

Anatomiese Vereniging van Suider-Afrika

Uitgekose uittreksels van referate wat opgelewer is gedurende die 14de Jaarlikse Kongres van die Vereniging wat op 13 en 14 April, 1984 in Pretoria gehou is.

Anatomical Society of Southern Africa

Selected abstracts of papers presented at the 14th Annual Congress of the Society held in Pretoria on 13 and 14 April, 1984.

Retrocaval Ureter in Kallmann's Syndrome

G. H. M. Vawda

Department of Anatomy, Faculty of Medicine, University of Natal, Durban.

The entities of Kallmann's Syndrome and retrocaval ureter have both been documented previously but independently. This paper describes the incidental finding of a retrocaval ureter in association with Kallmann's Syndrome in a coloured male, sixty-five years of age.

Symptomatically, the patient presented with urological complaints consisting of dull pain in the right lumbar region, coupled with an increased frequency of micturition of recent onset. There were no complaints regarding his general physical state which was abnormal.

Clinically, the patient had a tall stature with an arm span greater than height, a eunuchoidal physique with female hair distribution and poor muscular development, together with a large umbilical hernia. Examination of the genital region revealed infantile external genitalia with rudimentary scrotal testes. The anosmia was confirmed on specific testing, with no other defects of the central nervous system evident.

Biochemically, the gonadotrophins, follicle stimulating and luteinising hormones were low and the chromosomal analysis was normal. Radiological investigations, including an excretory urogram and computerised axial tomogram confirmed a right retrocaval ureter, while urinalysis revealed a mild urinary tract infection accounting for his symptoms.

In conclusion, this paper describes a previously unreported finding of a retrocaval ureter in Kallmann's Syndrome, reviewing the embryological basis of this rare congenital anomaly resulting in a pre-ureteric inferior vena cava. Furthermore, it also illustrates the principles of multiple anomalies co-existing and remaining asymptomatic for the greater part of the patient's life.

Ophidian Cranial Kinesis and the OHP

C. J. Leonard

Department of Zoology, University of the Western Cape, Bellville.

The purpose of the paper is twofold: firstly to consider some selection factors that may have been involved in the evolution of ophidian cranial kinesis, and secondly to demonstrate the use of the overhead projector (OHP) in the communication of complex comparative and functional anatomical information.

A conventional transparency with three overlays was used to illustrate the transition from a typical diapsid skull to the ophidian condition where both the superior and the inferior temporal bars are lost.

Three novel techniques, to illustrate the alternate movements of the palato-maxillary arcade, the biomechanics of ingestion and the mechanism of fang erection in a rattlesnake, were devised. A cardboard model of a python's skull constructed out of four portions, representing the quadrate, the palato-maxillary arcade, the mandible and the rest of the skull, and held together by drawing pins at the joints, was used to illustrate ingestion. By manipulation of the model it was demonstrated how prey could be drawn into the mouth by the raking action of the palato-maxillary arcade and the mandible. To illustrate the mechanism of fang erection, a diagram of the skull of a rattle snake (in lateral view) was traced onto perspex (1 mm thick). With the aid of a narrow band saw, the tracing was cut into five components: the maxilla plus fang, the palatine-ectopterygoid-pterygoid complex, the quadrate, the mandible and the rest of the skull. These components were linked together by fine wire to act as the kinetic joints. On the

surface of the OHP this model could be manipulated to demonstrate fang erection.

In conclusion, the OHP can be used for more than static illustration; with the aid of perspex models complex biomechanical information can be conveyed.

Chromosoomanalise op Persone wat Rook

E. J. Visser, J. D. Anderson en P.C. Minaar

Departemente: Fisiologie, Onkoterapie en Biofisika, Universiteit van die Oranje-Vrystaat, Bloemfontein.

Die mutagene/karsinogene invloed van sigareetrook is gekwantifiseer deur susterchromatied-uitruilings te bepaal in 18 persone wat gemiddeld 20 tot 30 sigarette per dag rook. Verskillende groepe is soos volg saamgestel: persone wat onafgebroke vir 5 jaar, 10 jaar, 15 jaar en 20 jaar lank rook. 'n Kontrolegroep bestaan uit ses persone wat nooit gerook het nie.

Limfosiete is van die betrokke persone gekweek en die DNA is gemerk deurdat bromo-deoksie-uridien (BrdU) in die plek van timidien in die molekule ingebou is. Met 'n fluoressensie tegniek is dan die gemiddelde aantal chromatied-uitruilings per metafase vir elke groep persone vasgestel.

'n Eksponensiele verband is gevind tussen die gemiddelde aantal chromatied-uitruilings en die tydperk van rook. Hierdie bevindings dui op 'n toenemende onstabiliteit van die DNA-molekule met toenemende tyd van blootstelling aan die effekte van sigareetrook. Verder is ook gevind dat die spektrum van die aantal uitruilings vir elke groep verbreed met toenemende tydperk van rook. Dit dui weer daarop dat daar moontlik 'n variërende individuele weerstand teen die mutagene/karsinogene invloed van sigareetrook bestaan, want sommige persone wat 20 jaar lank gerook het, het dieselfde aantal uitruilings per metafase getoon as persone wat 5 jaar lank gerook het.

Some Aspects of the Myology of the One-Humped Camel (*Camelus dromedarius*)

Malie M. S. Smuts

Department of Anatomy, Faculty of Veterinary Science, University of Pretoria.

Many articles have been published on various aspects of camel anatomy. However, a complete systematic study has never been executed. The Ben Gurion University of the Negev initiated such a project in September 1982. It was completed by the author and Prof. A. J. Bezuidenhout of this department by May 1984. Three animals (two males and a female) were embalmed and dissected.

The muscular system presented features not found in other domestic animals. The *Mm. splenius cervicis* and *omotransversarius* are absent. The *M. dilator naris apicalis* runs rostro-ventrally, whereas the *M. dilator naris medialis* is arranged caudoventrally along the medial border of the nasal opening. Fascicles of the *M. nasolabialis* run along the lateral border and in this way a sphincter is formed which enables the camel to close its nostrils completely when needed, e.g. during a sand storm.

A muscle is present in the pharyngeal region, which does not appear to have a homologue in other domestic animals. It arises from the atlanto-occipital joint capsule and the adjoining edge of the atlas and attaches to the roof of the nasopharynx. It is provisionally named the *M. atlantopharyngeus*. It forms the substance of a partial partition which divides the nasopharynx into a rostral and a caudal compartment.

Also absent in other domestic animals are two pairs of fascicles, which are situated ventrally to the intercostal and sublumbar muscles. They rise

from the caudal edge of the last two pairs of ribs and insert on the tips of the first three pairs of lumbar costal processes. They are probably *Mm. subcostales*.

The *M. rectococcygeus* is absent in both sexes.

The muscular part of the *M. flexor digitorum superficialis* of the front limb is absent. It is represented by its tendon of insertion which arises from the carpus.

The digital cushions consist of two egg-shaped pads of soft adipose tissue, encapsulated in a firm layer of collagen and placed upon a thick layer of yellow elastic connective tissue. The latter is supported by the keratinized sole.

These findings, we hope, contribute towards the recorded systematic anatomy of this important and neglected animal.

Role of the Manchette in Spermiogenesis

S. W. Liebenberg

Department of Anatomy, University of Pretoria, Pretoria.

The manchette is an organelle present during spermiogenesis of vertebrates and invertebrates, and is even found in some plants. It consists of laterally associated microtubules that encircle the spermatid nucleus caudally. Anteriorly, it is attached to the nuclear ring and posteriorly it is free in the post-nuclear cytoplasm. Its presence is correlated in time with the initiation of chromatin condensation.

In the present ultrastructural study a close spatial association has been found caudally between the nuclear membrane and the manchette in the rat spermatid. This is especially evident at steps 10 to 12 of spermiogenesis. The appearance suggests that the manchette may exert pressure on the nucleus. The microtubular bridges may have a role in this respect and may by this means influence nuclear shaping as well as chromatin condensation. Evidence from invertebrates strongly suggests such an involvement of the manchette, but disagreement with this hypothesis has been recorded. The use of microtubular poisons might clarify the situation.

Cytoplasmic Microtubules — An Integral Component of Type 1 Epithelial Lining Cells of the Chicken Lung

J. T. Soley* and E. J. Marais†

*Department of Anatomy, Faculty of Veterinary Science, University of Pretoria, and †Poultry Section, Veterinary Research Institute, Onderstepoort.

As in other air-breathing vertebrates, the blood-air interface of the chicken lung is composed of three essential components, namely a capillary endothelium, a basal lamina and an epithelial lining. The structural stability of this delicate barrier (ranging from 0.1 to 0.2 μm in the fowl), in particular that of the epithelial component, is maintained by a number of mechanisms. A thin osmiophilic layer of surface-active material reduces the surface tension of the fine air spaces and rib-like thickenings of the attenuated epithelial and endothelial linings provide structural support. The corrugated appearance of the avian blood-gas barrier, like that of mammals, is considered to be physiologically advantageous as it provides a reasonable degree of mechanical stability while offering a lower overall resistance to gaseous diffusion than a barrier of uniform thickness.

We report on the presence of microtubular arrays within localized thickenings of the attenuated epithelial cells and propose that these ubiquitous organelles form an internal scaffolding which strengthens these supportive structures. Cytoplasmic microtubules thus constitute an additional mechanism for preserving the structural integrity of the blood-air interface.

Sexual Dimorphism in the Splenium of the Human Corpus Callosum: Preliminary Observations

B. M. Wium

Department of Anatomy, University of the Witwatersrand Medical School, Johannesburg 2001.

A recent study has provided evidence that the splenium of the human female corpus callosum is more bulbous and has a significantly larger area as seen in median section than the male splenium. The investigators have postulated that the larger size of the female splenium indicates that it contains a greater number of nerve fibres connecting the relevant cortical areas. This suggestion, if confirmed, would tend to support the view that the brains of females are less well lateralized for visuo-spatial function. In the

present study, the splenia of two human brains, one male and one female, were used. Examinations of the mid-sagittal plane of the splenia confirmed that the splenium of the female was absolutely larger in median-sectional area. On the other hand, microscopical examination of 5- μm sections cut in the mid-sagittal plane and stained for nerve fibres revealed that, in contrast with the suggestion made in the literature, the splenium of the male contained a greater number of nerve fibres per unit sectional area than that of the female. The splenium of the female was seen to contain large areas where no nerve fibres were observed. Moreover, estimates of the total number of splenial fibres showed the male splenium to contain absolutely more nerve fibres than the female splenium, despite the male's smaller sectional area. The nature of the substance making up the additional bulk of inter-neuronal tissue in the splenia of the female is at present being investigated.

Embryonic Development of *Schistosoma mansoni*

Z. Swiderski

Department of Anatomy, University of the Witwatersrand Medical School, Johannesburg 2001.

The embryonic development of *S. mansoni* eggs occurs during their migration through the host tissue. Eggs representing consecutive stages of development have been reconstructed from serial sections. Three developmental stages have been distinguished: (1) cleavage — early embryo; (2) blastomere differentiation — morphogenesis; and (3) miracidium.

The first cleavage division produces two nearly equal macromeres which differ slightly in size and ultrastructure and probably correspond to the so-called 'somatic' and 'propagatory' cells observed in other trematodes. Cleavage is total and unequal, resulting in the formation of three types of blastomeres: macro-, meso- and micro-meres. The future miracidium differentiates only from mesomeres and micromeres, while macromeres and some mesomeres participate in the formation of egg envelopes. The three main envelopes — the egg-shell, and the outer and inner envelopes — are formed around the developing embryos in the initial stage of blastomere differentiation. After egg envelope formation, eight major cell types have been distinguished in differentiating embryos. Classification of these cell types, based on the appearance of their nuclei and cytoplasm, has been established for more precise correlation of intermediate steps of ultrastructural and functional differentiation of blastomeres leading to miracidium formation.

This study was supported in part by the UNDP/World Bank/WHO Special Programme for Research and Training in Tropical Diseases and by the University of the Witwatersrand Medical Faculty Research Endowment Fund Grant.

Occurrence of Differentiated Endocrine Cells and their Progenitors in the Splenic Lobe of Embryonic Chick Pancreas: Preliminary Results

J. A. Cowap

Department of Anatomy, University of the Witwatersrand Medical School, Johannesburg 2001.

The aim of this study was to establish whether differentiated, or only progenitor, endocrine cells are present in the splenic lobe when it first becomes distinct on the sixth day of incubation. Tissue from 6-, 7- and 8-day-old embryos has been compared with chorio-allantoic grafts of tissue from donors of the same ages. Immunocytochemical staining shows that differentiated insulin and glucagon cells are present at 6 days whereas somatostatin cells apparently differentiate during that day. So far, the earliest stage at which pancreatic polypeptide cells have been found is 7 days. In all tissue apart from normal 6-day-old splenic lobe, some of the pancreatic polypeptide cells show glucagon immunoreactivity.

Preliminary Results of the Application of New Height Prediction Techniques

N. Cameron

Department of Anatomy, University of the Witwatersrand Medical School, Johannesburg 2001.

New regression equations have been published to predict adult stature from both cross-sectional and longitudinal growth data. In contrast to older equations, these latest ones were based on a source sample that included numbers of very tall and very short subjects. Also, the authors were able to obtain greater precision by including variables relating to rate of growth,

i.e. height velocity and bone age velocity. The importance of these factors is that prediction equations are routinely used on tall or short subjects in a clinical situation yet all current techniques include only normal children in their source samples. Whilst cross-sectional data are the only data routinely available, in some clinical situations longitudinal data may be available and the opportunity to obtain greater accuracy of prediction was thought to be desirable. These equations were tested on a group of 71 boys from the

Saskatchewan Longitudinal Growth Study and compared to earlier equations, TW Mark 1, published by the same authors.

Preliminary results indicated that the new Mark 2 equations significantly improved the predictions on normal children by an average of 0.2 to 0.6 cm. No real improvement was noted for tall subjects but 60% to 70% of short subjects had improved predictions. In all cases the inclusion of a velocity variable produced the greater improvement in prediction.

South African Association of Physicists in Medicine and Biology

The following are abstracts of papers presented at the Annual Congress held in Cape Town in March 1983.

Suid-Afrikaanse Vereniging van Fisici in Geneeskunde en Biologie

Die volgende is uittreksels van referate, wat gedurende die Jaarlikse Kongress in Kaapstad in Maart 1983 gehou is.

Effect of γ -Radiation on the Sedimentation Properties of Human Lymphocyte Nucleoids

E. J. van Rensburg, W. K. A. Louw, M. J. Pitout, H. L. Izatt, C. J. J. van Vuuren, N. Hugo and J. J. van der Watt
NUCOR, Pretoria.

With the growing awareness concerning occupational and environmental carcinogenesis, it has become important to develop methods to quantitate the response of individuals to these carcinogens. The various effects of radiation on cells can either lead to cell death or, even worse, to mutation. DNA is considered to be the most critical cellular radiation target.

The influence of ^{60}Co γ -radiation on the sedimentation behaviour of human lymphocyte nucleoids in neutral sucrose gradients (one of the most sensitive techniques for detection of DNA damage) was studied with the aid of a modified fluorescent monitor system consisting of the DNA-binding dye, Hoechst 33258, and centrifugation in a vertical rotor. DNA damage due to irradiation of mixed lymphocytes and sub-populations with ^{60}Co γ -rays at doses as low as 0.1 Gy were estimated. This procedure was also applied for determination of the extent of DNA strand break repair after irradiation.

Computer Models of Nuclear Aerosols

J. W. Rossouw, A. H. Leuschner and J. Kruger
NUCOR, Pretoria.

We have compared computer models of aerosol releases after a reactor accident with special reference to the reactor type, the accident, aerosol processes and the reactor containment. The source, the particle size distribution and the computer required for each code were considered.

Calculations for the leaked mass as done with the HAARM-3, NAUA and AEROSIM codes were compared. After 2.2×10^4 seconds the highest leaked mass was twice the lowest. Calculations for particle concentration from the PARADISEKO3 and HAARM-3 codes compared well with each other. However, both codes gave higher concentrations than those obtained from the CASSANDRE-03 test. One hour after release the concentration from the codes was 1.5 times that of the experimental data.

It is concluded that these computer codes may be valuable. However, cognisance must be taken of the limitations of the model and the importance of the accuracy of input parameters.

Testing of Air-cleaning Scrubbers at Uranium Processing Plants

A. H. Leuschner, J. W. Rossouw and J. Kruger
NUCOR, Pretoria.

The physical characteristics have been determined of aerosols released from air-cleaning devices in uranium processing plants.

Release of UF_6 into the air results in conversion of an aerosol of UO_2F_2 and an AMAD of $1 \mu\text{m}$. If the concentration is a few g/cm^3 and the relative humidity about 40%, this conversion is rapid and total, which enables

sampling with a teflon filter paper. The efficiencies of scrubbers for such aerosols varied from less than 10% to more than 90%, depending on the type of scrubber and its operating conditions. Testing the efficiency for HF was done by sampling upstream and downstream of the scrubber with a midjet impinger according to the NIOSH standard. Efficiencies of more than 98% for HF were found.

It is concluded that the *in situ* determination of scrubber efficiency is imperative.

Evaluation of Mathematical Models to Determine Platelet Life Span

M. G. Lotter, A. du P. Heyns, P. Wessels and P. C. Minnaar.
Department of Biophysics, University of the Orange Free State, Bloemfontein.

Platelet kinetics were analysed by investigation of platelet survival (PS) as well as the shape of the survival curves (CS) in 55 patients divided into groups of patients with linear PS, intermediate PS and exponential PS. PS was analysed with the following mathematical models: linear; exponential; weighted mean; multiple hit (MH); Dornhorst (DH); and alpha order (AO). CS was evaluated by the number of 'hits' (MH model); the alpha value (AO model); and the variance shape factor (VS), which is independent of the mathematical PS model. Comparison of goodness of fit of the platelet survival data showed that the MH, AO and DH models were equivalent and gave similar results.

The variance shape factor and alpha value gave a good reflection of the shape of the PS curve, whereas the number of hits was not as sensitive an index. Analysis of the shape of the survival curve in conjunction with platelet life span may prove a more accurate tool for determining platelet kinetics in disease states.

Die Bepaling van Linkerventrikulêre Volume deur Middel van Radionuklied Metodes

C. P. Herbst, R. D. Burow, A. van Aswegen, P. H. T. Kleynhans, M. G. Lötter en P. C. Minnaar
Departement van Biofisika, Universiteit van die Oranje Vrystaat, Bloemfontein.

Die bepaling van linkerventrikulêre volume (LVV) kan belangrik wees in die evaluering van kardiële geneesmiddels en die diagnose van hartsiektes. Die nie-ingrypende radionuklied metode van LVV bepaling is 'n nuwe tegniek wat baie moontlikhede bied. Die doel van die studie om hierdie metode te evalueer, deur die waardes wat hiermee verkry word, te korreleer met waardes verkry vanaf kontrasventrikulografie. End-diastoliese volume (EDV), end-sistoliese volume (ESV), slagvolume (SV) en die uitwerpsfraksie (UF) van twintig pasiënte, is met kontrasventrikulografie bepaal. Die parameters is ook bepaal deur die konsentrasie Tc-99m gemerkte rooibloedselle in die LV te bereken nadat 'n attenuasie korreksie uitgevoer is. Korrelasie was in alle gevalle hoër as 0.88. Gepaarde *t*-toets kon geen verskille aantoon tussen EDV ($2.05 \pm 1.46 \text{ ml}$, $P > 0.01$), SV