PROCEEDINGS OF THE INAUGURAL MEETING OF THE ANATOMICAL SOCIETY OF SOUTHERN AFRICA, 18 MAY 1968

The Anatomical Society of Southern Africa was inaugurated in Johannesburg at the fourth of a series of annual colloquia, begun in 1965 at the instigation of Prof. P. V. Tobias, Professor and Head of the Department of Anatomy of the University of the Witwatersrand.

The Opening Address for the inaugural meeting was delivered by Prof. F. Daubenton, Dean of the Faculty of Medicine, University of the Witwatersrand.

Session on Cytogenetics, Cytology, Nervous System and Endocrines:

CHROMOSOMES OF THE PERISSODACTYLA

IRMGARD G. HEINICKEN, *Professional Officer, Department of Anatomy, Faculty of Veterinary Science, University of Pretoria, Onderstepoort*

A cytogenetic survey was undertaken on the Southern African species and subspecies of the order Perissodactyla, taking advantage of the relatively recent improvements whereby chromosome number and karyotypes could be established with greater accuracy.

Material was obtained from male and female animals which had been chemically immobilized, caught or shot in various game parks or game farms in South Africa, South West Africa, Rhodesia and Mozambique. The bone-marrow biopsy technique based on that of Sandberg *et al.* with some adaptations was employed. Up to about 50 good chromosome spreads were counted and karyograms were constructed. Simultaneously, blood smears were made and the nuclear appendages on 500 neutrophil polymorphonuclear leucocytes counted to determine the feasibility of polymorphic sexing.

The following results were obtained (Table I):

The subspecies of *Equus burchelli*, namely *E.b.burchelli*, *E.b.antiquorum* and *E.b.crawshaii* (=*selousi*) and intermediate types between the last two all have the same chromosome number, namely $2n=44$, and morphologically apparently identical karyograms. The same applies to the subspecies of *Equus zebra*, *E.z.zebra* and *E.z.hartmannae*, with a diploid chromosome number of 32.

The karyotypes of the different species of the Perissodactyla were compared with each other. There is a great variation in number and morphology of the karyotypes, so that no

morphological relationship between the autosomes was found, although a similarity was recognized in the sex chromosomes throughout the order. The sex chromosomes of the rhinoceroses resemble those of the horse.

TABLE I. RESULTS OF CHROMOSOME COUNTS

Species	*2n chromosomes*	*Metacentric (=meta-submeta-centric) chromosome pairs*	*Acrocentric (=acro-subtelocentric) chromosome pairs*	*No. of animals*
Ceratotherium simum	82	0	40	5
Diceros bicornis	84	4	37	1
Equus burchelli	44	18	3	15
Equus zebra	32	13	2	8

Karyotype evolution among the Perissodactyla cannot be explained by Robertsonian fusion only. It must have been accompanied by other phenomena, such as tandem fusion, translocations with subsequent loss of heterochromatic centromeres, translocations reverting to acro-subtelocentric chromosomes as a result of pericentric inversion or possibly the loss of very small chromosomes.

These cytogenetic studies could not assist in clarifying the taxonomic problems among the zebras at subspecies level. Nevertheless, it has confirmed the existing classification at species level, with every species of this order having its specific diploid chromosome count.

It was concluded that an identical chromosome number and an identical karyotype may not be advanced uncritically for the identity of species, and that differences in chromosome number cannot be accepted as proof of difference in species, unless one excludes chromosome polymorphism.

Suggestive evidence was found for the existence of a mitotic cycle with peak activity at about 9 - 11 a.m. Although not specifically investigated, indications were found that activity of the animal (and thus external factors influencing that activity) may play a role, yet physical stress, excitement, and delay in collection of bone marrow after immobilization may possibly depress the number of mitotic figures obtained, presumably due to circulatory changes in the bone marrow.

Clear-cut sex differences exist in all the species and subspecies examined, and can be determined by counting typical 'drumsticks' only.

CHROMOSOME STUDIES IN THE KRUGER NATIONAL PARK WITH SPECIAL REFERENCE TO A RARE CHROMOSOME TRANSLOCATION*

CLIVE WALLACE, *Department of Anatomy, Witwatersrand University Medical School,* AND NEIL FAIRALL, *Division of Nature Conservation, Skukuza, Kruger National Park, Transvaal*

In the course of a chromosome study being undertaken in the Kruger National Park, material for chromosome analysis is obtained from an animal after immobilization of the animal with a cross-bow and projectile syringe containing the necessary drugs. Chromosomes for analysis are obtained by the use of a short-term bone-marrow technique adapted for work in the Park.

Chromosome studies in the kudu in the Park show, up to date, that the male animal has a modal chromosome number of one less than the female. Studies of mitotic chromosomes led to the belief that the male kudu has a translocation between the Y chromosome and an autosome. The presence of such an extremely rare translocation has been confirmed by undertaking meiotic studies in a male kudu.

*This work is being undertaken with the kind permission of the National Parks Board. The study is financed, in part, by the Witwatersrand University Council Research grant received by one of the authors (C.W.).

THE SIGNIFICANCE OF THE ULTIMOBRANCHIAL BODY IN THE SHEEP

W. H. GERNEKE, *Senior Lecturer, Department of Anatomy, Faculty of Veterinary Science, University of Pretoria, Onderstepoort*

In the development of the sheep, the fourth pharyngeal pouch, after losing contact with the pharynx, is included in the mediocranial region of the lobes of the thyroid. The ventral portion of pouch IV (or complex IV as it is also known), often referred to as the ultimobranchial body, very definitely gives rise to thyroid follicles and to epithelial or mucoid cysts and in older sheep also to typical thymus IV tissue which is then present within the thyroid. A parathyroid IV also develops from the dorsolateral aspect of complex IV and is included in the thyroid where it is hardly visible in older sheep. These structures can often be seen as white spots in the thyroid and may be mistaken for tumours.

THE FINE STRUCTURE OF THE EXOCRINE CELLS OF THE PROVENTRICULAR GLANDS OF THE PIGEON, WITH REFERENCE TO THE POSSIBLE FUNCTION OF THESE CELLS

E. MARY VEENSTRA, *Lecturer, Department of Anatomy, University of the Witwatersrand*

Proventricular exocrine cells of the pigeon are compared with parietal and chief cells in rat gastric mucosa. Certain features in fine structure relate to hydrochloric acid production, and others to protein synthesis, indicating that these cells possibly perform a dual function. Dalton's chrome-osmium fixative solution at pH 7·4 and Bensley's fluid at pH 3·8 are used in an attempt to demonstrate secretory (? pepsinogen) granules for electron-microscopy. Both contain osmium tetroxide and potassium dichromate, but in different proportions. After fixation in either fluid, dense granules can be demonstrated within the proventricular exocrine cell, but granules within the rat chief cell are to be seen only after fixation in the acid solution. Unfortunately membrane preservation is poor at this level of acidity, so that Bensley's fluid, which was originally proposed for light microscopy, as such cannot be recommended for electron-microscopy.

THE EFFECT OF MYCOTOXINS ON CELLS *IN VITRO*

P. VON MIHÁLIK, *Head of the Histology Section, University of Pretoria,* IN COLLABORATION WITH CSIR

Aflatoxin (10 μg./ml.) in Eagle's medium retards the multiplication of mouse liver cells and stops it in 1 or 2 days. In 3 weeks all the cells are dead. If, after 5 days, the cells are placed in toxin-free medium, giant-cell formation will occur in 10 - 15 days. Large (100 - 160μ) round cells appear with a single large polyploid nucleus or with several smaller nuclei. Whereas smaller cells die, giant cells remain alive longer than a month.

Ochratoxin first has the same effect, but after 2 weeks giant cells appear without transfer into a toxin-free medium.

Larynx cancer cells in aflatoxin- or ochratoxin-containing medium react in the same way as the mouse liver cells. Sterigmatocystin-containing medium also produces giant cells after 2 - 3 weeks.

These effects are similar to the effects of X-ray irradiation. While the toxins inhibit spindle production, DNA duplication and cytoplasm production continues; thus the cells cannot divide and giant cells with polyploid or multiple nuclei arise.

THE INNERVATION OF THE PANCREATIC ISLET CELLS

A. C. ESTERHUIZEN, *Department of Physiology, University of Stellenbosch,* IN COLLABORATION WITH J. D. LEVER AND T. L. B. SPRIGGS, *Department of Anatomy, University College, Cardiff, UK*

Thick cryostat sections (30 - 35μ) of cat pancreas were stained for nerve fibres and acetylcholinesterase activity. In these preparations it was possible to distinguish within the islets

of Langerhans two distinct types of nerve fibres, viz. those showing a heavy silver-impregnation and a second type being less densely impregnated but surrounded by a fine crystalline reaction product indicating the presence of acetylcholinesterase. In an electron-microscopic investigation on the nature of islet-cell innervation the presence of adrenergic and cholinergic nerve terminal areas was confirmed.[1]

To meet the criticism that these fibres may in effect be associated with the blood-vessels without innervating the islet-cells as such, serial sections were studied with the electron-microscope. It was thus possible to follow single nerve fibres to their final terminations. One series of electron-micrographs was shown depicting a fibre and its termination deeply invaginating the surface of an alpha cell, with no blood-vessel in the near vicinity.

1. Esterhuizen, A. C., Spriggs, T. L. B. and Lever, J. D. (1968): Diabetes, **17**, 33.

HYPOTHALAMIC-PITUITARY-OVARIAN RELATIONSHIPS IN RATS AND THE INFLUENCE OF PLANE OF NUTRITION ON THESE RELATIONSHIPS

R. B. SYMINGTON, *Senior Lecturer, Department of Anatomy, University College of Rhodesia*

Despite marked reduction in size, the ovaries of underfed cows retained their ability to respond hormonally to the administration of gonadotrophins and slight elevation in nutrient intake. Conversely, administration of gonadotrophin-release factors failed to evoke ovarian response. Administration of the progestogen melengestrolacetate confirmed that pituitary secretion of LH was much reduced.

The nutrient intake of rams was adjusted so that body-weight increased or decreased. Although pituitary weight was associated closely with body-weight, testes weight and sperm numbers, the concentrations of total gonadotrophins, FSH and LH did not differ.

Semi-starvation of rats for eight weeks caused a loss of body-weight (23%), pituitary weight (43%) and ovarian weight (15%), whereas adrenal weight rose by 50%.

These results indicate that chronic undernutrition reduces fertility by diminishment of pituitary gonadotrophic function rather than by an adverse effect on hypothalamic release factor or on gonadal ability to respond to gonadotrophic stimulation.

Session on Gross, Comparative and Functional Anatomy:

THE URETEROVESICAL JUNCTION—SMOOTH-MUSCLE ANATOMY

C. VAN DEN BULCKE, H. FINE AND PROF. E. N. KEEN, *Head of the Department of Anatomy, University of Natal, Durban*

An account was given of the arrangement of smooth-muscle bundles in the 3 distinct layers which take part in the formation of the ureterovesical junction. These are the longitudinal muscle coat of the ureter, the Waldeyer sheath and the detrusor muscle. In each of these layers constant 'slings' were found in which longitudinal muscle bundles crossed each other in front of and behind the ureter. The ureteric muscle and the inner detrusor fibres were shown to be attached to the bladder neck, while the Waldeyer bundles did not reach so far. Attachment between the layers was scanty, and it was suggested that longitudinal movement between the layers could take place.

Functional implications of these arrangements had still to be worked out.

A PROVISIONAL INVESTIGATION INTO THE VARIABILITY OF THE SUBCLAVIAN ARTERY IN THE SOUTH AFRICAN BANTU

W. ROBBERECHTS, *Senior Lecturer, Department of Anatomy, University of Pretoria*

Drawings were made of the anterior aspect of both subclavian arteries and their branches in the dissected cadavers of 50 South African Bantu. To compare the findings of the series, a nomenclature is proposed, based rather on the distribution than on the origin of the branches, viz.: A. vertebralis, A. thoracica interna, A. thyroidea inf., A. cervicalis ascendens, A. suprascapularis, A. transversa colli, A. cervicalis superficialis, A. dorsalis scapulae, A. cervicalis profunda, A. intercostalis suprema.

Comparing the origins of the branches in our series with the data in the literature, no significant differences were found.

By classifying the origin of A. transversa colli—the most variable of the branches—into 3 groups (medial, behind, or lateral to scalenus ant.) or into 2 groups (medial or lateral of medial border of scalenus) no difference from the known distribution percentage in the literature could be demonstrated.

In both classifications, however, there was an outspoken tendency towards bilateral symmetry. This symmetry draws the attention to possible constitutional, rather than racial, factors.

This observation suggests that further investigation into the distribution, also in foetuses, would be of value.

BIFURCATION OF THE COMMON CAROTID ARTERY IN THE SOUTH AFRICAN BANTU

PROF. TOBIE MULLER, *Head of the Department of Anatomy, University of Pretoria*

A survey was made of the bifurcation of the common carotid arteries in 60 Bantu cadavers. A total of 120 cervical halves was examined, various measurements were taken and the relationship to landmarks in the neck was noted. There appeared to be a definite shift upwards in the level of bifurcation as compared with the findings of other authors, inasmuch as in 68·3% of cases the bifurcation was at and above the level of the greater horn of the hyoid bone. The average distance between the ramus of the mandible and the site of bifurcation was found to be 1·38 cm.

VARIATIONS IN THE COELIAC AND SUPERIOR MESENTERIC ARTERIES IN THE SOUTH AFRICAN BANTU

PAMELA M. DE BEER, *Lecturer, Department of Anatomy, University of the Witwatersrand, Johannesburg*

Variations in origin of the 3 major branches of the coeliac artery were investigated in a sample of 85 Bantu and 37 White cadavers. A preliminary analysis of the results suggests a higher incidence of the lienogastric type of coeliac axis in Whites as compared with Bantu. The colic branches of the superior mesenteric artery were investigated in a slightly smaller sample, and a preliminary analysis of the results suggests that there may be a difference between White and Bantu in the arterial patterns.

Session on Palaeobiology, Genetics and Radio-anatomy:

THE USE OF MASS MINIATURE RADIOGRAPHS BY UNDERGRADUATE MEDICAL RESEARCH ASSISTANTS IN ANATOMICAL STUDIES

PROF. A. P. D. THOMSON, *Professor of Preclinical Studies, Department of Anatomy, University College of Rhodesia*

The reliability of the techniques to be used by the students and by the radiographer in taking successive X-rays of single individuals was first established by Berney *et al.* and Castle and Jelbert. They concluded that the techniques were reliable and repeatable and that there was an increase in the average area of the shadow cast by the heart and vascular pedicle and in the average size of the long diameter of the heart shadow in successive X-ray photographs of the same individuals. They also confirmed the existence of a relationship between the area of the cardiac and pedicular shadow and the height of the diaphragm in each individual in their series.

Dickinson and Latif repeated the above measurements using (*a*) a population of 31 individuals with fibrosis of the lungs and (*b*) 18 individuals with healed pulmonary tuberculosis. In both these groups of pathologically affected individuals there was a significant increase in the area of the

shadow cast by the heart and vascular pedicle in successive photographs. There were also changes which could not be ignored from the statistical point of view in several of the other parameters. These changes were interpreted as being related to the mixed pathology of the diseases present in the individuals.

Mass miniature radiographs were also examined qualitatively for the incidence and distribution of cervical rib, bifid spines, scoliosis, bifid ribs, missing ribs, fusion of ribs, perforation of clavicles, azygos lobes and dextrocardia. The chests of all those with cervical rib, scoliosis and bifid spines were compared with the chests of normal people.

Initial studies have been made comparing populations of Zambians, Mozambique Africans, Malawians and indigenous Rhodesians. Preliminary results indicate that they fall broadly into two groups—Rhodesian-Malawi Africans and Zambian-Mozambique Africans.

BIOMECHANICS OF THE AUSTRALOPITHECINE JAW

J. A. WALLACE, *Research Fellow, Department of Anatomy, University of the Witwatersrand*

The mechanics of the masseter and temporalis muscles of Olduvai Hominid 5 (*Australopithecus boisei*) are described. From position and slope of muscle scars, the action line of each muscle was ascertained. Perpendiculars from action lines to fulcrum gave the moment arms.

The masseter's moment arm being 5 times that of the temporalis muscle implied that for the same unit of contractile force (e.g. 1 g) the masseter was 5-fold more effective in adducting the mandible. The anterior migration of the masseter onto the maxilla, while lengthening its moment arm and hence its torque, led also to an increase of its forward force component, which, during contraction, would tend to pull the capitulum forward out of the fossa. This dislocating tendency was compensated for by enlargement of the posterior temporalis, which, presumably, was active during closure. The compound temporal-nuchal crest and postglenoid wear facets were related to the posterior temporalis's role in retaining the capitulum in the fossa during adduction.

The method of moments was used to estimate what percentage of total adductor force was available for crushing at the cheek teeth. Because of its longer moment arm, the masseter was the dominant muscle. At M2 occlusal force was approximately 50%, i.e. for every 2 g of contractile force 1 g of crushing force was produced. The temporalis's role, particularly its middle fibres, was that of a postural or anti-gravity muscle, suspending from the cranium what must have been a robust and heavy mandible.

SKELETAL REMAINS FROM A 17TH CENTURY PORTUGUESE TRADING POST AT MAZOE, NEAR SALISBURY, RHODESIA

HERTHA DE VILLIERS, *Department of Anatomy, University of the Witwatersrand*

Excavations of a 17th century Portuguese trading post at Mazoe, near Salisbury, yielded the remains of 22 individuals. These were identified as representing: 12 Caucasoid males, 1 Negroid male, 4 Negroid females, 2 apparently hybrid (Caucasoid-Negro) males, 1 hybrid female. Two of the crania were too fragmentary for identification.

All burials were Christian and dated between 1626 and 1693. The grave goods associated with the Negro burials were very rich, and it is suggested that these individuals may well have been members of the Monomatopas family—who are known to have lived in this vicinity at that time. The presence of apparently hybrid individuals indicates that there may well have been some gene flow from the immigrant Caucasoid to the indigenous Negroid population.

TRACING THE INHERITANCE OF ACROTERIASIS CONGENITA

JOHANNA M. MARAIS, *Professional Officer, Department of Anatomy, Faculty of Veterinary Science, University of Pretoria, Onderstepoort*

Acroteriasis congenita, also known as 'amputated', or in Holland as 'Otter', calves, is a condition so far found only among Fries cattle. Wreidt and Mohr, in 1928, recorded the anomaly as a single lethal recessive gene, the origin of which could be traced to East Friesland.

The characteristics are as follows: The affected calves are either aborted or carried to term. A moderate hydrocephalus occurs with a more or less pointed upper jaw, cleft palate, and very short lower jaw. The incisors are compressed out of position and decreased in number. Prominent eyes and elongated palpebral fissures occur, with short, asymmetrical ears. The limbs are absent distal to humerus/femur, or are represented by stumps of radius-ulna/tibia. Rudimentary claws are often found.

Nine cases have been reported, 7 of which have occurred since February 1968. The problem is thus of increasing importance to our cattle breeders. By assuming that the present indications of it being inherited as a simple autosomal-recessive trait are correct, the defect was traced to its origin in East Friesland.

MAMMALIAN FOSSIL BONES FROM A DOLOMITE QUARRY NEAR SINOIA: A PRELIMINARY REPORT

A. PELLATT, *Lecturer, Department of Anatomy, University College of Rhodesia*

In June 1967 a living-site of early Man, containing much fossilized mammalian bone and a quantity of stone artefacts, was found in the Sinoia Cave in Rhodesia. Shortly thereafter more fossil bone material, not accompanied by any tools, was discovered in the nearby Quarry 3 belonging to the Alaska Dolomite Company.

Unfortunately no record is available of the original disposition of the find in the quarry. Quarrying operations had completely destroyed the site before the presence of fossils was reported. The find is quite small and consists of 870 specimens of which 30 are whole bones, the remainder being fragments. Five or 6 larger bovids are represented and two equids, the latter being zebra.

The age of the fossils is probably near the base of the late Stone Age. It seems possible that they were accumulated at a site occupied by early Man, though no trace of human fossils or implements was found with them.

The find is in itself not of major importance, but should stimulate further search for the presence of early human remains in Rhodesia.

SKIN STRUCTURES IN KAROO FOSSILS

PROF. G. H. FINDLAY, *Department of Dermatology, University of Pretoria*

The skin structure of labyrinthodonts shows how the skin aids locomotion when the body is too heavy for support by the limbs. The same fossil material gives evidence on the fossil representation of keratin. In the mammal-like reptiles considerable interest is centred on the evolution of the muzzle in ancestral groups such as the scaloposaurids. A rich innervation of the cheek area, and a gradual shift of the maxillary nerve plexus from the inside to the outside of the maxilla, suggest the development of a sensory cheek equipped with tactile hair for nocturnal habits. Dark-adapted vision, hairy covering for warmth, tactile hair for distance perception and improvement of the ear suggest that the successful evolution of mammals depended upon a conquest of the night. In this accomplishment the skin changes were important contributors.