

## Anatomical Society of Southern Africa

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## Anatomiese Vereniging van Suider-Afrika

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### Anomalous origin of the right coronary artery from the left aortic sinus

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Two patients who presented with inferior myocardial infarction were shown to have anomalous origin of the right coronary artery (RCA) from the left aortic sinus. In the first patient, aged 36 years, there was no history of angina prior to infarction. Apart from smoking no other risk factors were present. The second patient, aged 32 years, presented with a 6-month history of effort-induced angina, followed by myocardial infarction. No risk factors were present. In both patients there was failure to selectively engage the RCA at coronary angiography. After a sinus injection in one and aortic root angiography in the other the vessel was delineated and noted to arise from the left aortic sinus, close to the ostium of the left coronary artery. There was no evidence of atherosclerotic disease in the anomalous vessel. Both patients were asymptomatic at follow-up.

Two theories have been postulated to explain the development of myocardial ischaemia in this condition.<sup>1</sup> In its course to the ventricle the anomalous vessel passes between the ascending aorta and pulmonary trunk. During exercise, increased pulsations of these vessels may compress the anomalous vessel leading to ischaemia. Secondly, Roberts *et al.* have postulated that closure of the slit-like ostium within the aortic wall may occur when the aorta dilates during exercise. This dynamic obstruction to coronary flow may explain the effort-induced angina in one of our patients. Progression to myocardial infarction, however, has been described in only three patients with this anomaly.<sup>2</sup>

Anomalous origin of the coronary arteries may explain symptoms of myocardial ischaemia or infarction in younger patients with no major risk factors for coronary atherosclerosis.

1. Roberts W.C., Siegel R.J. and Zipes D.P. (1982). *Am. J. Cardiol.* 49, 863.
2. Roberts W.C. (1986). *Am. Heart J.* 111, 941.

### Differentiation of gut endocrine cells provoked in gizzard endoderm

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Little is known about factors involved in the differentiation of gut endocrine cells: what information there is<sup>1,2</sup> suggests that the mesenchyme underlying the endodermal epithelium plays a role. We have shown recently that the number of gastrin-releasing peptide (GRP) cells that develop from endoderm of the avian proventriculus (glandular stomach) is significantly reduced when its own mesenchyme is replaced by that of the pancreas. We then wished to find out whether proventricular mesenchyme could permit the differentiation of GRP cells from endoderm that normally does not give rise to these cells in any number. Since the middle region of the gizzard (muscular stomach) contains only rare cells of this type,<sup>3</sup> we associated gizzard endoderm with proventricular mesenchyme, using 5-day chick embryos as donors. After 2 days *in vitro* to allow association of the layers, the combinations were grown as chorio-allantoic grafts to a final age of 21 days. Controls comprised re-associated endoderm and mesenchyme of the proventriculus and of the gizzard.

An indirect peroxidase immunocytochemical technique was applied to resin sections of grafts. As expected, GRP cells were plentiful in all proventricular control grafts (11); in only 1 out of 12 gizzard controls were any demonstrated. GRP cells were well represented in all 12 experimental grafts.

The results can be explained in two ways: either proventricular mesenchyme stimulates the development of GRP cells, or gizzard mesenchyme inhibits their differentiation. Further experimentation is planned to test these alternatives, but clearly mesenchyme does have a part to play in gut endocrine cell development.

This work was supported by grants from the Medical Research Council of South Africa and the Council Research Committee of the University of the Witwatersrand, Johannesburg.

1. Yasugi S. (1976). *C.R. Acad. Sci.*, (Paris) 283, Ser. D, 383.
2. Haffen K. *et al.* (1983). *Differentiation* 23, 226.
3. Rawdon B.B. and Andrew A. (1981). *Cell Tissue Res.* 220, 279.

### Anterior communicating artery of the cerebral Circulus Arteriosus (of Willis): a comparative morphological study between infant and adult brains

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It has been shown that in neurovascular genesis, capillary plexuses in specific locations grow around the base of the embryonic neural tube, eventually fusing to form a single arterial trunk.<sup>1</sup> Cerebral anastomotic channels so formed are of two broad types, namely normal vascular connections and those present in adults as remnants of embryonic development.

The anterior communicating artery was examined morphologically in the cadaver brains of South African Negro infants and adults in order to determine the type of anastomosis that prevailed in each group. The anterior communicating arteries in the two groups were analysed with reference to their presence, number of channels, arrangement, shape and calibre. Group A comprised 50 infant brains ranging from preterm stillbirths to neonates. Group B comprised 50 adult brains taken from cadavers ranging in age from 35 to 75 years. Observations were made with minimal dissection and recorded photographically.

Group A demonstrated a complete cerebral circle both anatomically and functionally. In Group B, incompleteness accounted for 16% of cases and always involved the posterior communicating artery. The anterior communicating artery in Group A was always a single vessel, whereas in the adults (Group B) it was observed as a single artery in one brain (the youngest) in this series of 50 specimens. In the remaining 49 adults, four different morphological types of anterior communicating artery were observed: plexiform, fenestrated, double or multiple.

It is concluded that the single artery observed in all infant brains is the final embryological form, and that additional channels seen in the adults have developed due to other influences on the brain, possibly related to cerebral ischaemia. This vascular modification is thought to be an ongoing process throughout adult life resulting in regression to an appearance that resembles the embryonic stage.

This study was supported by grants from the Medical Research Council and Faculty of Medicine Research Fund of the University of Natal.

1. Padget D.H. (1948). *Contrib. Embryol.* 32, 205.

## Detection of factors stimulating outgrowth of sympathetic neurites in cultures of embryonic cardiac and gastric smooth muscle

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Cardiac and gastric muscle from neonatal mice produce substances that stimulate outgrowth of sympathetic neurites *in vitro*.<sup>1</sup> As these substances may play a role in the development of the enteric nervous system, an experiment was carried out to estimate when they first appeared in the embryo. Small pieces of atrium and gastric muscle from mouse embryos aged 10, 11, 14 and 17 days and from 1-day neonates, were set in nutrient collagen gels, flanked at 1 mm on either side by pieces of sympathetic ganglia from neonates. Cultures were prepared in duplicate: 10  $\mu$ l normal rabbit serum was added to the medium of one, and 10  $\mu$ l of anti-nerve growth factor (NGF) to the other. Cultures were incubated in air at 37°C for 48 hours. The efficacy of the antiserum was tested on cultures of ganglionic tissue to which NGF was added. The response of cultures was assessed by measuring the 10 longest neurites on each side of ganglionic explants.

Anti-NGF reduced outgrowth of neurites to control levels in isolated ganglionic tissue treated with NGF. Preferential growth of neurites from similar explants towards cardiac and gastric muscle was seen at all ages studied; for atrium the response was maximal with tissues from 17-day embryos and neonates, and for stomach with 11-, 14- and 17-day embryonic tissues. Anti-NGF almost totally blocked growth of neurites towards atrium, but with gastric muscle as target, directional growth—although reduced—persisted (well above control levels) in the presence of the antiserum. These results indicate that the muscle explants liberate neurotrophic factors from the earliest ages studied; indications are that atrium releases an NGF-like substance, and gastric muscle an NGF-like substance as well as another factor immunochemically distinguishable from NGF.

The support of the Medical Research Council of South Africa is gratefully acknowledged.

1. Rawdon B.B. and Dockray G.J. (1983). *Develop. Brain Res.* 7, 53.

## Histochemical localization of ATPase activity in *Xenopus laevis* previtellogenic oocytes

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Several phosphatase activities have been implicated in oocyte maturation during amphibian oogenesis. It has been proposed that sodium- and potassium-dependent adenosine triphosphatase (Na,K-ATPase) in biochemical assays plays a role in the step-wise activation of the amphibian oocyte during maturation.<sup>1</sup> Furthermore, alkaline phosphatase activity has been cytochemically localized to the oocyte plasma membrane during stage six of oogenesis.<sup>2</sup>

In a first experiment, the method of Mayahara *et al.*<sup>3</sup> was used histochemically to detect magnesium-dependent adenosine triphosphatase (Mg-ATPase) activity (indicative of Na,K-ATPase activity) during oogenesis of the frog *Xenopus laevis*. This work shows that Mg-ATPase activity is already present in stage one, or previtellogenic oocytes, which range in size from 30 to 300  $\mu$ m in diameter. Each developing oocyte is surrounded by a monolayer of flattened follicle cells and is separated from an epithelial cell layer by an area of connective tissue.<sup>4</sup> Under high magnification, the reaction product is identified as a dark-staining, granular precipitation, which is specifically localized along the basement membrane and the outer cell membrane of the epithelium. In a second experiment, alkaline phosphatase activity was detected histochemically using sodium- $\beta$ -glycerophosphate as substrate. This product was localized along the cell membranes of the follicle layer adjacent to the oocyte, and not in the epithelium as is the case for Mg-ATPase. There was no intracellular staining of the oocytes for either Mg-ATPase activity or for alkaline phosphatase activity.

The presence of these phosphatase activities at this early stage of development may relate to the special events occurring in the oocyte at this stage, namely that the oocyte is in a period of rapid growth, and that the lampbrush chromosome phase of development is being initiated.

1. Morrill G.A. *et al.* (1974). *Ann. N.Y. Acad. Sci.* 242, 543.
2. Le Goascogne C. *et al.* (1984). *Cell Biol.* 52, 96a.
3. Mayahara H. *et al.* (1980). *Histochemistry* 67, 125.
4. Dumont J.N. (1972). *J. Morphol.* 136, 153.

## Level of termination of the spinal cord during normal and abnormal development

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This study was undertaken to assess the possible causes of neural deficit in diastematomyelia. At birth the spinal cord terminates opposite the third lumbar vertebra, and the adult level (lower border of the first lumbar vertebra) is reached by the age of 2 years.<sup>1</sup>

The level of termination of the cord was assessed in 50 cases at post mortem. The ages ranged from 20 weeks stillbirth to 8-month-old infants. In a clinical study of four patients aged between 3 and 7 years with diastematomyelia, termination of the spinal cord was assessed using CAT scans and confirmed at surgery. A dorsal midline approach was used to expose the spinal cord. The dura was split longitudinally, and the junction between the conus medullaris and the ventriculus terminalis was identified. The relationship of this point was calculated to the midpoint of the nearest vertebral body of the intervertebral disc. The spinal cord terminated at the adult level in all the infants and in all foetuses ranging from 26 to 40 weeks. In the group below 26 weeks the termination was found to range from L1 to L3. In the four cases of diastematomyelia the spinal cord terminated at the lower border of L3. The filum terminale was short and thickened. All four cases were characterized by a bony spur splitting the cord. The cord was tethered on the dorsal aspect.

This preliminary report reveals that the spinal cord reaches its adult level during the latter half of foetal development. In diastematomyelia the ascent of the cord is retarded by the short, thickened filum terminale and the dorsal tethering. The traction effect of these structures may produce neurological deficit during the adolescent growth spurt.

1. Winter R.B. (1983). *Congenital Deformities of the Spine*. pp. 271–299. Thieme-Stratton, New York.

## Use of long-bone flattening as an indicator of nutritional stress during growth

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According to Lisowski,<sup>1</sup> flattening of the femoral and tibial shaft is an indicator of nutritional stress during growth. Archaeological specimens from Southern Africa, with distinct flattening of these long-bone shafts, have been interpreted by De Villiers<sup>2</sup> as representing poor nutrition in childhood. Because of the great interest in nutritional and environmental conditions shown by archaeologists, it is important to confirm or deny the link between nutrition and shaft flattening in the Southern African context.

Data on tibial and femoral shaft flattening for various samples are compared, and it is shown that nearly all these populations show a moderate to marked degree of flattening, particularly of the tibial shaft. The mean platymetric index for South African Negro skeletons is 81,9% for males ( $n = 143$ ) and 72,9% for females ( $n = 103$ ), and the platycnaemic index for the same groups are 70,9% and 71,7% respectively. In Khoisan populations the average platymetric index is 83,5% for males ( $n = 40$ ) and 81,8% for females ( $n = 27$ ), and the platycnaemic index for Khoisan males is 65,0% and 67,8% for females. There is no significant correlation between platymetric and platycnaemic indices ( $r = -0,147$ ), but the platycnaemic index is significantly correlated to tibial length ( $r = -0,324$ ).

It is concluded that all Southern African populations have relatively flattened femoral and tibial shafts and that platycnaemia is a normal population occurrence in these groups, especially in Khoisan samples. The negative correlation between tibial length and platycnaemic index indicates that childhood malnutrition is not an adequate explanation for the formation of long-bone shaft flattening.

1. Lisowski F.P. (1968). *Proc. 8th I.C.A.E.S.*, vol. 1. Anthropology. Sci. Council Japan, Tokyo.
2. De Villiers H. and Wilson M.L. (1982). *Ann. S. Afr. Mus.* 88, 205.

## Heights, weights and growth rate of Bloemfontein females aged 7 to 19 years of age

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An anthropometric survey of white female pupils and students in Bloemfontein aged 6 to 19 years was undertaken in the period March to May 1966 and in the same period in 1967. Cross-sectional growth charts were compiled and compared with similar charts from a survey in Pretoria.<sup>1</sup>

Twenty years later in April to May 1986, a similar anthropometric survey was conducted in Bloemfontein. Anthropological measurements were taken on 910 female pupils of the Eunice Primary and High Schools and female students of the University of the Orange Free State. About the same number of pupils or students were measured in each age-group from 7 to 19 years of age. Charts for height and weight distance and velocity were compiled and compared with the 1966/67 survey.

Above the age of 13 years no significant differences were found between the 1966 and the 1986 length/age curves. An increase in the mean length for each age-group, but a less pronounced adolescent growth spurt, is noticeable below the age of 13 years. The weight/age curve of the 1986 survey shows an increase in the mean weight for all age-groups, but was less pronounced above the age of 12 years.

Although not statistically significant, the differences between the 1966 and the 1986 growth charts indicate an improvement in the general health and nutrition of the subpopulation and should be taken into consideration when comparisons are made with other populations or subpopulations.

1. Grobbelaar C.S. Grafieke van die groei en die norme van fisieke status van dogters (6–20) jaar van die Provinsiale Administrasie, skole, kolleges en Universiteit van die stad Bloemfontein. – [s.n.] : [S. I.] : [1971?]

## Search for a secular trend in cranial index and cranial capacity in the South African Negro

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Various changes occurring in body dimensions and growth patterns in specific population groups over a period of time have been noted. These changes, known as secular trends, were originally thought to be positive, i.e. to produce a larger size and accelerated growth. New evidence has suggested a decrease (or absence of a change) in the height of the South African Negro over the last century. It now remains to be resolved whether the various changes shown to accompany an increase in height have also been reversed (or are static) in this particular population.

In this study, maximum cranial length, maximum cranial breadth and basi-bregmatic height of South African Negro males were measured, and cranial index and cranial capacity were determined. These subjects were divided into five 5-year birthdate cohorts from the year 1880–1884, 1890–1894 to 1930–1934, and the various changes occurring over this period of time were observed. A slight decrease in the cranial index and cranial capacity was found although this was statistically insignificant. This absence of the usual trend towards broader crania (brachycephalization) coincides with the decrease in the standard of living found in this population after 1900 and corresponds well with the absent secular trend in height found on the same skeletons by Price *et al.*<sup>2</sup>

1. Tobias P.V. (1975). *S. Afr. J. med. Sci.* 40, 145.

2. Price B., Cameron N. and Tobias P.V. (1987). *Human Biol.* (in press).

## Physical fitness and growth status of street boys in Cape Town

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Extreme poverty has obvious deleterious effects on growth. In this study, we seek specifically to identify which parameters of morphology and physical fitness are most affected by a harsh life-style. Children who run away from home and live on the streets come from the poorest, often

one-parent, families and experience the most difficult living conditions in the urban environment.

We examined 26 boys, aged 8–18 years, recently admitted to Khayamandi shelter for street children in Langa township, Cape Town. Anthropometric measurements of body weight, height, trunk length, length of extremities, chest and arm circumferences and skinfold thicknesses at three sites were taken, as well as a set of physical fitness parameters: neuromuscular reaction time, grip strength, resting and post-exercise pulse rates and back flexibility. Results were compared with international standards and with identical measurements and observations on 37 Cape Town boys of the same age range and similar ethnic background, but attending a private school and coming from families of higher socio-economic status.

It was found that, although body dimensions of street boys were smaller than those of their 37 middle-class Cape Town counterparts and those of NCHS norms, their body proportions were normal. The most impaired characteristics were those of physical fitness. Neuromuscular reaction times were significantly increased. Grip strength was reduced by about 33% compared to the control sample (20.3 kg versus 30.8 kg). Both resting and post-exercise pulse rates were significantly elevated (more than 10%).

While many of the above changes could be traditionally ascribed to "poor living conditions" it is probable that certain more specific factors (e.g. benzine addiction) may be important.

## Ciliogenesis in ependymal cells of the choroid plexus in rabbit embryos

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The course of ciliogenesis is very similar in all vertebrates, although detailed differences have been observed between different species.<sup>1–3</sup> A study was undertaken in the rabbit to determine whether differences occur in the ciliogenesis of ependymal cells of the choroid plexus and the respiratory epithelium of the nasal cavity<sup>3</sup> of that animal. The ependymal lining of the ventricles and the choroid plexus of 12- to 20-day-old rabbit embryos were routinely prepared for transmission electron microscopy.

Ciliogenesis was first observed in the roof of the fourth ventricle of 13-day-old embryos and in the choroid plexus on the 14th day of development. In 13- and 14-day embryos, centrioles form only around the diplosomal centrioles (centriolar mode<sup>2</sup>), whereas in the older embryos, in addition to the centriolar mode, they develop around electron-dense structures called deuterosomes<sup>1</sup> (acentriolar mode<sup>2</sup>). The immature centrioles, or procentrioles, always occur as apposing pairs between deuterosomes. This strings the deuterosomes and procentrioles together to form short chains or networks. At a later stage separate complexes of deuterosomes and procentrioles were observed, scattered in the supranuclear cytoplasm. Still later the mature centrioles were seen aligned against the apical surface of the cell as basal bodies. Thereafter, ciliary buds, indicative of ciliary growth, appeared above each basal body.

Ciliogenesis in the choroid plexus and the nasal cavity<sup>3</sup> are similar in most respects. In the nasal cavity both centriolar and acentriolar formation of centrioles were always encountered. In the ependymal cells only centriolar formation was observed. In rare instances the cilia of an ependymal cell were encountered deep within the cytoplasm of the cell, whereas this was not observed in the nasal cavity.

1. Sorokin S.P. (1968). *J. Cell Sci.* 3, 207.

2. Anderson R.G.W. and Brenner R.M. (1971). *J. Cell Biol.* 50, 10.

3. Loots G.P. and Nel P.P.C. (1986). *Proc. Electron Microsc. Soc. S. Afr.* 16, 53.

## Physique and sleep: A report on the relationship between somatotype, percentage body fat, weight and subjective report of total sleep time in young adult males

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To investigate the relationship between physique and sleep, body shape and composition and total sleep time per week was studied over 7 consecutive days in 37 healthy male medical and para-medical students between the ages of 19 and 29 years. Body shape and composition was deter-

mined using the Heath – Carter somatotype method, and the percentage body fat calculated from the formulae of Durmin and Womersley<sup>1</sup> using the four skinfolds (triceps, biceps, subscapular and suprailliac). In order to calculate the total sleep time per week, subjects were required to fill in a sleep questionnaire, comprising 18 general and 14 specific questions. Spearman rank correlations were then performed to see if there was any significant correlation between the somatotype rating, percentage body fat, body weight and total sleep time. The total sleep time per week was divided into five time groups, and the full somatotype rating of each subject in the groups was plotted on a somatochart.

No significant correlations were found between somatotype ratings, percentage body fat, body weight and total sleep time. This raises the question of how overweight (and/or overfat) or underweight a person must be for sleep to be subjectively affected. It has also been found previously that as obese people lose weight so they decrease their sleeping time,<sup>2</sup> and as people with anorexia nervosa increase their weight so they increase their sleeping time.<sup>3</sup> Because no significant correlation was found between any of the measured variables and total sleep time in this study, it is possible that the decrease in sleep time seen in obese people as they lose weight and the increase in sleep time seen in anorexics as they increase their weight is due to an improvement in the nutritional status as well as the metabolic and physiological processes that occur during weight loss and gain.

1. Durmin J.V.G.A. and Womersley J. (1974). *Br. J. Nutr.* 32, 77.
2. Crisp A.H. et al. (1973). *Psychother. Psychosom.* 22, 159.
3. Lacey J.H. et al. (1975). *Br. med. J.* 4, 556.

### Craniodental allometry in the Chacma baboon (*Papio ursinus*)

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Adult static intraspecific allometry of jaw size and tooth area was evaluated in a sample of 104 *Papio ursinus* crania (52 male, 52 female). Tooth areas were calculated from mesiodistal and buccolingual measurements of all the teeth in both arcades, and were scaled to four viscerocranial measurements: bimaxillary width, maxillo – alveolar length, mandibular length and bigonial width. Allometric relationships were probed with the use of the logarithmically transformed power formula:  $\log Y = \log b + a \log X$ . Size scaling was only recognised in the presence of significant correlations (quantified by coefficients of determination) and least squares regressions were used throughout.

Intraviscerocranial analysis showed that larger animals will tend to have proportionately narrower and shorter mandibulae. From interspecific analyses between *P. ursinus* and *Cercopithecus aethiops*, we conclude that males and females within each species share a common exponent for jaw length. Hence, increased dimorphism in muzzle length in *P. ursinus* may be attributable to increased slope divergence. Postcanine area and maxillary length were significantly correlated, with exponential values similar to those in *C. aethiops*. A hypothesis of nutritional equivalence is advanced to account for these observations.

The existence of a canine complex in males was confirmed by significant correlations between canine base area and the area of P3, only in males.

### Aberrant vertebral artery: a persistent proatlantal vessel

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A rare anomaly, the origin of the right vertebral artery from the external carotid artery, is described. The patient was a 35-year-old South African Negro man who presented with sudden onset of headache followed by cramps and weakness in the left upper limb. There was no hypertension or carotid bruit. Precordial examination revealed mitral valve prolapse. There was no blood in the cerebrospinal fluid, and computerized tomography was normal. Four-vessel angiography revealed a persistent proatlantal artery.<sup>1</sup> The vessel arose from the external carotid artery immediately above its bifurcation, and after a short transcervical course

entered the suboccipital triangle. Its subsequent course into the skull was normal.

In the embryo a similar vessel connects the internal carotid artery to the caudal part of the basilar artery. It normally regresses after the 40th day when the vertebral artery is fully formed and takes over the blood supply to the basilar system. With failure of development of the proximal portion of the vertebral artery, this anastomosis between the carotid circulation and the distal segments of the vertebral artery remains patent. The vessel so formed is a persistent proatlantal artery.

Subjects with anomalies of the vertebro-basilar system may suffer ischaemic accidents from vascular compression related to certain positions of the head and neck.<sup>2</sup> In this patient however, the limb weakness was attributed to an embolic episode arising from the mitral valve. The persistent proatlantal artery was therefore an incidental finding.

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2. Hope E.E., Bodensteiner J.B. and Barnes P.B. (1983). *Paediatrics* 72, 335.

### Incidence and age of development of enamel hypoplasia in Southern African human populations

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Enamel hypoplasias of permanent teeth are generally believed to result from non-specific metabolic and nutritional disruptions.<sup>1</sup> As enamel does not remodel after recovery from these injuries, such defects become useful as longitudinal records of the developmental ages at which physiological stresses occurred. The purpose of this study was to investigate the prevalence, chronological distribution and secular trends of enamel hypoplasia in permanent dentitions of a sample from the Raymond Dart Skeletal Collection (University of the Witwatersrand), representing past and present populations of Southern Africa. Identification of hypoplasias was achieved by comparison to published standards.<sup>2</sup> These standards chart the length of each tooth crown, with the corresponding age at development. Thus any insult to a tooth can be measured and the corresponding age at development can be assessed.

Enamel hypoplasia was present in 26,3% of the total sample ( $n = 2118$ ), with a range from 2,7% in San ( $n = 74$ ) to 58,8% in Chinese ( $n = 34$ ), representing a migrant labour force. S.A. Blacks ( $n = 1194$ ) showed a relatively high incidence of hypoplasia (36,6%). Tribal groups that possessed predominantly hunter – gatherer or mixed hunter – gatherer/pastoralist lifestyles, showed a lower incidence of enamel hypoplasia than tribal groups mainly dependent on a pastoralist existence.

The prevalence of defects by age cohorts showed a peak frequency of hypoplasia from 3 to 5 years of age in the present sample, corresponding to the age of weaning in this group. Assessment of the sample by birth cohorts showed a peak of hypoplasia between 1910 and 1920. This may be due to a deterioration in social and health conditions during this period. The present study provides a basis for the inferring of nutritional stress trends in Southern African populations. The data may be useful also as a comparative source for epidemiological and secular trend studies on hypoplasia in past and contemporary populations worldwide.

1. El Najjar M.Y., De Santi M.V. and Ozebeck L. (1978). *Am. J. phys. Anthrop.* 48, 185.
2. Goodman A.H., Armelagos G.J. and Rose J.C. (1980). *Human Biol.* 52, 515.

### POAMES – evolution or atavism in man

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The prevalence, anatomy and classification of palatal osseous alveolar marginal exostosis (POAMES) in *Homo sapiens* has been reported.<sup>1</sup> Absence of POAMES in nearly all mammals and vertebrates, other than the anthropoid apes, suggests that POAMES could be important in unravelling the evolution of humans.<sup>2</sup> The question arises as to whether phenotypic expression of POAMES is an irreversible process of gradual change in successive generations, tending towards increased complexity and differentiation of structures and function and occurring by the accumulation of genetic mutations over time – i.e. an evolutionary phenomenon. Alternatively, is the appearance of a heritable phenotype

character, present in a remote human ancestor but presumed lost because of its absence in more recent direct ancestors, a reversion to a throw-back phenotype – i.e. an atavistic phenomenon?

Assessment of museum skulls (in the Raymond Dart Skeletal Collection, University of the Witwatersrand, and in the Transvaal Museum, Pretoria) revealed POAMES in early Hominidae skulls such as *Australopithecus* (*A. africanus*, *A. boisei* and *A. robustus*), *Homo habilis* and *Homo erectus*. Examination of anthropoid ape skulls ( $n=35$ ) showed POAMES on gorilla ( $n=6$ ), chimpanzee ( $n=17$ ) and orang-utan skulls ( $n=6$ ), but not on the gibbon skull ( $n=6$ ).

Skulls of *Cercopithecoid* monkeys ( $n=287$ , *C. aethiops* and seven other species) and of *Papio* baboons ( $n=368$ , *P. ursinus*, *P. cynocephalus* and *P. hamadryas*) revealed no trace of POAMES. Evidence of POAMES in *Homo*, the chimpanzee, the gorilla and orang-utan suggests that POAMES are not an atavistic expression but rather an emergent evolutionary phenomenon that first appeared in the common ancestor of apes and humans. POAMES continue to manifest themselves frequently in modern man.

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2. Tau S. and Touyz L.Z.G. (1986). *J. dent. Res.* 65, 627.

### Brain size, body size and intelligence: convictions and facts

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The aim of this paper is to demonstrate the lack of evidence for a relationship between gross morphology of the hominid brain and behavioural characteristics. Firstly, neither our absolute brain size, nor the simple brain size/body size ratio place us at the upper end of the animal scale. Secondly, re-examination of the fossil evidence by means of allometric regressions shows that brain size gradually increased in hominid evolution<sup>1</sup> and in direct proportion to increases in body size. Thus, a tentative hypothesis is advanced suggesting that in hominid evolution the body size increased (an occurrence common in a number of mammalian lineages), followed by an increase in brain size. The situation is complicated by structural reductions of the hominid body resulting from increasing reliance on extrasomatic adaptations. Thirdly, abundant numerical evidence based on fossil material and on modern human crania (241 samples totalling 12 900 individual skulls) shows a steady and significant decrease (over 10% of the initial value) of cranial capacity since the Upper Palaeolithic. This decrease occurred during a period in which the most fruitful achievements of the human mind took place (introduction of agriculture, formal mathematics, written language, etc.). Finally, no significant correlations were found between mental capacity, cranial volume and head shape of nearly 500 individuals controlled for sex, age, ethnicity, and social and educational experience.<sup>2</sup>

It is concluded that no positive evidence exists at present for a significant relationship between brain size and development of human intellectual capacity. Differences between human and animal brains seem to lie in their physiology and the external stimulation to which they are exposed in their respective environments.

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### The Taung skull revisited: new evidence from high-resolution computed tomography

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Just over 60 years ago, Raymon Dart's description and analysis of the Taung skull triggered a revolution in human thought that continues to this day. During these 60 years, external features of the Taung skull and dentition have been studied in every possible way. Previously, however, radiographic analyses have been of limited value because of the dense mineralization and calcified matrix within the Taung skull. For this reason, important intracranial structures, like the developing permanent dentition and the paranasal sinuses, have never before been clearly visualized.

This is particularly unfortunate since dental development patterns have been of such critical importance in evaluating australopithecine maturational affinities. Recent advances in high-resolution computed tomography now make it possible to rectify this situation and to make previously 'hidden' structures within the Taung skull visible.

The entire Taung skull was CT scanned in 2-mm-thick sagittal, coronal, and transaxial planes. These scans show for the first time, and with high resolution, the state of development of all the unerupted permanent dentition and the pneumatized portions of the facial skeleton. These views allow more refined inferences to be drawn concerning the developmental patterns of this important specimen. We conclude that the Taung 'child' shows a much more complex mosaic of pongid-like and hominid-like craniodental features than was previously realized.

### Left ventricular bands: previously ignored structures recently 'rediscovered' by ultrasound imaging techniques

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Left ventricular bands (LVBs) were first described almost a century ago but were largely ignored by anatomists, pathologists and clinicians, until their recent 'rediscovery' by echocardiography. These discrete tissue bands traversing the left ventricular cavity have been traditionally regarded as being of no functional importance. Recent claims have been made, however, regarding their causative role in innocent murmurs, premature ventricular contractions, intra-cardiac conduction disturbances, atypical chest pain and thrombus formation. A significant association between the vibratory systolic murmur and the presence of LVBs in the left ventricular outflow tract has been demonstrated.<sup>1</sup>

The confusion regarding the functional and clinical importance of LVBs prompted this investigation of the mechanism of the vibratory systolic murmur, the echocardiographic features of LVBs and their microscopic structure. Firstly, a group of 200 subjects with both the vibratory systolic murmur and LVBs were investigated. Using Doppler ultrasound, the left ventricle was carefully examined for the presence of turbulence; no turbulence was demonstrated to be associated with the LVBs. Furthermore, the various types of LVBs were noted. Secondly, serial sections of LVBs removed from necropsy specimens were examined by light microscopy. Preliminary results indicate that conducting tissue (Purkinje fibres) passes through some LVBs. These fibres were noted entering and leaving the LVBs studied. It is therefore suggested that LVBs may cause the innocent vibratory systolic murmur by some mechanism other than turbulence, and can play a role in the conduction process of the heart.

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### Ultrasonography and the fetal cavum septi pellucidi

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In prenatal obstetric care ultrasonography has acquired an indispensable and useful role. During a sonographic examination with modern advanced equipment, remarkable anatomical detail of the fetal brain is visualized, certain measurements can accurately be taken and developmental anomalies excluded. Ultrasonography refers to a relatively large fluid-filled space at the midline of the fetal brain as the so-called cavity of the septum pellucidum. This is employed as a readily recognisable landmark and point of reference during scanning procedures.

The aim of this study was to correlate the sonographic cavum septi pellucidi with the anatomical findings in human fetuses following abortion or a premature birth.

Recently aborted mid-trimester fetuses were immediately placed in a formalin mixture, then frozen to a firm consistency, and the skulls serially sectioned with an electric saw. The cuts were made serially parallel to the cantho-meatal line at approximately 5-mm intervals in order to locate and measure the septal cavity. Foot length was used to estimate gestational age. Third-trimester fetuses were cut according to accepted autopsy procedure for post-mortem brain examination. The brains of numerous

living intra-uterine fetuses were examined during routine ultrasonography on obstetric patients.

The presence of a surprisingly large cavum septi pellucidi et Vergae was found in every specimen examined.

The distribution of the gestational ages had a mean value of 27,6 weeks, range 19, median 27 and standard deviation 6,28. The cavity width had a mean value of 5,1 mm, range 7, median 4,5 and standard deviation 2,02. The correlation coefficient was 0,39.

It was concluded that the large centrally situated fluid-filled space of the fetal brain alleged by ultrasonologists to be the cavum septi pellucidi does verifiably and validly represent the anatomical developing cavity of the septum pellucidum. There is only a poor correlation between the gestational age and the width of the cavity.

### Fine structure of atypical mitochondria in Sertoli cells of an infertile bull

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The mitochondria encountered in the basal portion of the bovine Sertoli cell are described as small round or oval structures, whereas those located in the supranuclear region of the cell are frequently elongated and aligned along the major cell axis.<sup>1</sup> A similar mitochondrial distribution has been observed in the human Sertoli cell.<sup>2</sup> This paper describes the ultrastructural features of atypical mitochondria identified in Sertoli cells of an infertile bull displaying the 'stump tail' defect of the spermatozoa.

Testicular samples obtained from the bull immediately after slaughtering were immersion-fixed in 4% cacodylate-buffered glutaraldehyde, post-fixed in 1% osmium tetroxide, and routinely processed for transmission electron microscopy.

Atypical mitochondria were located exclusively in the basal part of Sertoli cells and occurred singly or in groups. These organelles were generally associated with normal mitochondria, which revealed characteristic features.<sup>1,2</sup> The abnormal mitochondria were extremely large structures which displayed round, pear or spindle-shaped profiles containing conspicuous concentrations of crystalloid material. In longitudinal sections this material was seen to consist of closely packed bundles of parallel-oriented filaments. Cross-sections of the crystalloids confirmed their closely packed fibrillar nature but revealed no specific pattern or arrangement of the filaments. Some mitochondria were almost completely filled with crystalloids, with only a thin rim of matrix containing rests of cristae visible. In other instances the crystalloids were limited to the central interior or apex of the mitochondria, the remainder of the organelle displaying a relatively normal, albeit enlarged, form.

Although the significance of atypical mitochondria in Sertoli cells is unclear, the similarity between the mitochondrial crystalloids and the Charcot - Böttcher crystalloids seen in man may point to an association between crystalline structures and defective spermiogenesis.

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### Accessory neurosecretory neurons in the mammalian hypothalamus

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The aim of this investigation is to demonstrate that there are other magnocellular neurosecretory groups of cells in the mammalian hypothalamus, besides the paraventricular and supra-optic nuclei. Accessory paraventricular and supra-optic nuclei, as well as isolated groups of magnocellular neurosecretory cells, were located in the hypothalami of the baboon, vervet monkey, cat and dog. The presence of accessory nuclei was revealed by the Klüver and Barrera method for myelinated nerve cells and by the Holmes technique for axonal projections. The Gomori chrome - alum haematoxylin - phloxine method for neurosecretory material produced fairly satisfactory results in the baboon hypothalamus.

The accessory paraventricular nucleus<sup>1</sup> lies medial to the principal paraventricular nucleus and is so closely related to the fornix that dissociated neurons from this nucleus appear to form anterior and posterior fornical nuclei.<sup>2,3</sup> Isolated groups of magnocellular neurons

were observed in the region of the anterior commissure and in the anterior hypothalamic area. In the latter case, an irregularly circumscribed group of neurosecretory cells, which is associated with a rich capillary network, was regularly observed in the mammalian species studied here; these lie 'midway' between the paraventricular and supra-optic nuclei. This is termed 'nucleus circularis'.<sup>2,3</sup> The accessory supra-optic nucleus<sup>1-3</sup> is not well represented in the species studied; it may merely be a retrochiasmatic part of the principal supra-optic nucleus.

As the principal paraventricular and supra-optic nuclei are known to contain the neurohypophyseal peptides (vasopressin and oxytocin), and their associated proteins (the neurophysins), immunocytochemical tests are now being carried out on the accessory nuclei to determine the type of peptide hormones contained in their neurons, and in which proportions these peptides occur compared to the principal neurosecretory nuclei.

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### Microvascular beds in rat omentum

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To gain better insight into some of the physiological functions of the omentum it would be advantageous to know more about its microvascularization. Casts of the vessels of rat omentum were made by injecting mercocryl resin via the coeliac trunk. The omentum was then macerated and the casts obtained were studied using a scanning electron microscope.

Casts of 36 omental microvascular beds from six rats were studied. According to capillary density and shape, three types of microvascular beds could be identified. The first and most common type consisted of tortuous capillaries which were densely packed. The second type consisted of tortuous capillaries that were more loosely arranged, and the third and rarest type consisted of straight capillaries that were loosely arranged.

The capillary junctions were also studied: 88% were 'T' junctions; 10% were 'Y' junctions and in 2% of cases, four capillaries met at one point.

The most interesting aspect of the microvascular beds of the omentum was the glomerular appearance of the first two types. These microvascular beds appeared to be encapsulated indicating that they lie superficially beneath the mesothelium. They could therefore have either a secretory and/or an absorptive function. They could also be related to the superficial milky spots of the omentum, which play an important role in the antimicrobial function of this structure.

### A preliminary comparative study of the relationship between the lateral pterygoid and the temporomandibular joint

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The lateral (external) pterygoid in man has a complex internal architecture and multiple attachments which suggest complex functioning. Some investigators conclude that the two heads of the lateral pterygoid can be considered as two functionally distinct muscles,<sup>1</sup> while others disagree.<sup>2</sup>

The relationship between the lateral pterygoid and the temporomandibular joint is compared in man, a vervet monkey, a rat and a rabbit. Except for the human material, which was stained by the gold reagent fibre-marking technique,<sup>3</sup> the muscles of the other specimens were stained with Lugol's solution and the blood vessels passing through them injected with latex.

Not unexpectedly, the anatomy and relationships of these muscles are closest in man and the vervet monkey, but even here a distinct anterior articular eminence is lacking in the latter. The muscle has two distinct heads in man, the vervet monkey and the rabbit. In the rat the two heads are not clearly differentiated. There are also differences in the proportion of the muscle associated with the meniscus of the temporomandibular joint. The mandibular condyle is relatively small in the rat and the rabbit. Moreover, it is oriented dorsoposteriorly in the rat and slightly dorsoanteriorly in the rabbit.

The human mandible is capable of extremely complex combinations of movements in the sagittal, frontal and horizontal planes. In the other

species, the interlocking teeth and simpler temporomandibular joints probably restrict the range of mandibular movements.

The human material was kindly supplied by Professor Sven-Eric Widmalm (School of Dentistry, University of Michigan, U.S.A.); a surgeon removed the block of tissue containing the muscle from an unembalmed head.

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### Pattern of venous drainage in the ileocecal junction of the horse

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The submucosal veins of the human ileocecal valve suggest that the venous plexus formed there complements sphincter muscle action.<sup>1</sup> Schummer<sup>2</sup> briefly describes a similar plexus in the horse. The purpose of this study is to establish the pattern and structure of venous drainage in this area.

Sixteen horse ileocecal junctions and one of a zebra (*Equus b. burchelli*) were injected with latex via the ileocolic vein and dissected. In all cases the ileocecal papilla was drained by two main branches: one cranial and one caudal to the papilla. A smaller dorsal branch was present throughout. In 11 cases (68,7%) the cranial and caudal branches drained into a common branch. The latter drained into the *V. cecalis lateralis* in eight cases (50%) and into the *R. ilei mesenterialis* in three (18,7%). In three cases the two branches drained separately into the *V. cecalis lateralis*, in two (12,5%) the cranial branch drained into the *V. cecalis lateralis*, while the caudal branch drained into the *R. ilei mesenterialis*. On removal of the mucosa these branches clearly supplied a rich submucosal venous plexus to the ileocecal papilla, while also giving branches to the cecum surrounding the papilla.

Vermineous arteritis is a known major cause of colic due to impaired blood supply to the distal ileum. The role of this venous plexus in the pathophysiology of colic needs further investigation.

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### Lateral costal branch of the internal thoracic artery in South African Negro cadavers

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The lateral costal branch of the internal thoracic artery, when present, usually arises from the internal thoracic artery near the upper border of the first rib, descends inferiorly and posteriorly near the midaxillary line and ends usually in the fourth intercostal space. It may be unilateral or bilateral and, when unilateral, occurs more frequently on the left than on the right.<sup>1</sup>

This study aimed to determine the incidence of this vessel in S.A. Negro cadavers. The presence, laterality and length of the vessel were determined in 64 adult South African Negro cadavers. The vessel was present in two subjects, the incidence being 3,1% of cadavers. In one it was bilateral; the right vessel was exceptionally long and reached the eighth intercostal space, but its length on the left could not be ascertained. In the other cadaver the vessel was present only on the left and extended to the fourth interspace.

Thus, the incidence in our Negro series (3,1%) was far lower than in Caucasoids (27,6%) and Mongoloids (18,6%).<sup>1,2</sup> It was bilateral in 1,6% of our series, in 5,3% of Caucasoids and 3,5% of Mongoloids; it was unilateral in 1,6% of Negroes, 22,3% of Caucasoids and 15,1% of Mongoloids. No vessel in Kropp's Caucasoid series<sup>1</sup> extended beyond the sixth interspace, but one of ours reached the eighth interspace, making it the longest variant on record.

It is suggested that the aberrant branch arises embryologically from a supernumerary longitudinal anastomosis between the ventral rami of

those dorsal intersegmental branches of the dorsal aorta, which lie immediately caudal to the seventh (which forms part or all of the subclavian artery). Functionally, it may be important in the establishment of the collateral circulation in cases such as coarctation.

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### The *M. atlantopharyngeus* of the dromedary

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Four dromedary camels (*Camelus dromedarius*) were sacrificed and preserved by infusion with a standard embalming fluid, in order to dissect, describe and illustrate the systematic anatomy of the musculature. In view of the fact that dromedaries are characterized by the presence of a pharyngeal diverticulum, the so-called 'dulaa', special attention was paid to the pharyngeal region. The hyoid muscles were dissected and exposed. The stylohyoid muscle was isolated and transected near its origin from the stylohyoideum and at its insertion on the thyrohyoideum. The intervening part of the belly was removed to give a better view of the pharyngeal muscles. For the same purpose the dorsal third of the stylohyoideum was removed. The surface of the pharyngeal and palatine musculature was cleaned and the functional groups isolated, i.e. the muscles of the soft palate, the rostral, middle and caudal constrictors of the pharynx as well as the dilators of the pharynx. In all specimens an additional muscle was found amongst the caudal pharyngeal muscles, which seems to have no homologue in other domesticated mammals. It is paired and arises from the ventral surface of the atlanto-occipital joint capsule, as well as from the ventral arch of the atlas. Its fibres fan out in a ventral and rostroventral direction. The more caudal ventrally directed fibres attach to the convex surface of the prominent dorsal diverticulum of the nasopharynx, while the more rostral fibres form the substance of the crest which partially divides the nasopharynx into rostral and caudal compartments. Most rostral fibres attach to the caudal aspect of the fornix.

It is provisionally named the *M. atlantopharyngeus*. The muscle is innervated by the *N. glossopharyngeus*, which may indicate that it is in fact a derivative of the *M. stylopharyngeus* caudalis. It appears to be a dilator of the nasopharynx. Its possible rôle in the extrusion of the palatine diverticulum ('dulaa') is discussed.

### ABO blood group frequencies in the inhabitants of an Ancient Greek colony, Metaponto, in Italy

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The aim of this study was to determine the frequencies of the ABO blood group system alleles in an ancient population in order to obtain a clearer understanding of its biological affinities. Blood groups of the ABO system were determined by the absorption method<sup>1,2</sup> on bone samples from 179 skeletons excavated at a rural necropolis dated at 6th–3rd century B.C., in the Colony of Metaponto located at the Gulf of Taranto. Samples of trabecular bone were cleaned, ground and treated with high-titre anti-A, anti-B, anti-AB and anti-H sera. Analysis of soil samples from the tombs excluded a possibility of non-specific absorption of antisera.

From among 179 individual skeletons examined, 67 (37%) showed no reaction with any of the sera. These must have either lost their antigenic properties, due to varying soil conditions, types of burials and possible exposure to atmospheric oxygen,<sup>2</sup> or have belonged to individuals of the non-secretor type. Among the remaining 112 individuals the phenotypic frequencies were: A = 0,13, B = 0,20, AB = 0,08, O = 0,60, yielding allelic frequencies of P = 0,11, Q = 0,15, r = 0,77.

Due to the above uncertainties of determination only a very general comparison with other populations is warranted. Data for pre-World War II inhabitants of Greece and Puglia (an Italian province adjacent to Lucania where Metaponto is located) were selected for comparison. The phenotypic and genotypic frequencies obtained for the ancient population of Metaponto are closer to those for Puglia than to modern Greek data. This finding supports a previous conclusion<sup>3</sup> reached on the basis of morphological studies of a continuity in the population of the region from antiquity to modern times.

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### New stereophotogrammetric approach for *in vivo* measurement of the lumbar spine

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Accurate measurement of bony anatomy from radiographs has been frustrated by the planar limitations of standard radiology; the position of image points in three dimensional space cannot be determined, nor can any rotational offset of the object be measured. The aim of this study is to establish a precise and reliable method for quantitative anatomical studies of the lumbar spine that surmounts these limitations and can be applied to living subjects.

In order to overcome these difficulties a technique of stereophotogrammetry<sup>1</sup> has been used for the precise localization of image points in space, using simple stereo X-ray projections of the object within a radio-opaque control framework. The stereogram is viewed through a stereoscope, and common image points are located and digitized. The XYZ co-ordinates of the selected points may then be calculated using projective transformation mathematics.

This study, made on fresh cadaver material, assesses the validity of this method for measurement of vertebral body dimensions on lateral X-ray views. The results obtained from the X-ray analysis and subsequent direct measurement of the macerated bones of the same specimens were correlated yielding a standard error of 1–2 mm. The main source of error was ascribed to the degree of estimation involved in the localization of bony landmarks not identifiable by specific anatomical features.

Calculation of random error allows for mathematical manipulation of results such that true error-free averages and variances may be estimated. On this basis the proposed method of X-ray analysis is recommended for *in vivo* studies of bony anatomy. The method has been applied to a small test sample ( $n = 10$ ) and yielded a description of spine morphology that may be interpreted in biomechanical terms.

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### Report on an archaeological human skeleton showing calcification in the region of the lumbar spine

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During the excavation of isolated graves along the north shore of the Orange River in the vicinity of Augrabies Falls National Park in July 1984, a skeleton was uncovered on the farm Omdraai, showing two large calcium-like deposits near the vertebral column in the abdominal region. Careful excavation clearly showed that this material was in the correct

anatomical position of the kidneys and was not part of the grave fill. The individual was an adult female of about 40 to 45 years of age at the time of death. The grave sequence from which the skeleton was excavated is dated to the late 17th or early 18th century,<sup>1</sup> and the remains probably represent a member of a pastoralist Khoikhoi community.

The calcified residue does not in any way resemble the external or internal anatomical form of a kidney, but X-ray powder diffraction analysis identifies the material as apatite  $[\text{Ca}_{10}(\text{PO}_4)_6(\text{OH})_2]$ , a common constituent of human urinary calculi. It is postulated that both kidneys were affected by a chronic disorder, and that calcification had occurred in and around both kidneys. Although it is rarely possible to identify the cause of death from skeletal remains alone, the disorder as seen in this specimen would appear to have been very severe, and it may well have been the ultimate cause of death.

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### Preliminary investigation of unknown human skeletons originating from Danielskuil

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In 1976 during excavations for a sewerage system in Danielskuil, human bones were found. Further digging was undertaken at three neglected graveyards in and around Danielskuil and the skeletal remains of 31 individuals were found. Historically and according to legend, the skeletal remains were of Griquas who inhabited the area at the beginning of the century. Fifteen of the skeletons were complete enough for cranioscopic and craniometric investigation. The aim of the study was to determine whether the skulls were a homogeneous group and to what extent the skull characteristics of the Griqua's antecedents were still identifiable.

The 25 measurements obtained from the craniometric investigation were scrutinized for outlying observations. Fifteen measurements were investigated by means of the multivariate statistical methods of principal components analysis, cluster analysis and discriminant analysis. Classification functions were computed and used to assess the affinities between the Griqua skulls and the skulls of Khoisan, Negroid and Caucasian samples. The analysis showed that the 15 skulls comprised four groups. Ten of the skulls were classified as Griqua men or women, although the San people and Negroid women could also appear statistically in these groups. Three of the skulls were noticeably larger and more dolichocranial with Caucasoid or Negroid characteristics. Two skulls had an intermediate position and could not be associated with any race.

The investigation supports Brink's<sup>1</sup> finding that the Griqua skull generally shows a parallelism with the Khoisan but also has signs of the influence of other races.

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