

## EXPERIMENTAL BIOLOGY GROUP : SUMMARIES OF SCIENTIFIC PAPERS

The following are summaries of papers presented at the 13th meeting of the Experimental Biology Group (EBG) held on 7 August 1964 in the Physiology Department, University of Stellenbosch.

### THE OSMOTIC COEFFICIENTS OF URINARY ELECTROLYTES

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Raoult's law, relating the depression of freezing point of any given solution with the mole fraction of solute, is not applicable to solutions as complex as urine. Not only have the various electrolytes differing degrees of dissociation, but the proportions of electrolyte to non-electrolyte mole fractions vary from one urine to another.

Measurement in a number of urines of both the total molar concentration of solute and the depression of freezing point has, however, revealed a surprisingly close correlation between these parameters. Investigation showed that this was consequent upon an inverse relationship in individual urines between the electrolyte osmotic coefficient and the proportion of electrolyte to non-electrolyte molar concentrations. This relationship is of interest for the following reasons:

1. It can be used as a basis for the rapid estimation of the urinary urea concentration.

2. In urines containing much non-electrolyte the electrolyte osmotic coefficient may be 0.70 or less. This contrasts with a minimum osmotic coefficient of 0.89 in aqueous salt solutions of similar ionic composition, and may be an expression of a biological mechanism for cramming more solute into an osmotically limited compartment.

3. The quantitative correlation of urinary osmoles with gram moles of solute (largely electrolytes and urea) reveals that, at least under steady-state conditions, the urinary osmolar output must be a function of the dietary intake. This in turn permits the assessment of adequacy of dietary intake in any individual, by expressing the 24-hour urinary osmolar output as a function of that of creatinine. This has been found to be true in a number of normal adults and infants, as well as in diverse conditions such as thyrotoxicosis, obesity, convalescence, anorexia nervosa, and hard manual labour.

### ENTEROBACTERIACEAE OF FREE-LIVING SOUTH AFRICAN SNAKES

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During a period of 18 months 206 free-living South African snakes were examined for *Enterobacteriaceae*. To prevent cross-infections in captivity bacteriological specimens were taken in the natural environment immediately after the animals were caught. From all the 206 snakes rectal and oral swabs were taken. From the total of 206, 33 (11 cobras, 11 puff adders, 1 garter snake, 1 reed snake, 4 skaapstekers, 2 tree snakes and 3 mole snakes) were singled out, transported to our laboratories, and dissected.

It was found that snakes are important reservoirs of human pathogenic *Enterobacteriaceae*. Of the 206 snakes, 51 were rectal carriers of *Salmonellae* and 32 of *Arizona*; 38 were oral carriers of *Salmonellae* and 31 of *Arizona*. *Proteus morgani* was found in oral swabs of 11 and in rectal swabs of 22. *Providencia* types were present in oral swabs from 5 snakes (cobras) and in rectal swabs from 11 snakes. In 14 snakes no *Enterobacteriaceae* were found in the oral swabs. From the 33 gallbladders tested, 8 were sterile, 7 contained *Salmonellae*, 5 *Arizona* types, 2 *Providencia*, and 10 *Proteus mirabilis*, of which 5 were mixed with *Proteus vulgaris* and 3 with *Proteus rettgeri*; one gallbladder showed a pure culture of *Proteus rettgeri*.

Altogether 34 different *Salmonella* types were isolated, 23 belonging to subgenus I and 11 to subgenus II. The most

important human pathogenic types were *S. manhattan*, *S. anatum*, *S. bovis morbificans*, and *S. enteritidis*.

The *Arizona* types had the following serological structure:

Somatic antigens	Flagella antigens	
26	24 - 25	from mole snakes
9	33 - 28	from puff adders
16	23 - 21	
30	27 - 28	
9	26 - 21	from cobras
26	24 - 25	
26	33 - 25	
30	27 - 28	

Eggs and embryos from snakes were free from *Enterobacteriaceae*. The small number of snakes that were free from *Enterobacteriaceae* pathogenic to man indicates that these bacteria do not belong to the normal intestinal flora of snakes. It is suggested that snakes act as depot-carriers for human pathogenic *Enterobacteriaceae*, which they take in with their normal food, viz. small reptiles, amphibia, rodents, and birds. All the examined snakes were apparently healthy.

### ISOLATION OF *LEPTOSPIRA ICTEROHAEMORRHAGIAE* FROM *RATTUS NORVEGICUS* IN THE CAPE PENINSULA

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In a preliminary study 120 rats (all *Rattus norvegicus*) from different parts of the Cape Peninsula were examined by cultural and serological methods to establish the infection-rate of leptospirosis among its natural reservoirs. One isolation serologically typed as *Leptospira icterohaemorrhagiae* AB was made, and 2 significant titres against the same serotype were found.

The isolation—a virulent leptospiral strain—was made from the kidney emulsion of 1 out of the 30 rats trapped in the Bellville-Stikland area. Immediate dark-field microscopy of the preparation revealed leptospirae. Out of the 55 rats examined from the Cape Town Docks, only 1 disclosed a significant titre (1:10,000) against *L. icterohaemorrhagiae* AB. All 35 rats from the Constantia area and Cape Town railway station were culturally and serologically negative.

Agglutination tests were carried out on serum samples with the following screening dilutions: 1:20; 1:200; 1:2,000;

1:20,000. Live *Leptospira* antigen from well-grown stock cultures in modified Korthof's medium<sup>1</sup> was used. The strains were *L. icterohaemorrhagiae* A and AB, *L. canicola*, *L. pomona*, *L. sejroe*, *L. ballum*, *L. grippotyphosa*, *L. hebdomadis*, *L. hyos*, *L. batavia*, *L. bovis*, *L. australis* A and B, and *L. saxkoebing*. Positive serological tests were repeated with higher serum dilutions up to 1:100,000. A surprisingly healthy rat population was found in this short survey, and therefore only titres of 1:2,000 and higher were interpreted as significantly positive. During the period of study a number of dog sera have also been tested; 2 positive titres were found, viz. one against *L. canicola* to a titre of 1:20,000, and one against *L. icterohaemorrhagiae* to a titre of 1:50,000. Lower titres from sick animals or humans must be evaluated in each individual case and interpreted with caution.

1. Steytler, J. G. (1962): S. Afr. Med. J., 36, 413.