AUSTRALIAN FAUNA AND MEDICAL SCIENCE.

By

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Up till recent times the appeal for the preservation of the unique fauna of our country has been based largely on sentiment. To-day, thanks to poison and the gun, we recognise that many of our animals that were common twenty years ago are becoming increasingly rare, and within a short period of time will have completely disappeared, never to be recalled. In this paper I wish to draw attention to what is now the most urgent plea for the preservation of our fauna, viz., its importance for a correct understanding of the human body in health and disease.

The animals of Australia and Tasmania are teeming with points of scientific interest. Through them human complexities are revealed in their simpler form. Their study is really a study of human embryology, i.e., embryos in which we can study not only structure, but function, on which structure depends—for to the medical scientist the latter must be regarded as the register of the former. So-called "sports," "monsters," and "precocious developments" must have a functional origin and correlations.

NORMAL OR STANDARD TISSUE.

In the consideration of any diseased tissue of the human body, such as cancer, a comparison must be made with the condition in health—the abnormal must be compared with the normal. Thus arises the question, what is normal mammalian tissue? Recognising the effects, over centuries, of alcohol, syphilis, and other poisons on the human race, one would be loth to regard tissues from an individual dying from misadventure or natural causes as typically mammalian, and similarly with animals commonly used for experimentation, such as dogs, rabbits, and guinea-pigs, owing to the modifications of domestication. It is to the primitive mammals of

Australia and Tasmania, unaffected by syphilis, alcohol, or domestication, that have lived in a natural environment for millions of years, that we must look for normal tissue. In the case, e.g., of the ductless glands, the platypus (*Ornithorhynchus anatinus*) offers a remarkable standard for human comparison. Thus the parathyroids are constant, and easily found at the junction of larynx and trachea; Cowper's glands, rarely seen by the medical student, are highly developed; the thymus is retained in the adult; and three ductless glands not so far discovered in us can be demonstrated, viz., parathymus, scapular, and sex glands. In the National Museum the collection of normal histological preparations from reptiles and primitive mammals of Australia and Tasmania, with which human or other mammalian tissue can be compared, is quite unique in the world, and numbers many thousands.

THE HUMAN BRAIN.

To the student of medicine no portion of human anatomy presents such difficulties, whether from the point of view of structure or function, as the brain, and, for the reason that, generally speaking, he knows little about the history of the entities which go to make up the complex central nervous system. When and why does the callosum, the great connecting commissure between the hemispheres, arise? What does the fornix represent? Why is the grey matter external to the white matter? Why should the thalamus be a single body in mammals up to man, in whom the only representation of unification may be but a simple band? What does the free edge in the interior of the brain represent? Is the lateral ventricle of man a similar structure to that of reptiles? These are basic problems in neurology, and can only be answered by a study of the brains of Australian reptiles, monotremes, and marsupials. Our lizards, broadly speaking, can be divided into two main divisions, viz., those moving on their belly wall, such as the blue-tongued variety, using their limbs for bodily propulsion, but not for bodily support; and those, such as the bearded and frilled, that raise themselves off the ground, using their limbs for bodily support as well as bodily propulsion. In the former the olfactory sense is well developed in contrast to the latter with its more extended horizon, the result of an improved muscular effort towards the erect posture. Of the two monotremes, one, the platypus, depends on the streams for its food; while the echidna (*Tachyglossus*) has left the water, is found all over the Commonwealth, and has its body well raised off the

ground, using its limbs definitely for bodily support as well as propulsion. In the former the brain is smooth and unconvoluted, in contrast to the richly convoluted brain of the latter, which reminds one of a miniature human brain. Amongst the marsupials the nearest approach to the brain of higher mammals is found in the kangaroo (*Macropus*), an animal able to adopt an erect attitude owing to the tripod formed by the great tail and the two feet. Its cortex is in marked contrast to the feeble unconvoluted cortex of koala—an arboreal animal. In our mammals the free edge in the interior of the brain—which is not found in that of reptiles—is present, and the grey matter is external to the white; but the characteristic callosum of higher mammals has not yet appeared.

THE GASTRO-INTESTINAL TRACT.

Many arbitrary divisions of the human intestinal tract are described, and, in the case of the large intestine or colon, no less than nine portions are noted. In addition there are two ill-understood areas, viz., the great omentum and the lesser peritoneal sac. It may be stated that no portion of the human abdomen is so puzzling to the anatomical student as these areas. If we examine the lowly stump-tailed lizard (*Trachysaurus rugosus*) or the blue-tongued skink (*Tiliqua scincoides*) we find a simple primitive intestine without development of cæcum, great omentum, or lesser sac. In the bearded lizard (*Amphibolurus barbatus*), using its limbs for propulsion as well as support, although there is a commencement of the hitching up of intestine which reaches its culmination in erect man, together with the genesis of a cæcum and duodenum, there is still no trace of great omentum or lesser sac.

In these reptiles the heart is not yet four-chambered—there is no respiratory piston or diaphragm, and the spleen is miniature in size.

In the platypus the heart is four-chambered, the red blood cell is now non-nucleated, a diaphragm has developed, and the spleen has reached great proportions, spreading itself in the shape of two great processes over the abdominal cavity. This development of spleen has necessitated the development of a mesentery or great omentum on which it is swung, and here in its simplest form we have the development of the lesser peritoneal sac. In our monotremes and marsupials the student can study the method of gut fixation which is such a marked and puzzling feature of the human intestine, and by studying the intestine of koala (*Phascolarctus cinereus*) or the common phalanger (*Trichosurus vulpecula*) he realises that the nine divisions of the human intestine really consist of but two portions, a right or mesenteric portion swung on the mesentery with the small intestine, and a left or mesocolic swung on the mesocolon.

In the bearded lizard we see the genesis of the cæcum, in the koala its greatest development, and in the wombat (*Phascolomys mitchelli*) we have an appendix resembling the human, but showing usually a more advanced stage of retrogression even up to complete disappearance. It may be mentioned that the minute stomach of platypus and the larger one of echidna show a lining of stratified epithelium, and not of columnar cells. In both the Tasmanian devil (*Sarcophilus*) and the Tasmanian tiger (*Thylacinus*) the intestinal tract presents a simple loop with little apparent distinction between the large and small intestines. No cæcum is present at the junction of these; but a well-defined vagal nerve distribution can be demonstrated. This latter is important in the consideration of the "lock" system of the alimentary canal, to defects of which diseases such as chronic constipation may be due.

THE MUSCULAR SYSTEM.

Of all mammals man is the most intelligent and the most erect.

Other animals, such as the anthropoid ape, monkey, and dog, can assume the erect attitude; but in all these, balance on the two limbs is an effort. There is not that freedom of the fore limbs from support that has given rise to the development of the tactual sense characteristic of the human. Whether viewed from the question of health or disease a correct understanding of the mechanism of the erect posture and its correlations, such as respiratory, circulatory, and intestinal, is essential.

The erect posture is the underlying basis of higher mammalian development, and the great epochs in this development are represented by improvements in muscular function. The erect posture is not an old acquisition, and consequently is easily attacked. To-day, recognising this, medical men are paying more attention to postural defects as the underlying pathological basis of much of the chronic disease seen in our hospitals. Included in our fauna we have animals crawling on their belly wall using their limbs for bodily progression, not for bodily support; others, such as the platypus, using limbs for bodily support as well as progression. In the echidna we have an animal whose belly wall is definitely off the ground. In koala we find an animal able to raise its hand above its head in reaching for the gum leaf, and in the kangaroo we can study an erect posture achieved by means of a tripod.

Through our fauna also the comparative value of the functions of human muscles can be studied, and it is along these lines that the modern treatment of infantile paralysis has been evolved. We recognise that muscular functions recently acquired as seen, e.g., in connection with the ectogluteus of the hip or the quadriceps extensor of the knee, or those disappearing as seen, e.g., in connection with the inverters and everters of the foot, are unstable and readily attacked by disease.

THE GENERATIVE SYSTEM.

Amongst our animals are egg-layers, egg-layers provided with mammary tissue for the nourishment of the young, and others whose young are born in an immature or embryonic state and develop to maturity within a marsupium or pouch. The fact that our marsupials have solved the question of sustained life with embryonic birth is interesting, when we consider that even a seven months' human fœtus is reared with difficulty. The greatest problem in human midwifery to-day is a knowledge of the impetus causing birth. Why should a human fœtus be born after a period of development of nine months, and that of the kangaroo at one month?

By a study of the method of unification of the Mullerian ducts in our marsupials light is thrown on abnormalities met with in the human genital system. Here, too, can be studied the physiological principles of uterine suspension, to correct defaults in which so many gynecological operations are now undertaken.

In the adult male monotreme the testes are still intra-abdominal, and the urinary and genital tracts separate. In the marsupials the prostate gland appears—in fact, in animals such as the phalanger it would appear to have reached its greatest relative development. Here, too, the urethra is genito-urinary and the testes have left the abdomen and are extra-abdominal. Interesting light is thrown on the pathology of hernia (rupture). In the kangaroo, wombat, and koala the internal abdominal ring and sac are patent;

but no instance of hernia has ever been recorded in these animals. In the Tasmanian tiger and devil the internal ring is closed. Nature has "cured" the hernial sac. Why is this necessary in the latter, and not in the former?

CONCLUSION.

This article but touches human problems on which a study of the members of our fauna throws light. The foundation of the National Museum of Australian Zoology by the Federal Government is a recognition of the importance of our native animals to medical science, and of the duty owed to future generations of Australians. But time is a factor; for the fauna is fast disappearing, and every specimen is of importance.

The Federal Capital Commission has now allotted sites for the National Museum at Canberra. That for the museum, laboratories, and lecture theatre is a magnificent one on Acton Hill, not far from Civic Place, and facing Parliament House and the Capitol site. The area is a semicircular one containing five and a half acres. The Research Reservation is a peninsula of about 80 acres, bounded by the River Molonglo, and facing Black Mountain. It lies in what is known as the Continental Arboretum. Here will be kept live specimens of Australian and Tasmanian native animals in their natural state. When the buildings are erected Canberra will become the world's centre for the study of our unique fauna, and every facility will be offered to workers not only Australian, but also from abroad, wishing to study comparative anatomy and its application to modern medical and surgical practice.

Documents, illustrations, and specimens, if sent to the National Museum of Australian Zoology, which is temporarily housed at 612 St. Kilda Road, Melbourne, will be catalogued with the donor's name attached, and will be national property for all time.