

## Anatomical Society of Southern Africa

The following are abstracts of papers presented at the Xth Annual Congress of the Society held in Durban on 6 and 7 July 1979.

## Anatomiese Vereniging van Suider Afrika

Die volgende is uittreksels van referate, wat gedurende die Xde Jaarlikse Kongres van die Vereniging vanaf 6 tot 7 Julie 1979 in Durban gehou is.

### Is There a Ventral Neural Ridge? Implications for the Origin of Adenohypophyseal and Other APUD Cells

N. B. Levy, A. Andrew, B. B. Rawdon and B. Kramer  
Department of Anatomy, University of the Witwatersrand Medical School, Johannesburg 2001.

Two- to ten-somite chick embryos were studied in order to ascertain whether, as has been proposed, there exists a 'ventral neural ridge' which gives rise to the hypophyseal (Rathke's) pouch. Serial sections, models, scanning and stereo-microscopy were used.

The neural ridges arch around the rostral end of the embryo onto the ventral surface of the head, but no evidence was found for their extension to form a 'ventral neural ridge' reaching the stomodaeum. In fact, a considerable expanse of non-thickened surface ectoderm was seen to separate the ventral portions of the neural ridges from the stomodaeum. The thickening of neural ectoderm which does appear on the ventral surface of the head results from apposition and fusion of the opposite neural ridges flanking the neural plate and thus the tip of the anterior neuropore — the classically accepted mode of closure of the neuropore.

These findings are in accord with the generally accepted concept of the origin of the hypophyseal pouch rather than with its derivation from a 'ventral neural ridge'.

No sign of neural crest formation was encountered ventrally. This observation excludes the possibility that endocrine cells of the APUD series could originate from neural crest in this region.

### Ultrastructural Identity of Pancreatic Polypeptide Cells in Chicks

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The ultrastructure of pancreatic polypeptide and somatostatin-immunoreactive cells in chickens is very similar. In order to characterize any differences between them, immunoreactive cells in semi-thin sections of chick pancreas were matched with the same cells in adjoining thin sections prepared for electron microscopy.

In pancreatic polypeptide cells there are elongate as well as round granule profiles, whereas in somatostatin-immunoreactive cell profiles are almost exclusively round. Within cells of both types the electron density of the granule matrix varies from one granule to another, but the range of density is greater among pancreatic polypeptide granules. The latter are slightly smaller than somatostatin granules.

It is possible to distinguish the two cell types on the basis of their ultrastructure. The differences are clearly seen in material fixed in picric acid-formaldehyde; they are somewhat less obvious after Karnovsky fixation.

### Quantitative Studies of the Evolution of the Thalamus in Primate Phylogeny

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Quantitative studies have been undertaken on the diencephalon of three prosimian primates, *Tupaia glis*, *Lemur catta* and *Tarsius bancanus*.

This study has been confined to thalamic nuclei, using a modification of the technique of Stephan *et al.* (1970), by making line-film negatives which are projected directly on photographic sheets at any magnifica-

tion; this allows better resolution in 'positive' prints for detailed examination of the selected area. Volumes of the diencephalon, and particularly the thalamic cell groups, are calculated by using a modified allometric method:

$$V = \frac{A \times D}{M^2}$$

where  $A$  = area and weight of cut-out photographic section in  $\text{mm}^2/\text{mg}$ ;  $D$  = interval distances between brain section;  $M^2$  = square of linear magnification. The phylogenetic division of the thalamus into palaeo- and neo-neural components provides a criterion for analysis of the quantitative data. Thalamic, diencephalic and brain volumes, and ratios between palaeo- and neo-thalamus, and of these structures with brain volumes were discussed in assessing the evolution of the thalamus in primates. The taxonomic status of *Tupaia* and the phyletic precedence of *Lemur* over *Tarsius* in the Order Primates were also discussed.

### Somatostatin-immunoreactivity Demonstrated in the Embryonic Chick Pancreas

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Immunocytochemistry was employed to demonstrate when first somatostatin-containing cells can be identified within the embryonic chick pancreas. Pancreatic buds were obtained from Black Australorp embryos of 5 days; 4.75 days; 4 days; 3.5 days; 3.25 days and 3 days of incubation.

Somatostatin-immunoreactive cells were found in all embryos examined, with the exception of the 3-day embryos. Thus, immunoreactive somatostatin becomes detectable at 3.25 days, when the dorsal pancreatic bud is beginning to evaginate from the foregut.

### Are the Various Pancreatic Islet Cell Types in Chick Embryos Derived from the Trunk Neural Crest? Preliminary Results

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It has been established that pancreatic APUD cells are not derivatives of the trunk neural crest (Andrew, A., *J. Embryol. exp. Morph.*, **35**, 577, 1976).

To determine which islet cell types are represented amongst these APUD cells, quail neural tube and crest were isotopically and isochronically transplanted to chick embryos before any crest migration had occurred. Evidence of subsequent migration from the grafts was seen in spinal ganglia. A, B and D cells have been demonstrated by immunocytochemistry. These cell types do not show the quail nuclear marker and are therefore not derived from the neural crest.

### The Venous System of the Lower Limb of the Crocodile (*Crocodilus niloticus*)

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The lower limb of a crocodile was dissected to determine whether or not the venous return was supplemented by a muscular pump such as is present in man.

The venous system consists of deep, superficial and communicating channels, arranged in a pattern very similar to that in man. A large muscle on the posterior aspect of the calf has a structure not dissimilar to the soleus muscle of man and has within it, a forked channel containing valves. This arrangement suggest a pumping mechanism. The presence of a muscular pump in an animal which has a low hydrostatic height is of phylogenetic interest.

### A Tubercle on the Shaft of the Fifth Metacarpal

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The hands of 75 South African Negro cadavers were examined for the presence of a small tubercle seen radiologically on the ulnar border of the fifth metacarpal shaft.

Gross inspection revealed that the tubercle is caused by tendinous fibres in the muscular bundle that arises from the tip of the hamulus and extends as an opponens layer superficial to the deep ulnar nerve.

A tubercle was found in 29% of males and 46% of females examined. The higher incidence in females is ascribed to the more frequent performance of opponens type (precision grip) hand labour, whereas males more frequently perform flexion type (power grip) hand labour.

Whether the existence of the tubercle might also be a racial characteristic was not resolved.

### The Angle and Level of Origin of Single Renal Arteries

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Fifty-two dissecting room aortas, from which sprang right and left single renal arteries, were measured for circumference, distance from the midline anteriorly (assumed to be equivalent to the centre of the superior mesenteric orifice) of each renal orifice, and the vertical separation of the two.

The mean take-off angle of the *left* artery was  $81^\circ$ , with a standard deviation of  $\pm 12.7^\circ$ ; on the *right* the figures were mean  $72^\circ$ , S.D.  $\pm 14.0^\circ$ . Statistical analysis confirms that the difference between the right and left take-off angles was significant, as was also the difference between the mean of  $81^\circ$  for the left artery from a strict lateral  $90^\circ$ .

In one third of the specimens the origin of the two arteries was at the same vertical level, or within 2 mm of each other. In the remainder the *left* artery was *twice* as likely to originate at a *lower level* than the right; the right artery never originated more than 9 mm lower than the left, while the left artery was found as low as 22 mm below the right origin.

### Variation in Renal and Gonadal Vessels

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The incidence of venous renal collars as well as arching of the gonadal arteries has been determined in South African Negro and Caucasoid cadavers. Renal collars occur in both Negro males ( $N = 136$ ) and females ( $N = 39$ ) in approximately 6% of cases. According to the literature this appears to be a high incidence. Although the white sample is small, this venous anomaly was found in 14.3% of females ( $N = 14$ ). The Negro population displays a high frequency of gonadal arteries arching over the renal veins. This arterial variation occurs in approximately 22% of males ( $N = 82$ ) and in about 12% of females ( $N = 16$ ). The presence of these anomalies, if unrecognized, could prove to be hazardous during surgery.

### Prenatal Diagnosis of Neural Tube Defects

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Neural tube defects affect about 1 of every 1000 newborn Whites, Africans, Indians and Coloureds in Natal. These defects may be detected prenatally by assay of maternal serum alpha-fetoprotein, which is done between 16 and 20 weeks of gestation. Hitherto the radio-immune assay

was the only method sensitive enough to measure the small amounts of a-fetoprotein in maternal serum, but it is an expensive technique, requiring special laboratory facilities, and the reagents are stable for only a short period.

Enzyme-linked immunosorbent assay (ELISA) has been adapted to the measurement of a-fetoprotein. This method is inexpensive, requires no special equipment, and it is as sensitive as radio-immune assay. It is therefore ideal for mass screening of pregnant women.

Screening has been offered to pregnant women in Natal since April, 1979 and the results of the first 1200 tests are presented. Of these, 95% were normal and 5% were not. These 57 cases were re-tested and 10 proved to be normal, 34 were equivocal and 13 had abnormally high levels of a-fetoprotein. Repeat blood specimens were requested from the 47 subjects in the latter two categories but only 18 were obtained. Two of these were referred for amniocentesis and the elevated amniotic fluid a-fetoprotein level in one led to the identification of an anencephalic fetus. The pregnancy was terminated.

Technically, the ELISA method worked well and as many as 100 sera were assayed daily, but the follow-up in cases with abnormal levels was poor. Closer collaboration with municipal and other health services will have to be arranged if the maximum potential benefit of prenatal screening for neural tube defects is to be attained.

### A Case of Cleido-cranial Dysplasia

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Cleido-cranial dysplasia is characterised *inter alia* by dysplasia of bone developing from membrane. One or both clavicles may be totally or partially absent and the question then arises whether the muscles normally attached to the clavicle would then be present.

In this case a 20-year-old European female presented with an absent medial half of the right clavicle and imperfectly ossified left clavicle, but the clavicular muscles were all present. Their functions were tested and graded according to the Oxford scale and the results showed no or minimal dysfunction.

It is concluded therefore that the clavicular muscles in the absence of ossified clavicle are present, and although probably attached to fibrous tissue, have lost none or very little of their function. A fully formed bony clavicle with periosteum does not appear to be necessary for adequate functioning of these muscles.

### Effects of Pars Distalis Grafts on the Growth of Chick Embryos

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In an experiment on hypophysectomised chick embryos, one of the groups was sham-operated, i.e. eggs were windowed and the vitelline membranes torn. Some 8-day, sham-operated embryos received grafts of partes distales from 19-day embryos, while others acted as controls. At 14 days of incubation all embryos were sacrificed.

The body weights and third-toe lengths of the sham-operated embryos that received grafts were significantly lower than those of sham-operated embryos without grafts; the latter group resembled non-operated controls in all respects. In embryos with grafts the thyroid follicles were significantly larger than in the other two groups.

It is postulated that excess thyroid hormones in embryos with grafts had catabolic effects on growth.

### Role of Acid Phosphatase in Granular Cells of Female Mouse Submandibular Gland after Testosterone Administration

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Administration of testosterone to young adult female mice stimulates an increase in number of cells containing electron-dense granules in the submandibular gland. Testosterone-treated females have been studied while feeding, and during feeding after a period of fasting, by both light (for

acid phosphatase — AcPase — activity) and electron microscopy.

After feeding, granular cells are crowded with electron-dense granules which push the nucleus towards the base of the cell. These granules are small and abundant in the perinuclear region; some appear to have fused with larger granules which are autolysing. Granular material in the basal third of the cell is AcPase + ve.

Forty minutes after refeeding, the apical cytoplasm is AcPase + ve. The secretory granules have moved towards the lumen; fewer small electron-dense granules and a greater number of autophagic vacuoles are seen. The latter are less numerous in animals that have been feeding continuously.

These results suggest that the electron-dense granules are lysosomes, since they contain AcPase. They accumulate during fasting and, when mobilised on refeeding, their autolytic effect is enhanced. A similar but stronger reaction can be provoked in the male under the same conditions.

### Which M.C.Q. Question Format to Use?

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Six types of question format are mainly used in M.C.Q. tests set in the department, namely (i) one-from-five, (ii) wrong-from-five, (iii) correct-from-four, (iv) causal, (v) related-exclusion, and (vi) true/false.

An investigation was undertaken to ascertain (a) if students found some question types easier to answer than others and (b) if some formats discriminate more than others between good and bad students.

The item difficulty and phi-coefficient of item discrimination was ascertained for each of 577 sequential questions set in class tests. Analyses showed that these formats were distributed into 3 classes:

- (i) Very easy — mean I.D. over 75% consisting of the related-exclusion type.
- (ii) Easy — mean I.D. 65-75% comprising the one-from-five and true/false types and
- (iii) Moderate — comprising correct-from-four, wrong-from-five and casual with significant ( $P = .01$ ) difference between these classes.

As far as discrimination is concerned the formats were found to group themselves into four significantly distinct groups:

- (i) excellent ( $P = .001$ ), related-exclusion;
- (ii) very good ( $P = .01$ ), one-from-five and correct-from-four;
- (iii) good ( $P = .02$ ), wrong-from-five and casual; and
- (iv) poor distractors ( $P = .05$ ), true/false.

Attention is thus drawn to the fact that true/false items, while found easy by the students, are not significantly capable of distinguishing between good and bad students, as opposed to all the other formats used which are capable of this distinction to significant limits.

### Some Aspects of Tooth Size and Shape in Hominid Evolution

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Many interesting trends in dental evolution are revealed by odontometrical analysis. From mesiodistal and buccolingual diameters, studies have been made on lengthening, shortening, broadening, attenuation and on tooth size expressed either as module or crown area. The author's modified version of Howe's 'tooth material' formula sums crown areas of permanent cheek-teeth, uppers and lowers separately. This modified tooth material analysis reveals that the oldest hominids (*Australopithecus africanus* including hominids from Laetoli Beds, Tanzania) were *macrodont*. From them two divergent lineages flowed — on one line teeth became *megadont* (*A. robustus*) and even *gigantodont* (*A. boisei*); on the other line (*Homo habilis*, *H. erectus* and *H. sapiens*), teeth were reduced progressively to *mesodonty* and *microdonty*. The greatest hominid tooth material (that of *A. boisei*) is 1231 mm<sup>2</sup> (uppers) and 1312 mm<sup>2</sup> (lowers), respectively 2.6 and 2.7 times the smallest tooth material (that of modern man, inter-racial mean).

### Secular Trend in Two Venda Populations

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Using regression analysis, 137 traits (body measurements, derived measurements and indices) were screened for secular trend. Significant trends ( $P = 0.01$ ) were found in 28 traits (20 positive and 8 negative) in the rural population, and in only 6 traits (2 positive and 4 negative) in the urban population.

It has been suggested that positive trends occur mainly in 'have-ample' populations, and that negative trends occur in 'have-little' populations. However, since the urban population is better nourished and healthier than the rural population,<sup>2</sup> this hypothesis does not apply to these Venda. The number of traits which show secular trend (whether the trend is positive or negative) may be another index of nutritional, health and socio-economic status of a population. Thus the 'have-ample' urban population is changing less than the 'have-little' rural population, and these two populations appear to be diverging metrically from one another.

1. Tobias, P. V. (1978). The secular trend in African peoples. In *Mankind and Medicine in the Third Millennium*, edit. A. J. Brink and C. M. Lewis, 64–74. University of Stellenbosch.
2. Human Biological Programme (1971). *S. Afr. med. J.*, 45, 1277–1317.

## Book Reviews

*The Invertebrates*. By R. McNeill Alexander. Pp. 561. (Cambridge University Press, London; 1979.) £22 (hc), £7.95 (pc).

This book offers a fascinating introduction to the study of invertebrates because it reflects current trends in experimental biology. It differs from others of the same title because structure, function and ways of life are studied mainly through the quantitative analysis of recent investigations. The author of *Functional Design in Fishes* and *Animal Mechanisms* has now described most of the invertebrate groups with a

similar emphasis on how they work and fit their habitats.

### Invertebrate Biology

An introductory chapter gives an account of experimental techniques in just sufficient detail for the reader to follow the methods reported in the book, such as various kinds of microscopy, chemical analyses with micro-apparatus, recording techniques and the study of the fossil re-

cord. There are twenty-four chapters, each on a different phylum, class or sub-class, and each begins with a simple description of the group-specific plan of organisation. Gross structure, microscopic organisation, ultrastructure and the properties of large molecules are illustrated with simple diagrams and described in the text. Then, physiological mechanisms, selected for their relevance to each chapter, are explained using two strategies. A recent method of investigation and its results are quoted. This is followed by skillful arith-