accompanied by changes in temperament or intelligence. It is possible also that at the front of the frontal lobe

there is a centre which initiates voluntary movements, and this centre is probably to be found in the superior and middle left frontal convolutions in right-handed people.

Cerebral Localisation. There are several methods by which the various parts of the brain can be localised with relation to the surface of the skull, and in order to do this certain important bony points must be recognised. The Nasion is situated in the midline at the base of the nose, *i.e.*, the midpoint of the naso-frontal suture: the Inion is the external occipital protuberance which can easily be felt, and a line joining these points corresponds in direction to the Falx cerebri, and the superior longitudinal sinus. The point on this line where the parietal and frontal bones meet is called the Bregma, while the corresponding point where the parietal and occipital bones meet is the Lambda and is about 2½ inches above the Inion. At the side of the skull the following structures may be felt: the parietal eminence, the inferior temporal crest, which may be traced backwards from where it commences near the external angular frontal process, the external angular frontal process itself, and the malar tubercle just below it, the zygomatic process passing backwards towards the ear, the mastoid process behind the ear, with Macewen's suprameatal triangle just above and in front of it.

The lateral sinus commences at the Inion and goes with a gentle curve upwards to the posterior part of the upper half of the mastoid process. Thence it curves downwards nearly to the apex of this process.

Reid's base line is a line drawn backwards from the lower border of the orbit to the middle of the external auditory meatus, and this, when prolonged, runs just below the inion. The line lies almost completely below the level of the lateral sinus.

The Sylvian point, where the three limbs of the Sylvian fissure diverge, is 1½ inches above the zygoma and 1¼ inches behind the external angular frontal process: this very nearly corresponds with the Pterion. The posterior horizontal limb of the fissure runs from this point to a point ¾ inch below the most prominent part of the parietal eminence, while the vertical and horizontal limbs of the fissure pass directly upwards and directly forwards from this point for ¾ inch.

The external parieto-occipital and first temporo-sphenoidal fissures correspond to a line joining the malar tubercle and the lambda, the posterior and middle thirds of this line corresponding to these two fissures.

The Fissure of Rolando is marked out best by finding a point ½ inch behind the midpoint of the line from the nasion to the inion: this point is 2 inches behind the bregma. From this point a line should be drawn downwards and forwards at an angle of 67½° to the median line and this line should extend for about 3½ or 4 inches. The precentral convolution containing the motor area will then be found immediately in front of this line, and the sensory area will be immediately behind it, while it is useful to remember that the superior temporal crest to which the temporal fascia is attached, and which lies about ¼ inch above the inferior temporal crest, crosses this Rolandic line at a point which marks roughly the separation of the face and arm areas from one another.

The *middle meningeal artery*, which is a branch of the internal maxillary, is a vessel of some importance in connection with the surgery of the brain. It enters the skull through the foramen spinosum and divides into two branches at a point just above the midpoint of the zygoma. The anterior branch is the one more commonly injured, and the course of the vessel is mapped out by taking three points and joining them together: a point 1 inch above the zygoma, and 1 inch behind the external angular frontal process, a similar point 1½ inches above and behind these bony prominences, and a third point 2 inches above and behind the same prominences. In the lower part of this course the artery frequently runs into a canal within the bone, and it is therefore better when endeavouring to expose the artery to remove the trephine circle at the highest point and then to cut the bone away downwards. The posterior branch of the vessel will be found running backwards and parallel to the zygoma and about 1¼ inches above Reid's base line (see also Vol. I., Chapter X.)

It is sometimes necessary to tap the lateral ventricle, and this is best done by removing a trephine circle or boring a small hole 1¼ inches behind the external auditory meatus and 1¼ inches above Reid's base line. A trocar introduced here and directed towards the tip of the ear on the other side should strike the ventricle at a depth of about 2 inches from the surface.

Macewen's suprameatal triangle is the surface marking of the mastoid antrum, and this triangle is formed above by the supramastoid crest (the continuation backwards of the upper root of the zygoma), behind by a line drawn vertically upwards at the