

The Opportunities for Research in the Department of Anatomy

UNIVERSITY COLLEGE OF RHODESIA
AND NYASALAND

BY

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The academic members of the staff of every department in all the faculties of a university or university college have three inescapable duties all on equal footing. The first is the provision of courses of instruction for undergraduate students and, where applicable, graduates as well, in the subject appropriate to the department. The tuition to be provided for the first intake of medical undergraduates attending classes in the department of anatomy, University College of Rhodesia and Nyasaland, has already been published in outline.¹ The second obligation expected of the staff of individual departments in a university is active participation in the administrative life of the institution. The contribution to faculty and college business by the members of the staff of the department of anatomy is contained in annual reports that the head of the department submits to the college authorities. The third fundamental responsibility of the members of the staff of each department, by virtue of being part of a university, is the search for new knowledge either in the form of original discoveries or as re-assessments of what is already known in the light of new concepts or other circumstances. The head of each department and his academic departmental colleagues are individually and collectively required to make the department not only a centre of research activity, but also a centre for training individuals to pursue research. They must seek collaboration with others inside and outside the department, faculty and college wherever and whenever opportunities either present or can be made to present within the resources available or foreseeable.²

The authors of the second report of the Nuffield Planning Committee,³ whose proposals were accepted by the University of Birmingham as basic to the special relationship which exists between the university and the college in respect of the award of the medical degrees of the University of Birmingham to the successful students in the faculty of medicine in Salisbury, had this to say about research, paras. 118-122:

"Throughout our report we have emphasised, explicitly and implicitly, that the conduct of research is one of the essential functions of a medical school. The reasons which reflect, in turn, upon the reputation of the school, its staff and the country's medical practice are familiar ones, but perhaps it may not be out of place to recall them: (i) If the school is to be something more than a technical institute—if, in fact, it is to take and keep its place as part of a university—it is vital that it should be a centre for research as well as for teaching. (ii) The opportunity for first-class research is one of the surest ways of attracting a first-class staff. (iii) Active and well-directed research is a major factor in setting and maintaining a high standard of medical practice.

"We suggest that in Rhodesia the direction of medical research should be determined by the conditions of the country. In this way those who are engaged in it will constantly be coming up against urgent problems and will not lack for research material, while any conclusions that may emerge will stand a chance of immediate application and so engender new problems.

"Projects should be chosen which exploit local resources and which are complementary to rather than duplications or direct extensions of work being done in the United Kingdom or the United States. Those requiring very elaborate and expensive apparatus and a highly-trained technical staff for its use and maintenance should, on the whole, be avoided. It would be better for the choice to fall on those that require a generous supply of animals and of clinical material. The supply of animals, including monkeys, should incidentally be extremely good and the school could, in time, if it so wished, build up animal colonies which would be second to none.

"The greatest research asset in the Federation is the almost unlimited field for the study of physiology in a tropical environment and of the natural history of disease.

"Normal standards in the African need to be established. . . ."

The present paper deals with the scope for research in the department of anatomy, University College of Rhodesia and Nyasaland. Opportunities lie currently within the compass of human morphology, reproductive physiology and endocrinology and medical education. Other topics which may be considered as properly the concern of a department of anatomy include electron microscopy, tissue and organ culture and transplantation, embryology and the biology of nervous system.

In the field of human morphology the patterns of variation in the arrangement of the soft tissues of Africans have not received the attention they merit and that a medical school in Africa is well equipped to give. That considerable variations do occur in the anatomy of Africans compared with well documented European subjects is offered by the bodies recently dissected by second year students in the department. In one cadaver, for example, the cephalic veins ran a supra-clavicular course instead of joining the axillary vein through the deltopectoral triangle, as is usually the case in European bodies. In another subject the biceps muscle showed three origins, a circumstance which is not unknown in European subjects, but is somewhat unusual. It is obviously important to ascertain the frequency of such anatomical variations and to establish what is anatomically normal in the African. Three investigations are therefore in hand to study certain aspects of the morphology of normal adults, children of different ages and still-born children.

The first of these studies in human morphology proposes a comparison by measurements of selected features of the chests of normal adult males with similar measurements of the corresponding features of the chests of diseased adult males. The material to be used in this investigation is the exceedingly fine library of mass miniature X-ray photographs at the X-ray Centre, Market Square, Salisbury. These films, numbering about 250,000, have hitherto been used by the Medical Officer of Health, Salisbury, only to determine whether or not a particular individual is suffering from tuberculosis or some other potentially incapacitating condition. Understandably they have not been analysed to provide information on a wide range of topics of interest and use to practising physicians and other specialists in tuberculosis, cardiology, orthopaedics and anthropology, to name a few. The parameters being measured include several diameters of the heart shadow and vascular pedicle, the greatest internal diameter of the chest, the maximum length of the lung shadows as well as the areas of the heart and lung shadows and the height of the diaphragm. Within the limitations of the materials being used these measurements will provide the data necessary for the calculation of indices which will give information about similarities and differences that exist between normal and diseased chests in African and European men. They will also provide a body of knowledge of a statistical nature about the shape of the normal adult thorax and its contents in the male in several groups of peoples—Rho-

desians, Portuguese East Africans, Malawians, Zambians, Europeans and so on. The department of anatomy is doubly fortunate in that the Medical Officer of Health, Salisbury, has given permission for his collection of films to be used in this way, and second, in that a private benefactor has given a grant to cover stipends for three medical students to work on this problem as undergraduate research scholars during the long vacation January to March, 1965. The time and energies of the research scholars will be divided between the department of anatomy, the X-ray centre in Market Square and the college library.

Another study in human morphology relates to an investigation into the patterns of variation in the arrangement of the blood supply to and embryological vestiges remaining in the digestive, excretory and reproductive systems of African still-born children. This work is being supported by a grant to the head of the department from the research fund sub-committee of the university college. The award includes money to pay for a further two medical undergraduate research scholars whose endeavours in this study will be divided between the department of anatomy, the *post-mortem* room at Harare hospital and the college library during the forthcoming long vacation. Liaison for this work has been effected with the superintendent of Harare hospital and the consultant obstetrician and gynaecologist.

These five research scholars will be chosen from amongst the existing second year medical students, who number 22. Selection will be made early in December, 1964, with the co-operation of the chief examiner in anatomy from Birmingham, on a triple basis, first, of excellence in performance academically in the forthcoming Part I of the second professional examination in human morphology; second, on the quality of the student's class work during the present academic year; and third, on an assessment of the extent to which the candidates for the research scholarships are themselves likely to benefit from the experience of having participated in research. The academic promise among the students who have said they would like to participate in these research projects with or without scholarships is exceedingly heartening.

It is of interest at this point to record the practice in the majority of medical schools in the United Kingdom and in the most progressive schools in America to encourage research activity by undergraduate medical students. Most medical schools in Great Britain prepare their undergraduate students for research by encouraging

the more gifted amongst them to side-step the medical course for a whole year to allow them to enter an honour school in one of the medical sciences, viz., anatomy, physiology, biochemistry and sometimes pharmacology and pathology. A majority of these students eventually take up a career either in academic medicine or proceed to higher degrees with a view to entering consultant practice. In the present circumstances of the faculty of medicine in the university college several years will elapse before it can staff an honour school in human biology within the faculty of science. In the meantime and as a stop gap it may, however, be possible to come to some arrangement with the authorities in the University of Birmingham to give opportunities to selected students from Salisbury to join their undergraduate colleagues in Birmingham in the honour schools of anatomical and physiological studies in the faculty of science, Birmingham.

There are comparatively few research scholarships available in the United Kingdom to enable students to do research during long vacations. This is in striking contrast to the position in certain forward looking medical schools in the United States of America. Yale medical school, as an example, has set aside the staggering sum of between \$400,000 and \$500,000 annually for student research projects. As one of the Yale professors put it, "this money prevents the students from heaving coal during the vacations." A few schools across the Atlantic Ocean have included in their medical undergraduate curricula one or two research periods lasting a month or two within the period of undergraduate training, either as a compulsory feature, as at Western Reserve, or as an elective, as at Stanford. One school in San Francisco has compulsory research periods for their undergraduates within the time allotted to its department of anatomy. The administrative set-up within that department to cope with research projects for 120 students is understandably becoming increasingly burdensome, so much so that some 30 students were recently allocated research activities in some other department in the faculty, notably endocrinology and embryology. The only criterion here was that the research project should have some slant towards morphology.*

The third study in the field of human morphology currently being carried out in the department of anatomy is interesting from a number

of points of view additional to those already put forward in support of the need for research in human morphology *per se*. Students in the second year of the medical course in Salisbury visit an African school in Chikwaka reserve as part of their undergraduate training to make a series of measurements—for example, the weight, standing height, sitting height and the circumference of the chest on boys and girls of different ages. It is proposed to make the same measurements on the same children in successive years. These measurements, including others which can be taken from a photograph of each child standing against a squared grid, will form the basis of the calculation of a number of norms for African school children. Unfortunately this does not imply that the children are normal. There is, for instance, a high incidence of goitre in the area and we have no knowledge of the frequency of bilharziasis or of worm infestation amongst the pupils. Doubtless these conditions are also common. Nevertheless the information which the data will provide will be useful to doctors, paediatricians (some of our findings have already been quoted at a Paediatric Conference in Uganda), manufacturers and others. Besides participating in a study which has considerable intrinsic value, the medical students will have had practice in handling living people and this will prepare them in some measure for their work in hospital. They will begin also to appreciate the limitations of statistics and of statistical methods, for the students who have made the measurements will also participate in the analysis of the data. In addition, they will have had the opportunity early in their undergraduate medical career to observe in a population of about 200 children the large amount of variation that is still within limits of normality. Finally, they will have had the chance to see something of certain aspects of the processes of growth and development in children whose ages range from seven to seventeen years.

Three problems in reproductive physiology and endocrinology are currently being investigated by members of the department of anatomy. The first involves the use of seasonal breeding animals, the second concerns the mechanism of the implantation of the embryo in certain animals, and the third is the examination of the school children at St. Joseph's School, Chikwaka reserve, to determine the incidence of goitre among them.

Normal function on the part of the pituitary gland is of the utmost importance to Man—indeed, to all vertebrates—in respect to the con-

* Much of the information contained in this paragraph was collected during a world trip of medical schools made towards the end of 1962 on a grant from the Rockefeller Foundation, to whom I am much beholden.

trol which that gland exercises over a number of cyclical activities, notably reproduction. Much still remains to be discovered about the mechanisms which control the elaboration and secretion of the trophic hormones from the anterior lobe of the pituitary gland. It is known, for instance, that certain hormones themselves (e.g., oestrogen) can influence the production of gonadotrophin by the pituitary. It has also been established that the nervous system can modify the activity of the gland. For instance, it is commonplace that certain seasonally breeding animals apparently have a physiological pathway between the retina and the hypophysis because light, under certain experimental conditions, can influence in a striking way the cyclical activity of the pituitary gland in respect to the timing of the breeding season. In contrast, there are other seasonal breeding animals, which include bats, which do not respond to light by an alteration in the timing of their breeding season. The question is: Is there another component of their environment which can be made to influence the cyclical activity of the pituitary gland in these animals? May it not be related to temperature, or to the food the animal eats, or to atmospheric pressure, or to the muscular activity of the animal, or what? Or is the cyclical activity of the pituitary gland in such a seasonal breeding animal completely independent of changes in the external environment? A start has been made in an attempt to answer these questions. Beginning in March, 1964, and every four weeks thereafter, some 15 male and 15 female bats of the species *Miniopterus natalensis schreiberei* have been taken from a single cave in an old gold working near McIlwaine, some 30 miles from Salisbury, in order to establish the timing of the breeding cycle in these animals. The cyclical activity of the gonads, the adrenal, thyroid and pituitary glands is being investigated histologically. The information thus obtained will provide the background essential to decisions affecting experimental work which will begin next year or as soon as possible thereafter on these animals. There is an interesting possibility that the cave from which the animals are taken might itself be used as a natural experimental animal house which would have the attractive advantages of not having to provide the animals with food, water, cages and so on.

The cost of this investigation is being borne by another grant to the head of the department from the research fund sub-committee of the university college. This work provides an interesting example of the liaison that has been developed between the academic staff of the

department of anatomy and other groups of individuals interested in the anatomy and physiology of bats. For example, an officer of the Government Department of National Parks and Wild Life Management is receiving samples of blood; the director of the Atlantica Research Foundation receives bats of species other than the one that interests the department of anatomy; members of the consultant clinical staff at Harare hospital wish to receive samples of bat faeces, and liaison has also been made with a private individual interested in the mechanism of echolocation which he is endeavouring to adapt as an aid for the blind.

The other research endeavour in the field of reproductive physiology at present engaging the attention of the academic staff in the department of anatomy is relevant to current worldwide interest in population studies. It takes cognisance of the fact that some species of animals in widely separate orders appear constantly to have their young solely in one or other uterine horn. Preliminary studies of the gross and microscopic structure of the reproductive tracts of the duiker (*Sylvicapra grimmia*) and of the bat referred to above appear to confirm that the single young which these animals uniformly bear is always implanted in the right uterine horn and never in the left. There may be other species of animals where the opposite is the case and still others may implant a single zygote randomly in either the right or the left uterine horn. The material already available (duiker and bat) is being used in an attempt to discover the mechanisms underlying unilateral implantation of the single embryo—are they anatomical, embryological, physiological, biochemical or what? Liaison has been made with Wild Life Utilisation Services (Pvt.) Limited, in the Gwaai Forest reserve, to provide reproductive tracts of male and female duiker. This research project is being carried out by the department within the general funds that have been allotted to it by the college authorities.

As far as the department of anatomy is concerned there is, in addition to the intrinsic worth of these endeavours in the field of reproductive physiology, another and important reason for the choice of these particular investigations with bats and duiker. The faculty of medicine does not yet have an animal house where surgery can be done and where experimental animals can be kept under prolonged observation which is necessary when one is working with seasonal breeding animals. These preliminary investigations will nevertheless be critical to the decision that these

animals might be useful in long-term research in reproductive physiology. The experiments under way will also provide time to think more extensively than might otherwise have been possible on likely lines of future experimental work in an animal house when it becomes available.

The third study in the field of endocrinology currently being undertaken by members of the academic staff in the department of anatomy is a clinical examination of the children attending St. Joseph's School, Chikwaka reserve, to determine the incidence of goitre among them. This study stemmed from a chance observation made during the course of the visits to the school that some of the children appeared to have enlarged thyroid glands. This study necessitated co-operation on the part of the department of anatomy with the local and central education authorities and with the Ministry of Health.

In the circumstances of the newly created faculty of medicine, University College of Rhodesia and Nyasaland, there are many opportunities for the members of the academic staff to study problems relating to medical education. Members of the academic staff in the department have in hand a number of investigations of more than purely academic interest in this field. The first of these is the compilation in Shona of phrases, etc., that will be useful to students, nurses and other hospital staff when they are taking a medical history from an indigenous patient. The second is the continuation of the analysis of the replies received from doctors now in practice in Africa to a circular letter asking them in what ways their undergraduate training fitted them and in what ways it fell short of their needs when they first began to practise medicine in this part of the world.⁴ The third study deals with the efficiency of the methods currently used in the selection of medical students. This investigation is not so much an examination of the academic performance of the successful students at present in the faculty, but is rather an inquiry into the fate of (a) the applicants who, for a variety of reasons, did not come to the faculty of medicine in the first place; and (b) the students who were required to withdraw from the course on academic grounds or who left the faculty of medicine of their own accord. A fourth inquiry in the field of medical education concerns an examination of examinations. The particular facet of this important topic that is being considered is a continuation of an investigation into the ability of medical students to forecast their own ability

and the ability of their colleagues in professional examinations.⁵

It is all too apparent that the number of research problems proper to the interests of a department of anatomy is without limit. One of the important skills of an investigator lies in the choosing of his study. The research problems currently being investigated by the staff of the department of anatomy, University College of Rhodesia and Nyasaland, have been chosen with the following circumstances in mind: first, the materials being used are readily available and in large quantity; second, the work in human morphology will provide results that will be useful to practitioners in private and consultant practice as well as to a variety of specialists; third, the experiments in the field of reproductive physiology will advance the understanding of at least two of the fundamental aspects of reproduction; fourth, the investigations in medical education will contribute to the alertness of the faculty in this endeavour; fifth, the investigations do not require elaborate apparatus or premises in which to carry them out; sixth, few, if indeed any, of the small seasonal breeding animals indigenous to Central Africa have ever been used experimentally; seventh, the experiments and investigations are graded to match the skill and the permanence of the investigators; and eighth, they make use of the research talent inherent in the population of medical students. This last circumstance is extremely important, since these young people will be among the future academic leaders in medicine in this country. Some of them will return to the department of anatomy as teachers and research workers. When that happens the department will have come of age.

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