

INAUGURAL MEETING OF COMPARATIVE
PHYSIOLOGISTS - 1984

The response to the first circular has been good. So far we have 22 offers of papers, a potential attendance of around 40 and evidence of wide support for the venture. Thus we intend to go ahead and run the meeting as planned on the weekend of 1-2 December at UNSW.

Programme

Contributed papers are expected to run all day Saturday and for at least half of the Sunday. Morning coffee, lunch, afternoon tea and administrative costs will be covered by a charge of \$20 payable in advance. A dinner will be arranged at reasonable cost at a local restaurant on Saturday evening. Please indicate on the attached form if you wish to attend the dinner; payment will be at registration or at the restaurant.

Projection facilities will include an Overhead Projector and 35mm slide projector. Please submit title and abstract of your paper on the form provided.

For those of you requiring college accomodation please indicate the days on the attached form. Payment (\$30 a night B/B) will be required at registration.

RETURN FORM AND ADDRESS QUERIES TO

*\$20 sent 3-12-84
Abstract sent to Kjal for
approval & comment.*

DR PETER GREENAWAY
SCHOOL OF ZOOLOGY
UNIVERSITY OF NSW
PO BOX 1, KENSINGTON
NSW 2033
TEL 02-6972116

INAUGURAL MEETING OF COMPARATIVE
PHYSIOLOGISTS 1984

ABSTRACTS

ACID-BASE BALANCE AND TEMPERATURE IN THE TURTLE
(Chrysemys picta bellii)

S C Nicol (Department of Physiology, University of Tasmania)
M L Glass & N Heisler (Abteilung Physiologie,
Max-Planck-Institut für experimentelle Medizin, Göttingen,
Federal Republic of Germany)

Many studies on ectotherms have shown arterial pH to vary inversely with temperature. In air breathers this is caused by a rise in blood PCO₂ with body temperature, while total CO₂ (and thus bicarbonate) remains constant. This has been explained in terms of constant ionization of proteins (alphastat hypothesis). Other studies have shown a departure from this pattern, with bicarbonate changing significantly with temperature. However in most studies bicarbonate has been calculated rather than measured directly. We measured plasma bicarbonate in turtles at different temperatures. While bicarbonate remained remarkably constant the actual changes of pH with temperature differ from those predicted by the alphastat hypothesis.

Rochelle Buffenstein.

The role of crystalline allantoin in the water economy of
Namib Cricetidae.

Despite the fact that the Namib desert is an extremely arid and hostile environment, it has many resident rodent species. Most of these rodents are nocturnal and therefore not subjected to the extreme daily temperature fluctuations. They are however forced to cope with scattered and unpredictable food and water resources. When examining the response of Namib rodents to food and water shortage, it was found that the cricetids produced large quantities of an off-white crystalline precipitate. This compound was identified as allantoin, the common end product of purine degradation. The quantity found in the solid precipitate alone accounted for 47% of the total nitrogen excreted and was approximately 14 times greater than the predicted quantity of allantoin from purine degradation. Its importance in the water economy of cricetids was then investigated and it was found to enable substantial savings in water turnover.

Abstract

T.J. Dawson, E. Skadhauge*, and R.M. Heard
The School of Zoology, University of New South Wales,
Kensington 2033, Australia

The emu, a large (40 kg) flightless bird, has low water requirements yet it has a limited ability to produce concentrated urine. To clarify the factors involved in excretion and water conservation by the emu the patterns of excretion during water restriction were examined.

Following water restriction the osmolality of the excreta fluid increased to a maximum level at 6 days of $428 \pm 39(8)$ mosmol ($\bar{X} \pm SE(N)$), the U:P ratio being $1.35 \pm 0.12(8)$. In normally hydrated birds almost all Na and Cl were excreted in the fluid fraction but a third of the K^+ was associated with the solid fraction of the excreta. After water restriction for 9 days the pattern of excretion^{of} K did not change but the majority of Na (79%) and Cl (73%) were excreted in the solid phase, possibly associated with urates.

The cloaca-rectum appears to play a major role in the modification of excreta. Invivo perfusion studies showed transepithelia net transport rates of water and major electrolytes to be large. Transport of water from an isosmotic solution, 3.36 ± 0.17 ml/kg h, was approximately 10 times the maximum value reported for birds previously. The Na and Cl transport rates were also comparatively high.

Factors affecting sodium and potassium concentrations in parotid saliva of red kangaroos.

A.M. BEAL.

Red kangaroos have evolved a parotid saliva which, in Na-replete animals, is similar to that of ruminants. The saliva has high levels of Na, HCO_3 and PO_4 , low levels of K & Cl and an osmolality approaching that of plasma. In Na-replete kangaroos, acute changes in plasma Na concentration cause correlated changes in salivary Na concentration whereas acute elevation of mineralocorticoid levels has negligible effects. Long-term administration of mineralocorticoids (21 days) at high rate causes a fall in salivary Na/K ratio, chloride concentration and osmolality associated with hypertrophy of the duct system of the gland.

WHY DOES THE FRESHWATER MUSSEL *VELESUNIO*
ANGASI ACCUMULATE SO MUCH Ra-226?

by

Ross A. Jeffree

Environmental Science Division
A.A.E.C., Lucas Heights Research Laboratories,
Private Mail Bag, Sutherland 2232

ABSTRACT

The freshwater mussel *Velesunio angasi* from the Magela Creek area, Northern Territory, naturally accumulates Ra-226 in its tissues to levels higher than those recorded for any other animal. The mussel takes up Ra-226 as a metabolic analogue of Ca. Its ability to accumulate so much Ra-226 can be explained by:

- (i) Peculiarities of the water chemistry of Magela Creek.
- (ii) The mussel's mechanism of storage of Ca and Ra-226 within its tissue.
- (iii) Aspects of the chemistry of Ra-226.

This ability may also be related to the mussel's high demand for Ca to build a large shell; some preliminary results from studies of Ra-226 and Ca metabolism by freshwater turtles are presented.

ADAPTATIONAL ASPECTS OF THE RENIN-ANGIOTENSIN SYSTEM IN THE
DESERT-HOPPING MOUSE (*Notomys alexis*)

D.A. WEAVER, S.L. SKINNER, L. WALKER, S. PATTON & D. ALCORN
Departments of Physiology and Anatomy, University of Melbourne.

Kidney and submaxillary gland (SMG) renin concentrations, and plasma renin concentrations (PRC) were measured in *Notomys* and compared with Balb/c and Swiss strains of laboratory mice respectively. Renin concentrations at all sites were lower in *Notomys*; ratios were kidney 1:4:4, SMG 1:40:6000 and plasma 1:10:50. Sexual dimorphism or renin levels, which is known in Swiss to be due to testosterone induction of a duplicated renin gene, was observed in all mice.

Blood pressure sensitivity to injected angiotensin I, angiotensin II and noradrenaline did not differ significantly between *Notomys* and Swiss. PRC increased 10-fold after 7 days dehydration in each group.

The renin-angiotensin system is active during dehydration in *Notomys alexis* but does not appear to have any specific adaptations related to its desert environment.

This work was conducted under grant D181/15801 from ARGGS, and permit number 84/15 from the Fisheries & Wildlife Division.

Isosmotic Secretion in the Avian Nasal Salt Gland

A.T. Marshall

Zoology Dept., La Trobe University

The secretory tubule epithelium of the avian nasal salt gland has been thought to secrete a hyperosmotic fluid containing high concentrations of Na^+ and Cl^- . It is shown by x-ray microanalysis that the average composition of the luminal fluid of secretory tubules in duckling salt glands is Na 80 mmol l^{-1} , Cl 100 mmol l^{-1} , K 40 mmol l^{-1} , Mg 11 mmol l^{-1} , Ca 6 mmol l^{-1} . It is assumed that the anion deficit is accounted for by HCO_3^- . This fluid is approximately isosmotic to blood. The fluid becomes increasingly hyperosmotic in the duct system, most concentration apparently occurring in the main ducts running from gland to external nares. Modification of the primary isosmotic secretion therefore appears to occur in the duct system.

RELATIONSHIPS BETWEEN DIET AND DIGESTIVE TRACT MORPHOLOGY AND FUNCTION IN MACROPODS - COMPARISONS WITH WILD RUMINANTS

Ian Hume

Department of Biochemistry, Microbiology and Nutrition,
University of New England, Armidale, NSW 2351

In his book "The Ruminant Stomach", Hofmann (1973) related the feeding habits of 28 East African wild ruminant species, including "concentrate selectors" (browsers), "bulk and roughage eaters" (grazers) and "intermediate feeders", to a number of morphological and anatomical features of the stomach, and interpreted these relationships in terms of the digestive characteristics of each ruminant species and the nutritive value of their principal dietary items.

A search has been made for similar relationships among the macropodoid marsupials. Although such an exercise is limited severely by lack of detailed knowledge of (a) natural feeding habits, and (b) gut anatomy of all but a few species, several relationships are evident. These include features such as body size, dental morphology, relative capacities of stomach versus hindgut, and relative capacities of different gastric regions. However, no clear relationships between diet and distribution of different types of gastric mucosa are apparent.

MARSUPIAL ARBOREAL FOLIVORY: ALTERNATIVE STRATEGIES AND THEIR
ENERGETIC CONSEQUENCES

Robert Degabriele
School of Applied Science
Riverina College of Advanced Education
Wagga Wagga, NSW 2650

The plant-herbivore interaction involves a balance between the antiherbivore strategy employed by the plant and the countermeasures developed by the herbivore. Antiherbivore strategies fall into four broad categories. Being arboreal mammals, the brushtail possum and the koala have overcome two of the possible strategies; the third is successful against the brushtail possum, a generalist herbivore; the koala has overcome the third strategy, but at some energetic cost. The ultimate antiherbivore defence has been successful against the koala, despite its specialisation as an arboreal folivore.

Utilization of *Eucalyptus* Foliage by Arboreal Marsupials

W.J. Foley: Department of Biochemistry and Nutrition
University of New England, Armidale, 2351

Eucalyptus foliage is an important part of the diet of several arboreal marsupials including the Greater Glider and the Brushtail Possum. In a study of the digestive physiology of these two species, several related factors were identified which affected both the intake of metabolizable energy (ME) and the retention of nitrogen.

The urinary excretion of essential oils and their detoxification products was the principal factor limiting ME intake in the Greater Glider. In the Brushtail Possum, dry matter (and energy) intake appeared to be limited by the inhibitory effects of tannins on microbial cellulases together with the lack of an effective mechanism for separating coarse and fine digesta particles in the hindgut. The importance of hindgut separation mechanisms in the utilization of high fibre diets by these and other herbivores will be emphasized.

RESPIRATORY CALORIMETRY: A WHOLE SYSTEM CALIBRATION METHOD

B.A. YOUNG

Visiting Professor, School of Zoology,
University of N.S.W., Kensington, N.S.W.

Permanent address: University of Alberta,
Edmonton, Alberta, CANADA.

Precise measurement of whole animal metabolism is encumbered with technical difficulties. Measurement errors, especially bias, are problematic where metabolic data comparisons are made between species, laboratories or time. A simple calibration method is described for respiratory calorimeters wherein oxygen is removed from the subject chamber or gas stream by combustion of steel wool and measured gravimetrically with an accuracy of better than $\pm 1\%$. The method encompasses simultaneous calibration of gas metering and analysis components, and the rate of uptake of oxygen by the calibrating method can be adjusted to be similar to the rate of an experimental subject.

THE EMU AS A MODEL FOR STUDIES INTO AVIAN RESPIRATORY PHYSIOLOGY

W. B. Runciman, R. V. Baudinette, B. J. Gannon and J. B. Love
Schools of Medicine and Biological Sciences: Flinders University.

Details of the anatomy from various bird species have been described and patterns of gas flow and perfusion have been clarified. However, the mechanisms which determine these patterns have not been defined.

The emu (*Dromaius novohollandiae*) provides a potentially useful model for investigating these mechanisms, as it is a large bird and has the relatively simple "palaeopulmo" system. In this communication we outline our methods, correlate a full range of endoscopic photographs with the anatomy and histology of the respiratory system, define the pattern of gas flow, and identify a control mechanism.

Further studies using this preparation are planned to include measurements of differential pressure gradients, rates of parabronchial gas flow and pulmonary blood flow, and ventilation perfusion ratios, both under resting conditions and during a variety of perturbations.

GAS EXCHANGE BY THE NEONATAL JOEY AND THE POUCH OF THE TAMMAR WALLABY (MACROPUS EUGENII).

Bren Gannon¹, Dave Randall^{1,3}, Russ Baudinette² and Bill Runciman¹, Schools of Medicine¹ and Biological Science², Flinders University, South Australia and Zoology Department³, University of British Columbia, Canada

The gaseous environment within and gas exchange characteristics of the wallaby pouch containing a single joey (age 4 - 33 days) was determined in conscious animals via a chronic catheter. Pouch oxygen tension was ~ 3 mm Hg. below and CO_2 ~ 4 mm above ambient levels. In a surgically sealed pouch, without a joey, equilibrium values of PO_2 and PCO_2 were ~ 70 and ~ 40 mm Hg. respectively. The high O_2 consumption/ CO_2 production of the pouch ($\sim 85\%$ of the total of the pouch and 4 day joey system) was shown to be largely due to pouch bacteria. Histological studies confirmed that the pouch wall was moderately well vascularized, the joey skin poorly vascularized and the joey lung richly vascularized. O_2 uptake studies in the joeys confirmed that this was virtually entirely pulmonary, contradicting previous suggestions by others of significant O_2 uptake across the skin in young joeys.

DO CARDIO-RESPIRATORY FREQUENCIES ENTRAIN WITH HOPPING FREQUENCIES IN MACROPODS?

R. V. Baudinette, B. J. Gannon and W. B. Runciman
Schools of Biological Sciences and Medicine: Flinders University

It is an attractive hypothesis that respiratory and cardiac cycles entrain with limb movement in hopping macropods. In support of this idea is the concept of the gut as an inertial "piston" acting on the diaphragm, and the potential avoidance of large excursions in vascular resistance during isometric contraction of the limb musculature. We have examined the possibility of cardio-respiratory-locomotor coupling in the tamar wallaby, Macropus eugenii. Heart rate was not entrained with the rate of limb movement but breathing frequency and hopping frequency are always identical. Locomotory-respiratory coupling in this 1:1 ratio appears to be general in macropods.

THE RELATIVE ROLES OF GILLS AND LUNGS IN LANDCRABS

Peter Greenaway and Caroline Farrelly, School of Zoology, University of New South Wales.

The air-breathing crabs have retained their gills and expanded the dorsal and lateral walls of the branchial chambers to form lung-like structures. Thus both gills and lungs are potentially available for aerial gas exchange. In practice, amphibious and terrestrial crabs seem to have adopted a number of strategies of air-breathing which utilise gills and lungs in different ways and to varying degrees. We shall present morphological evidence for the function of gills and lungs in a range of air-breathing crabs.

RIGHT-LEFT SHUNTING IN THE HEART OF THE CROCODILE

Gordon C. Grigg, School of Biological Sciences, The University of Sydney
and Kjell Johansen, Department of Zoophysiology, University of Aarhus

For over 100 years the anatomy of the crocodilian heart has attracted interest because the ventricles are divided, the left aortic arch arises from the right ventricle and left and right aortic arches communicate via a small opening, the foramen of Panizza. Although puzzles remain, much progress has been made in the last 25 years towards understanding the functional significance of these anatomical peculiarities. In this paper we report and interpret recent measurements of pressure events and blood oxygen within the heart and the major outflow vessels of Crocodylus porosus.

DO EELS CONTROL SYSTEMIC VASCULAR RESISTANCE?

S.F. Hipkins, D.G. Smith and B.K. Evans
Department of Zoology, University of Melbourne

Dorsal aortic and cardinal venous blood pressures, dorsal aortic blood flow and heart rate were measured, in various combinations in conscious unrestrained Australian short-fin eels (*A. australis*). One group of animals was treated with either saline vehicle or bretylium (10 mg/kg) and dorsal aortic pressure and heart rate monitored for 6 days. Two other groups were treated with phentolamine (5 mg/kg) and either dorsal aortic pressure and heart rate, or dorsal aortic blood flow and venous pressure monitored for 6 hours. After completion of *in vivo* measurements each animal was saline perfused via the dorsal aorta and the spinal cord electrically stimulated.

Chronic *in vivo* treatment with either bretylium or phentolamine produced effective blockade of the α -adrenoceptor mediated vasoconstriction of stimulated trunk preparations; however, neither drug changed arterial or venous blood pressures or dorsal aortic blood flow. It is concluded that in the resting eel, systemic vascular resistance is not normally under adrenergic control.

ENERGETICS OF SLEEP IN THE LITTLE PENGUIN

C D Stahel and S C Nicol
Department of Physiology
University of Tasmania
GPO Box 252C
Hobart 7001

Although sleep is ubiquitous in birds and mammals, its physiological significance is unclear. It has been suggested that one of the major functions of sleep is to conserve energy; a proposal tested in this study by concomitantly measuring sleep and metabolic rate in the little penguin. Little penguins show similar electrophysiological correlates of sleep to other birds. The amount of sleep in the little penguin varied with circadian phase and temperature. Sleep was associated with a 8% decrease in metabolic rate in comparison to values in quiet wakefulness. This decline, however, represents only a marginal reduction in daily energy costs in resting little penguins.

EVOLUTION OF MAMMALIAN ENDOTHERMY: LEAKY MEMBRANES AS A SOURCE OF HEAT.

A.J. Hulbert and P.L. Else,
Department of Biology,
University of Wollongong,
Wollongong, N.S.W. 2500
Australia.

Liver cells were isolated from a mammal (*Rattus norvegicus*), a lizard (*Amphibolurus vitticeps*) and an amphibian (*Bufo marinus*). The passive permeability of the cell membranes was assessed using $^{22}\text{Na}^+$ and the mammalian cells were found to be 5-9 times more "leaky" than the amphibian and reptilian cells respectively. This difference is associated with a similar difference in the metabolic activity of the sodium pump in these tissues (as measured by the oxygen consumption of tissue slices). We have postulated that the increased membrane permeability in endotherms was evolved as a means of increasing heat production at the cellular level and was probably the results of increased level of thyroid activity in mammals compared to ectothermic vertebrates.

CRANIAL STRUCTURES FOR BRAIN HOMEOTHERMIA IN THE TASMANIAN DEVIL
SARCOPHILUS HARRISII (MARSUPIALIA : DASYURIDAE)

Syed K. H. Shah and Stewart C. Nicol

Physiology dept. University of Tasmania

Anatomical basis for brain homeothermia in marsupials have not been reported. Studies on anatomical mechanisms for brain homeothermia in Sarcophilus harrisii revealed the presence of bilateral retia, similar in functional morphology to the carotid rete of panting eutherians. These retia were also evidenced in Dasyurus viverrinus, Trichosurus vulpecula, but not in Isoodon obesulus. The Circle of Willis in these species differed from that reported for eutherians. Anatomical modifications for thermal panting in the devil included a highly vascularised, complex structure formed by the turbinate bones and situated within the nasal passages, and a lateral nasal gland which has previously not been reported in marsupials.

Regulatory Nonshivering Thermogenesis in a Cold Acclimated Marsupial.

Bryson K. Smith

Investigations were carried out to determine whether the small Australian marsupial, Dasyuroides byrnei, was capable of employing a form of nonshivering thermogenesis (NST) during prolonged cold stress.

The fractional distribution of radioactive microspheres revealed that the visceral tissues, in particular the liver, may be important sites of thermoregulatory heat production in the cold acclimated state. Cold acclimated animals showed significant increases in liver weight and the fraction of cardiac output received by the liver. No obvious deposits of brown fat were found in D. byrnei.

Noradrenaline had no thermogenic effect in either cold (CA) or warm (WA) acclimated animals whereas adrenaline increased heat production in CA but not WA animals.

These results are at variance with similar studies on CA placentals in which noradrenaline mediated NST in brown fat is an important thermogenic process. The data suggests that marsupials may utilise a form of NST which is mediated by adrenaline and occurs within the liver.

RED KANGAROOS - COLD BODIES OR HOT BRAINS?

Dominic Fanning

The arid zone can be characterized by high thermal loads and a relative scarcity of water. These conditions can, for large mammals, create severe thermoregulatory problems, particularly when associated with activity.

Some of the African ungulates, and many birds, have resolved this problem by partially uncoupling brain and body temperatures. Heat can then be stored in the body and subsequently lost by passive transfer to the environment, obviating the requirement for evaporation of water to actively lose heat. Because of the brain's greater susceptibility to heat damage, preferential cooling of this organ is achieved using counter-current retia and cooled blood from the nasal mucosa or throat.

How do red kangaroos respond to the thermal stresses imposed by conditions in the arid zone?

Is heat storage a significant part of their thermoregulatory repertoire?

Can they establish and maintain a differential between brain and body temperatures?

THE ACTIONS OF PALYTOXIN ON AMPHIBIAN AND TELOST NERVES

CAROLYN VICKERS AND MICHAEL CAPRA*
Department of Physiology and Pharmacology
University of Queensland

The actions of ethanolic extracts of *Palythoa tuberculosa* on nerve conduction parameters in toad and fish nerves were studied. Palytoxin significantly diminished the amplitude of compound nerve action potentials in both toads and fish. The action of palytoxin on Na^+ conductance in toad nerves was indirectly assessed by examining its action on the supernormal period. The action of palytoxin as well as tetrodotoxin and veratrine on the length and magnitude of supernormality will be presented. Interactions between these compounds will also be discussed.

* Presented by M. Capra.

The Innervation of the Bat Heart.

James E. O'Shea,
Department of Zoology, University of Melbourne, Parkville,
Victoria, 3052.

The metabolic extremes associated with flight and hibernation place very different demands on the bat cardiovascular system. Modification of the innervation may be expected in relation to this functional specialization. Available data reports the absence of an adrenergic ventricular innervation; a situation atypical of mammals. This study provides both anatomical and physiological evidence of an adrenergic innervation to the ventricle and also describes a prominent cholinergic innervation. The potent cholinergic innervation is a significant finding as mammalian ventricles lack such an innervation.

The dual innervation of all cardiac chambers would provide fine control of cardiac function. The cholinergic ventricular innervation may be important in maintenance of electrical stability during the various phases of hibernation and/or flight.

ABSTRACT

Adrenergic Innervation of the Gills of Teleost Fish.

John Donald,
Department of Zoology, University of Melbourne, Parkville,
Victoria, 3052.

The gill vasculature consists of an arterio-arterial pathway carrying blood to and from the gas-exchange capillaries of the secondary lamellae, and an arterio-venous pathway consisting of nutritive vessels arising from the efferent arterial vessels and draining into a series of veins and sinuses. There is little information regarding the distribution of autonomic nerves within the gills.

Catecholamine fluorescence histochemistry has shown that in all species studied, fluorescent varicose nerve fibres were consistently found on afferent arterial vessels. However, a sparse innervation of efferent arterial vessels was only found in species possessing an interbranchial septum. Many fluorescent varicose fibres were observed around the filament venous sinus, between the sinus and the filament epithelium, and on nutritive arterioles.

It is clear that the gills receive a rich adrenergic nerve supply which would be involved in regulation of gill function.

FROM KANGAROO TO GHOST CRAB: THE ECOLOGY OF SPATIAL VISION

Jochen Zeil School of Zoology, The University of New South
Wales, Kensington NSW2033

Animals, moving around as they do, need information about the three-dimensional lay-out of their environment to guide their course. In most cases, animals gain this information visually and thus face the task to derive depth cues from two-dimensional retinal images. There are essentially five ways in which this can be done (Collett and Harkness 1982, Wehner 1981): from still retinal images by using stereoptic, focussing or retinal size cues and from moving retinal images by using motion parallax or looming cues (flow field variables). The neural and optical requirements of mechanisms for extracting depth cues and the conditions in which they will yield depth information are discussed.

The eyes of a large variety of animals show specialisations which can be related to the three-dimensional structure of the environment they live in: the differences in retinal organisation between the plains and the tree kangaroo are a case in point: the area centralis (acute zone) in the former is elongated in a horizontal direction (visual streak), while in the latter it is round. Hughes (1977) suggested that the visual streak in animals living in flat environments is adaptive in terms of spatial vision: in a flat world, information about the distances and sizes of objects on the substrate can be derived 'directly' from the retinal positions and retinal sizes of their images, provided the animal 'knows' its own height above ground. The working range and the accuracy of depth vision in this situation increases with increasing eye height above the substrate and increasing vertical resolution of the eye.

A comparative study of eye specialisations in amphibious crabs lends support to this hypothesis: species which live in flat environments - like sandy beaches and mudflats - all have elongated, vertically oriented eye stalks (i.e. increased eye height above the substrate) and their eyes show a steep gradient of vertical resolution with its maximum along the horizon. Species which live in three-dimensionally complex environments - like rocky shores - lack these specialisations: their eyes are set far apart on short eye stalks and have no pronounced acute zone. This suggests that different mechanisms of depth vision have evolved in differently structured environments.

- Collett TS, Harkness LIK (1982) Depth Vision in Animals. In: Ingle DJ, Goodale MA, Mansfield RJW (eds) Analysis of Visual Behaviour. The MIT Press, Cambridge Mass., London. pp 111-178.
- Hughes A (1977) The Topography of Vision in Mammals of Contrasting Life Style: Comparative Optics and Retinal Organisation. In: Crescitelli F (ed) Handbook of Sensory Physiology Vol VII/5. Springer, Berlin Heidelberg New York, pp 613-756.
- Wehner R (1981) Spatial Vision in Arthropods. In: Autrum H (ed) Handbook of Sensory Physiology Vol VII/6C. Springer, Berlin Heidelberg New York, pp 287-616.

Supported by Humboldt Stiftung, West-Germany.

CURRENT ASSESSMENT OF CHORDOTONAL ORGAN

FUNCTION IN INSECTS

L.H. Field

Department of Zoology, University of Canterbury,
Christchurch, New Zealand.

Chordotonal organs in arthropods have been considered classically to mediate resistance reflexes at joints in which they detect position and movement. These reflexes serve to stabilise posture. Recent work on the femoral chordotonal organ of locusts and New Zealand wetas has elucidated several facets of the complex circuitry underlying resistance reflexes, and also has shown that chordotonal organ feedback appears to be important in the control of voluntary movement, which would normally be opposed by resistance reflexes.

The circuitry mediating resistance reflexes involves control of groups of motor neurones to antagonistic muscle pairs by non-spiking interneurones. The non-spiking interneurones receive FCO input indirectly, probably through spiking primary afferent interneurones. Several interesting properties of the resistance reflex are conferred by the non-spiking interneurones: a) some show an hysteresis in directional response to ramp and hold movements, b) a position effect occurs whereby the reflex is always stronger toward one extreme of joint movement, compared to the other, and c) the reflex may be modulated in strength by non-spiking interneurones.

The role of the FCO in voluntary movement involves, phasic drive, a) to muscles of non-homonymous joints to produce assistance reflexes which augment propulsion, b) to activate the tarsal compensatory reflex during stepping, and c) to promote a hernation of stepping (phase control) of left and right legs during onset of walking. Tonic drive to muscles of the coxa and femur is also activated by the FCO during walking.

The femoral chordotonal organ is now considered to have an extremely important and complex feedback function in insect leg control during postural and voluntary active behaviours.

TESTICULAR STEROIDS - A COMPARATIVE APPROACH

Anthony R. Bourne

Biological Sciences, Deakin University, Vic. 3217.

The pattern of steroid synthesis in vertebrates generally follows the mammalian pattern. However non-mammalian vertebrates secrete some unusual steroids, some of which have biological activity. Phylogenetic differences in androgen production, and the significance of comparative studies to the determination of physiological roles for testicular steroids will be discussed. Particular emphasis will be given to reptilian examples.

SEX REVERSAL IN THE YELLOWFIN BREAM *ACANTHOPAGRUS AUSTRALIS*

*MICHAEL CAPRA, MAMAN SUPARTA AND ALAN BLACKSHAW
Department of Physiology and Pharmacology
University of Queensland

The yellowfin bream, an important recreational and commercial fish in the coastal waters of Eastern Australia - appears to function reproductively as a protandrous hermaphrodite. Preliminary histological studies of the seasonal changes in the gonads of the bream will be presented. Spermatogenesis and oogenesis will be outlined. The transition from functional males to functional females will be described and discussed.

* Presented by M. Capra