drate, Bromoacetal, 3-Bromo-4-Hydroxytoluene, Carbobenzoxy Chloride and Derivatives, 1,1-Cyclobutanedicarboxylic Acid and Cyclobutanecarboxylic Acid, Cyclopropyl Cyanide, *beta*-Di-*n*-Butylaminoethylamine, 2,3-Dihydropyrane, *beta,beta*-Dimethylacrylic Acid, *beta*-Dimethylaminopropiophenone Hydrochloride, *beta*-Ethoxyethyl Bromide, *beta*-Ethoxypropionitrile, Ethyl Benzoylacetate, Ethyl Bromoacetate, Indole, Ketene Diethylacetal, Mandelic Acid, *l*-Menthoxyacetic Acid, l-Menthoxyacetyl Chloride, Mesitaldehyde, *beta*-Methylglutaric Acid, *beta*-Naphthaldehyde, *p*-Nitrobenzoyl Peroxide, Pentamethylene Bromide, *alpha*-Phenylethylamine, *beta*-Phenylethylamine, Phthalaldehydic Acid, Pseudoionone, 1(*alpha*-Pyridyl)-2-Propanol, *trans*-Stilbene, Tetrahydrofurfuryl Bromide, Tetrahydropyrane, Tetraphenylcyclopentadienone, Tetraphenylphthalic Anhydride, Tribiphenylcarbinol, Triphenylcarbinol, Triphenylchloromethane.

The subject index at the close is cumulative in the sense that it covers the contents of Volumes 20, 21, 22 and 23. The cumulative indexes for previous volumes in the series will be found in Collective Volumes 1 and 2. The series is so well established as the leader in its chosen field that no eulogy is necessary on the part of the reviewer.

MARSTON T. BOGERT
COLUMBIA UNIVERSITY

THE MOTHS OF SOUTH AFRICA

The Moths of South Africa. By A. J. T. JANSE. Vol. IV. Part I. (Published by the University of Pretoria, South Africa.)

WHEN my wife and I visited Pretoria in 1931, we called on Dr. Janse, and saw his wonderful collection of moths and his great and completely indexed library of works on Lepidoptera. We discussed the forthcoming revision of "The Moths of South Africa," and since that time the volumes have been coming out at long intervals, under circumstances of increasing difficulty. The present part contains a list of the subscribers, but of these, several are in enemy countries, and others are likely to have dropped out. The principal support has come from the National Research Council of the Union of South Africa, and we note that General Smuts has made a generous subscription.

The part just received (dated November, 1942) is of unusual interest because it deals with the most primitive Lepidoptera known, the Hepialids and the Micropterygids. The former are numerously represented in South Africa, with only one species, *Leto venus,* of large size and comparable with the large Australian forms. The genus *Leto* has also one species in New South Wales and one in the Fiji Islands, a distribution suggestive of great antiquity and approaching extinction. It is interesting to note that *Leto venus* has only been found at Knysna, the locality on the coast of South Africa noted for its relict fauna. The Micropterygids appeared to be absent from South Africa until in 1917 Janse took a single female specimen of a new genus and species at Karkloof, Natal. In 1930 he returned to the same spot and took a male, and these two alone represent the known South African Micropterygid fauna.

In the classification of moths, it has always been usual to place the Micropterygids at the bottom of the scale, as nearest to the caddis-flies, from which the Lepidoptera are supposed to have been derived. But Janse now classes the Hepialids as most primitive on various grounds, but thinks they originated quite apart from the Micropterygids, the Lepidoptera being thus diphyletic.

The book is illustrated by eleven plates of Janse's exquisite drawings of structures and five photographic plates of moths. It is dedicated to the memory of Edward Meyrick of England, who described more Microlepidoptera than any one else and a bibliography of Meyrick's publications is included.

T. D. A. COCKERELL

SPECIAL ARTICLES

ON THE TYPE OF CHOLINESTERASE PRESENT IN BRAIN TISSUE[1]

TWO esterases capable of hydrolyzing acetylcholine have been shown[2] to exist in the animal body: a true cholinesterase, acting exclusively on certain choline esters, and a non-specific enzyme hydrolyzing not only esters of choline but a variety of non-choline esters as well. The true cholinesterase exhibits its maximum activity at low concentrations of acetylcholine (around 3 mg per cent.) and displays increasing inhibition with rising substrate concentrations, whereas the non-specific enzyme exhibits its greatest activity at high concentrations of acetylcholine (above 300 mg per cent.) and displays decreasing activity with diminishing concentrations of this substrate. Since the physiological function of the non-specific enzyme is as yet unknown it has been provisionally named pseudo-cholinesterase.

In view of the differences in activity of the two enzymes at high and low concentrations of acetylcholine, measurements at these two substrate concentrations can serve to indicate whether true cholinesterase

[1] A preliminary report on this investigation, which was aided by a grant from the Banting Research Foundation, was presented before the Toronto Physiological Society on December 2, 1942.

[2] B. Mendel and H. Rudney, *Biochem. Jour.,* 37: 59, 1943.

or pseudo-cholinesterase predominates in various tissues or body fluids.

Recently we have found[3] that acetyl-beta-methylcholine is hydrolyzed only by true cholinesterase and not by pseudo-cholinesterase, whereas benzoylcholine is hydrolyzed only by pseudo-cholinesterase and not by true cholinesterase. These facts make it possible to estimate quantitatively the activities of the true cholinesterase and the pseudo-cholinesterase separately in any mixture of the two enzymes.

Using this method determinations were carried out on the same organs of various species in order to ascertain which type of cholinesterase is present.

Since cholinesterase plays an essential role in the chemical transmission of nerve impulses,[4] it was deemed of great importance to find out which of the two enzymes is present in brain tissue. Gray and white matter from the brain of representatives of all the vertebrate classes were investigated. In addition, various other organs, such as parotid gland and pancreas, of several mammalian species were tested. The results are tabulated below (Table 1).

TABLE 1

TYPE OF CHOLINESTERASE PRESENT IN:

	Brain	Parotid gland	Pancreas
Rat	true		
Mouse	true		
Guinea pig	true	pseudo-*	
Rabbit	true	true	
Dog	true	mixture	pseudo-*
Cat	true	mixture	true
Cow	true	true	
Pig	true	pseudo-*	
Chicken	true		
Turtle	true		
Frog	true		
Carp	true		

* Traces of true cholinesterase present.

The results listed in Table 1 show that the brains of all the vertebrates tested contain only true cholinesterase and no pseudo-cholinesterase. This fact demonstrates that in brain tissue it is the true cholinesterase which performs the function of hydrolyzing acetylcholine after it has been liberated.

The other organs tested, however, show no regularity as to the type of cholinesterase present, *e.g.*, the parotid glands of various species may contain true cholinesterase or pseudo-cholinesterase or both. Similarly, the pancreas of the cat contains only true cholinesterase, while that of the dog contains only pseudo-cholinesterase.

Summary: Brain tissue of all vertebrates contains only true cholinesterase.

No general statement concerning the type of cholinesterase in any other organ can be made, since true cholinesterase may be present in a particular organ of one species and pseudo-cholinesterase in the same organ of another.

BRUNO MENDEL
HARRY RUDNEY

BANTING AND BEST DEPARTMENT OF MEDICAL RESEARCH, UNIVERSITY OF TORONTO

[3] B. Mendel, D. B. Mundell and H. Rudney, in press (*Biochem. Jour.*)

[4] B. Mendel and R. D. Hawkins, in press, *Jour. Neurophysiol.*, 99.

ENTRANCE OF CHLORIDE WITH POTASSIUM INTO LIVE RAT MUSCLE FIBERS—CL-SPACE ERROR

THE muscle of animals after adrenalectomy with high plasma potassium contains more extracellular fluid[1,2] expressed as Cl-space (*liters* of *plasma water* calculated to contain all Cl in 1 kg muscle) than after DOCA therapy[3] when plasma K is low. This result, surprising in view of Na retention in the latter case, may be elucidated by, in fact, is a good test of, the Boyle and Conway[4] theory, in which Cl enters muscle fibers as KCl in a Donnan equilibrium. Tested to date only in excised and immersed frog muscle, the theory is now tried in live rats. Conditions predicted to increase fiber Cl were imposed: a doubled plasma K and an 11 per cent. increase in fiber water. Fiber Cl, designated as Cl- minus inulin-space, increased 75 per cent. The error involved by designation of extracellular fluid as Cl-space, error expressed as (Cl- minus inulin-space)/(inulin space), is 44 per cent. before, 58 per cent. after imposing the condition. Thus the Cl-space error is not only absolute[5] but also dynamic or functional. Thiocyanate-space should involve similar errors.

Of rats nephrectomized under ether, litter mate A received intraperitoneally 66 ml/kg of a solution containing 3.75 gm per cent. inulin or equivalent sucrose, 150 mM Na, 125 mM Cl, 25 mM bicarbonate; in mate B, 50 mM K replaced equivalent Na and only this rat received drinking water during the 22-hour equilibration. Only sheet muscles taken under amytal from the thighs were stripped into slender pieces and cleared of connective tissue, fat, and visible blood. The *same* zinc filtrate of muscle or plasma gave aliquots for the Volhard chloride and the Seliwanoff color reaction for inulin or sucrose as fructose.[6] The small uniform muscle "fructose" blank was deducted. Equilibrium was attained as revealed in comparable inulin- and sucrose-spaces and in comparable chloride and inulin values for plasma and the occasional peritoneal water.

[1] A. H. Hegnauer and E. J. Robinson, *Jour. Biol. Chem.*, 116: 769, 1936.

[2] D. C. Darrow, H. E. Harrison and M. Taffel, *Jour. Biol. Chem.*, 130: 487, 1939.

[3] D. C. Darrow and H. C. Miller, *Jour. Clin. Investigation*, 21: 601, 1942.

[4] P. J. Boyle and E. J. Conway, *Jour. Physiol.*, 100: 1, 1941.

[5] L. V. Heilbrunn and P. G. Hamilton, *Physiol. Zoöl.*, 15: 363, 1942.

[6] K. Steinitz, *Jour. Biol. Chem.*, 126: 589, 1934.