adjacent nuclei are frequently in close apposition to one another. The nuclei are thus arranged in pairs, a single layer of such pairs surrounding the oöcyte. This duplication of nuclei is frequently seen in germ cells, and its existence in the zona glomerulosa of the young follicle, taken together with the evidence of the heteromitoses which this tissue exhibits, may be regarded as being highly suggestive of the non-somatic nature of the follicle, while its existence would seem to indicate the period at which these cells undergo reduction in their number of chromosomes.

The significance of these observations, so far as they go, may be calculated to form a new factor in more than one branch of scientific research, among which may be mentioned the problem of oögenesis, the obscure functions of the ovary connected with the sexual characteristics of the female, the nature of the yellow bodies that are largely constituted of the substance of these follicle cells, the abnormal heteromitoses of malignant tumours, and with the character of heteromitoses in general.

The metabolism of the sexual glands has for long been suspected of being in some way connected with malignant tumour growth. The work of Farmer, Moore, and Walker, already referred to, has established a subtle morphological resemblance between the character of the cells of malignant tumours and those that are directly concerned with the production of the sexual cells—a resemblance which is based upon the heterotype characters of the mitoses exhibited in both cases. The relation has been more recently emphasized by the important investigations of Beard² into the distribution of germ cells in the embryo of Raja batis and other fishes, showing that the cells from which a cancer springs, no matter how remote they may be from their normal position in the sexual glands, may be actually germ cells, and may bear a close relation or, as it were, family connexion to the cells of reproductive tissue.

The revelation of heteromitoses in what may be termed "natural follicle tumours" forms an important factor in connexion with certain problems of malignant tumours, in so far as these problems bear upon the morphology and history of germ cells, and upon the sexual characteristics and history of the individual. Further, the germ-cell character of the follicle cells carries with it a significance that should throw light upon those obscure functions of the ovary, generally attributed to internal secretions, and which determine the sexual characteristics of the female. Some transplantation experiments after the manner of Limon,³ Knauer,⁴ and others have already been carried out by the writer in connexion with this work, and will be published at a later date.

With regard to oögenesis, the connexion or family relation that is suggested between the follicle cells and the oöcyte, finds a parallel in certain of the lower orders; for example, in *Dytiscus*, as described by Giardina,⁵ and in *Styelopsis Grossularia*, as described by Julin.⁶

Lastly, the remarkable and unparalleled changes that follicle cells undergo in the yellow bodies of the ovary after the expulsion of the ovum and liquor folliculi suggests a hope, dim though it may be, of finding a means of antagonizing what would otherwise seem to be a hopelessly incurable disease, a means more hopeful than that of removing or administering the combined products of the ovarian tissues *in toto*.

In a paper that is already being elaborated, the writer hopes to publish a fuller account of his work together with diagrams illustrating the same, and to enter into the more important bearings of his investigations in connexion with the problems already referred to. The present paper has been hurried into print sooner than would otherwise have been advisable owing to the fact that the investigations described are already known directly or indirectly to other pathologists and physiologists who are carrying out work that must be influenced by that of the writer.

I cannot conclude without expressing my deep sense of gratitude to Dr. Beard of Edinburgh for the valuable hints and assistance he has given me in connexion with this work, and also to Professor Sherrington for much of the material necessary for the investigation, and to my former colleague and senior, Professor Grünbaum of Leeds, without whose teaching and kindness this work would not have been entered upon.

REFERENCES.

- ¹ Farmer, Moore, and Walker, Resemblances exhibited by the Cells of Malignant Growths in Man and those of Normal Reproductive Tissue, *Lancet*, December 26th, 1903, p. 1830. ² Beard, The Germ Cells, *Journal of Anat. and Physiol.*, October, 1903, et seq. ³ Limon, Observations sur l'état de la "Gland Interstitielle" dans les Ovaires Transplantés, *Journal de*

Phys. et de Path. Générale, September 15th, 1904. ⁴ Knauer, Die Ovarian Transplant. experimentelle Studie, *Archiv f. Gynak.*, Bd. ix, 1899. ⁵ Giardina, Origine dell' Oocyte e delle Cellule Nutrici nel Dytiscus—Sonderabdruck aus der *Internat. Monatschr. für Anat. und Phys.*, Band xviii, 1901. ⁶ Julin, Structure et Développement des Glandes Sexuelles; ovogénèse . . . chez *Styelopsis Grossularia*, *Bulletin Scientifique de la France et de la Belgique*, June 30th, 1893.

AMBIDEXTERITY.

By N. BISHOP HARMAN, M.A., M.B. CANTAB.,
F.R.C.S. ENG.,

Ophthalmic Surgeon to the Belgrave Hospital for Children; Oculist to the London County Council (Education Department); late Examiner, Natural Sciences Tripos, Cambridge University.

THE relation of the right hand to the left, and the tendency of man to exercise the right hand to an apparent advantage as compared with the left, have been the subject of considerable debate owing to the formation by Mr. John Jackson of an "Ambidextral Culture Society," with a propaganda—the equal training of right and left hands in the arts and crafts of the day.

It appears reasonable that before we give our aye or nay to such a proposition we should find out how we arrived at our present state of so-called right-handedness, and realize what that state really is. In this paper I wish—

1. To consider the influences determining our general right-handedness, and, incidentally, the persistence of cases of left-handedness.

2. To demonstrate the present existence of a very general degree of ambidexterity, or rather co-ordination of function in the fore-limbs.

THE PRODUCTION OF RIGHT-HANDEDNESS.

If we look back upon the line of phylogenetic development, we shall note that the limbs at their earliest appearance were just bilateral buds from the body wall; the condition is shown in the sharks, their limbs are symmetrical in arrangement and coincident in action. To this day man under similar circumstances uses his limbs in the same manner—in swimming with a breast stroke the limbs in their movements are in every way coincident. Quadrupeds when driven to a high speed drop the alternate use of the limbs, as in trotting and walking, and break into a gallop, in which there is a coincident action of the limbs of the two sides. In the progress of the phylum through amphibians to land animals the limbs developed flexures; fore and hind limbs became specialized—the fore-limbs to bear the weight of thorax and head, the hind-limbs to propel the body forwards—and this differentiation of function was allowable by reason of a peculiar torsion of the basal limb rod—humerus and femur—whereby elbow and knee flexures opposed each the other.

In the anthropoid type there is an appearance of an erect position of body, probably for the purpose of increasing the range of vision, and with this change there is an alteration in the shape of the trunk; from a deep carinate quadrupedal type it becomes broader and less deep, and the fore-limbs are carried outwards and dorsally, held apart by a new dermal clavicle, and serve no longer as supports but as servants of the head. The change in the shape of the trunk necessitates a new mode of packing the viscera within it; hitherto the viscera have been symmetrically disposed—heart betwixt lungs, liver in the anterior mesogastrium. Now these organs are pressed to the sides of the flattened trunk: liver takes one side, stomach and spleen the other, and the heart will take the roomiest side—that farthest from the liver. The liver has been pushed to the right side, stomach, spleen, and heart to the left. But what is it that turns the balance in this direction? Why should not the reverse emplacement be the general rule, as it is rarely in the anomaly of "situs transversus"? I think the clue is to be found in the direction of growth of the caecum. In quadrupeds, particularly in the herbivora, with their monstrous caecal sacs, the caecum lies in the most dependent part of the belly—that is, close up under the liver. It is to be found here in the newly-born of man. It has already been pushed to the right by reason of the twist of the rapidly-growing gut about its early attachment to the yolk stalk; and with its descent, by reason of the action of gravity and growth, on the assumption of the upright position there is determined the balance of the other viscera; the drag the caecum exerts on the peritoneum overbalances the liver to the right side.

But it will be asked, What determines the twist of the rapidly-growing gut, so that the caecum arrives beneath the

liver, pointing to the right? In the embryo the upper part of the gut, which forms stomach and duodenum, has ventral and dorsal mesenteries, and is so "stayed," thereby, that there is no inherent inducement for it to turn to the right or to the left when its growth in calibre and length requires a folding for its packing; but the lower part of the gut which forms small and large intestines, has only a dorsal mesentery, it is only fixed at its extremities and at one point low down in its original position by the vitelline pedicle. As this lower part of the gut grows in length the lowest part swings over the upper part in an arch, with the convexity to the left side; the "head" of this arched loop of gut becomes the caecum, the first part of the large gut to differentiate, and grows up under the liver to point to the right side. As I have indicated, that part of the gut which forms large and small intestines is free along its ventral border save at one spot, here it is continuous with the yolk stalk passing to the yolk sac, the connexion is large in the early embryo; along this tube run the vitelline vessels, which early get a twist from right to left. Now when an intermittent increase of pressure is forced into a coiled tube, the tube tends to uncoil or right itself, so with each pulse of the fetal heart there will be a tendency to reverse the twist of the vessels; the placental ends of these vessels are practically fixed, so the twisting action of the vessels must be exerted on the gut itself which at this early period bulges out from the line of the belly wall alongside the yolk-stalk. This is my explanation of the primitive twist of the gut which brings the caecum beneath the liver pointing to the right, and so determines our visceral asymmetry.

The production of the coiling of the vessels of the funis (it is a coiling and not a torsion as has often been erroneously stated) has been the subject of unavailing discussion amongst obstetricians for generations. There may be a particular explanation for it, or it may be of the nature of the curious spiral growths in climbing plants, the horns of antelopes, and the shells of snails, each of which has its own recognized direction; there may be explanations for these phenomena, but I do not know of them.

So far the argument has been a linking together of morphological facts; now we must conceive an incident in the life of primitive man. Suppose a fight between two of these men over some desirable female or coveted meal; man No. 1 smites man No. 2 a mighty blow below the left pectoral region, over the heart, and, knocking his enemy out, secures the desired booty; but man No. 2 communes within himself, and his awakening intelligence connects the knock-out blow and certain palpitations under the site of the blow; so, covering the aching part with his nearest available forelimb, he falls upon his gorged conqueror with his single free arm, and slays him with a blow on the region he had found weak in himself. He has learned the secret of division of labour in his forelimbs! A left shield-arm and a right fighting-arm. To those of his kind who follow his cunning selection of his natural weapons there comes victory over those who do not follow him, or, following, faultily oppose fighting-arm to fighting-arm and shield-arm to shield-arm—that is, become left-handed. But the death of the less cunning ones would not necessarily mean the complete establishment of a right-handed succession, for the victorious right-handed ones appropriating the females of their victims would beget to themselves offspring who would revert to the maternal custom; and the occasional occurrence of left-handed folk in our days may be fairly put down to such a habit of reversion. The process can be paralleled by casting back in improved breeds of cattle; the not infrequent lack of development of binocular vision in man and consequent divergence of the eyes, although each eye in all its equipment is normal; but most nearly in the case of the pleuronectids, the lop-sided flat fish, some of the genera of the order have the right side uppermost, others the left side, yet occasionally fish of a dextral genus are found in which the left side is uppermost and vice versa.

This is the explanation I incline to for the presence of a general right-handedness in man; it is a hypothesis I have put forward in many a round-table "grind" when teaching in Cambridge; it has been subjected to the keen criticism incident to such grinds, and found at least plausible and not abounding in fallacies.

DIVISION OF LABOUR IN THE FORE-LIMBS.

Man is now right-handed, or, as I would rather say, man has a right fighting or active arm, and a left shield or passive arm; for it is not a case of superiority of limbs so much as a division of labour, save in the notable exception of writing,

and then not altogether, as I shall show later. Almost all work is shared between the hands, the right always taking that share which is most active or vigorous. Illustrations of this might be given *ad infinitum*; I will content myself with stating a few examples from the common operations of the toilet, of feeding, and of some of the more skilled tasks.

Most men brush the hair of the head with a pair of brushes, using each hand equally and coincidentally in the task. With women it is otherwise; the long hair of their heads requires that the hair be guided to the brush lest it tangle, so the left hand deftly separates braid from braid and the right hand wields the brush throughout the operation; when plaiting the braids each hand works equally and coincidentally, and in the final view of the resulting coiffure through a double reflection each hand alternately holds the back mirror, whilst the other adjusts coils, plaits, and pins. The extraordinary bimanual dexterity, with hand-and-eye cerebration, involved in these common toilet operations of women, can hardly be appreciated by the man who has not attempted something like it, say, to push to the right or left a marked hair on the back of the head; although the hair can be clearly seen in the double reflection, it is ten to one he will on the first attempt push the hair the reverse of the way desired.

No right-handed man would dream of cutting cloth with the scissors held in other than the right hand, yet most cut the finger-nails with scissors held first in the right hand and then in the left. No right-handed man would shave another with razor held in other than the right hand, yet I know many men who in shaving themselves use the right hand for the right side of the face and the left hand for the left side.

Take the use of implements in feeding, say at the dinner table: The soup is conveyed to the mouth by the spoon in the right hand; the meat passively held by the fork in the left hand is cut by the knife in the right hand, and the left hand with singular accuracy performs a flexion and supination to carry the morsel to the mouth (in some countries this active conveyance is performed with the knife held in the right hand, in these places I have noticed that the back of the knife is recurved to facilitate the operation). The sweets are steadied in the plate by the fork in the left hand, whilst they are broken and conveyed to the mouth by the spoon in the right. And of the accessories to the meal: the bread is broken by the left hand, and the glass lifted to the mouth by the right.

Amongst the more skilled tasks, violin playing is a performance which illustrates in a most remarkable way the division of labour between the forelimbs: The left hand shows a remarkable nimbleness of co-ordination of movement in fingering the strings, but this is a relatively passive movement to the swift and deft manipulation of the bow on the strings by the right hand. In the not unskilled tasks of screw-driving and nail-driving is seen the same division of labour; in screw-driving the left hand holds the screw and directs the thrust of the blade of the tool held in the right; in driving a nail the left hand holds the nail in place and dextrously evades the swiftly-descending blow of the hammer wielded in the right. In all these performances, can we say which hand does the most work? As well revive the fabled quarrel of the nose and eyes as to which owned the spectacles.

It may be urged that these examples are of actions which by long usage have become automatic, yet it can be as easily shown that when necessity arises most ordinary folk can learn at a relatively late age in life to perform intricate operations with either hand. We ophthalmic surgeons in England—at least, those of us trained at Moorfields—can operate on the eye, say for iridectomy, with either hand with equal facility. The surgeon, standing behind the head of the patient, incises the left eye with the long narrow-bladed knife of v. Graefe held in the left hand and vice versa.

WRITING.

In writing alone we appear to be almost, though not wholly, right-handed. Not wholly, for there are old and new methods of inscription which are bimanual. He who uses a typewriter will know that his left hand can write swiftly and accurately both in alternation and in conjunction with the right (the latter in the use of shift keys for capitals and figures), and this whilst the writer thinks out his message. This is the new bimanual writing.

But there is an old method of bimanual writing. A visit to the nearest cemetery mason's yard will show the mason cutting his inscription with chisel and mallet, chisel in left

hand and mallet in right. Which does the most writing—the chisel hand or the mallet hand? The sign-writer exhibits a remarkable instance of two-handed writing: the right hand of the painter holds the brush and rests on the mahl-stick held in the left. The left hand accurately moves the supporting stick as the letters are marked with the brush, the painter gets the vertical part of his flourish by the movement of his left hand, and the horizontal by the movement of the right.

But the most extraordinary performance in writing is the inscription of the Braille type by the blind; it is an astonishing piece of work. The writing is done from right to left; the right hand holds the tool which impresses the paper, whilst the left guides the point into the marks on the guiding frame; when the writing is complete the writer withdraws the paper, reverses it, and reads the embossed characters, feeling with both hands from left to right. Often I have noticed the left hand running on to the beginning of the succeeding line whilst the right hand was feeling out the finish of the line above. Was bimanual division of labour ever more surprising!

But enough. The examples I have given show clearly, I think, that ordinarily trained men are possessed of a real ambidexterity, or, as it would be better stated, co-ordination of bimanual action. It follows from this that the aim of the Ambidextral Culture Society is futile; mother nature has already done the work which this new society proposes, and done it so quietly and secretly and so delicately that the sponsor of the society has not seen her working. To the assertion of its founder that it would be well to train children to write, draw, and paint with each hand, I unhesitatingly reply—No. Nature has already shown in a long course of evolution that it is desirable to specialize in the use of the limbs. Four primitive flippers of the early vertebrate have developed into propellers and supporters in the mammal, then into the general carriers of the body and the particular servants of the head in man, and now last of all man has learned to use his fore-limbs in an exquisitely adjusted association so that each is the complement of the other.

In conclusion, I would like to add a word on a tendency I have noticed towards the cultivation of educational fads. In my school days the cast-iron "Latinism" of the public school system crushed out all pleasure in lessons, unless I count the joys of the occasional blue and red flares, the bangs and stinks of chemistry demonstrations; but the schools of to-day are by comparison places of delight where true knowledge is so exposed as to excite desire. Modern educational modes step more nearly in the ways of Nature, and in so far as we continue this healthy lead we shall succeed in drawing on the children. Do we take up with fads we shall be as bores to the youngsters and butts for the gibes of the cast-iron pedagogues who, alas! are not yet dead.

A CASE OF CUTANEOUS ANTHRAX SUCCESSFULLY TREATED BY SCLAVO'S SERUM.

BY

C. B. LOCKWOOD, F.R.C.S., and F. W. ANDREWES, M.D.,
Surgeon, Pathologist and Lecturer
in Pathology,
St. Bartholomew's Hospital.

ON November 9th, 1904, a man, aged 31 years, presented himself at St. Bartholomew's Hospital with a small slough on the right cheek. He was a worker in horsehair, and the lesion had all the appearance of a malignant pustule. Bacteriological examination showed the presence, in the clear fluid from the neighbourhood of the slough, of large numbers of bacilli in all respects resembling anthrax bacilli, and the man was therefore admitted to the hospital under the care of Mr. Lockwood. It may be added that cultivations yielded typical anthrax bacilli in large numbers, and that they proved virulent upon a mouse in quite characteristic fashion. The diagnosis of anthrax was thus completely established.

The patient stated that a red spot had first appeared on the cheek on November 5th. On admission his temperature was 101° F. The slough was about a quarter of an inch in diameter, and there was a moderate amount of redness and oedema around it. The glands at the angle of the jaw were enlarged. The lesion was on the right malar eminence, about three-quarters of an inch outside and below the outer canthus of the eye. The usual operation of excision would have entailed considerable disfigurement and probably a plastic operation to avoid ectropion.

The case seemed, therefore, a specially suitable one for

serum treatment, and a supply of Professor Sclavo's serum was at hand, having been provided by Dr. T. M. Legge, of the Home Office, a few months previously. We were unaware of any case previously treated with the serum in this country, but Dr. Legge had reported to us very favourably of the results which he had seen at Siena in the hands of Professor Sclavo. We have since learned from him that the serum had once before been used in England, but on a hopeless case. The present case seems to be the first in which it has had a fair trial.

Forty c.cm. of the serum were injected subcutaneously into the flank and abdomen on the afternoon of the man's admission to the hospital, and no other treatment was adopted. The temperature was then 102.4° F., and it rose in the evening to 103° F., when the pulse was 92. During the night the temperature fell to 98.6° F.

For the next two days the patient showed little improvement. The temperature oscillated between 98.4° and 101.4° F. and the pulse from 80 to 99. The slough increased somewhat in size, but was never larger than a threepenny bit. The surrounding oedema became much more marked, at times almost closing the eye, and the enlargement of the glands at the angle of the jaw increased considerably. There was also some swelling and redness of the fauces. Nevertheless, no new vesicles appeared around the slough, and the patient's general condition was well maintained, giving no ground for anxiety. No further dose of the serum was given.

By November 12th there was distinct improvement. The temperature was normal, the oedema much less, and the glands had decreased in size. On this day a cultivation from the tissues at the edge of the slough yielded no anthrax bacilli. Convalescence was now rapid, but the slough did not come away till November 26th, seventeen days after the administration of the serum. A small granulating surface was left, which appeared likely to leave a scar scarcely more serious than that resulting from vaccination. The patient left the hospital in good health on November 30th.

The serum treatment thus proved, in this case, completely successful, fully justifying the claim made for it by Professor Sclavo. We publish it because we believe it to be the first successful instance of its use in this country. In those cases which have recovered without excision there has commonly been a much more considerable loss of substance than was seen here, and the risk of a fatal issue is considerable. The operation of early excision, chiefly relied on in this country, is undoubtedly successful in the great majority of cases. But where the lesion is on the face, and especially in the vicinity of the eye, as in this case, the advantages of serum treatment are manifest.

THE VALUE OF NITRO-GLYCERINE IN THE PRACTICE OF SURGERY.

BY FRANK ELVY, M.R.C.S.ENG., L.R.C.P.LOND.

THE action of nitro-glycerine upon the arterial walls can be measured by the observant finger at the radial pulse, and a check is thus made upon its general action, almost corresponding to a control experiment, while one notes the local effect upon a diseased part. In the following cases the arterial walls, unnaturally contracted as a sequel to kidney disease, yielded sufficiently to permit of recovery.

ON December 21st, 1900, I was asked to visit W. C., suffering from a swollen hand and insomnia. The patient was a man of 50 years, employed as a smith in De Beers's works. Fairly well nourished, pale of face and with minutely contracted pupils, he gave a history of a rough life, hard drinking, and many attacks of the "horrors," together with "bad kidneys" and frequent suppression of urine. For three days he had passed little urine and had had no rest, owing, he said, to pain in the back. His pulse showed high tension, the radial arteries resembled fine whip-cord. On the left hand were three small spark wounds, the cause, he stated, of the swelling and oedema of the dorsum around the wounds, brawny patches occurring at intervals. The oedema extended to the elbow and the axillary glands were enlarged and apparently tender. The small quantity of urine obtainable was dark and slightly albuminous, the temperature subnormal and general headache complained of. Fomentations were applied to the hand.

ON December 22nd increased cellulitis, bogginess, and a rise of temperature made incisions imperative, and under ether four half-inch incisions were made on the dorsum, followed by fomentations, while strychnine and stimulants were administered throughout.

ON December 23rd I found the man weaker and obviously going down-hill. The hand, more swollen, was now very cold, and pain and sensation lost. The radial pulse on the affected side could not be felt. The skin from finger tips upwards was blanched, with blue and purple patches on the dorsum. The incised wounds had enlarged and gaped