



Australian
National
University

THESES SIS/LIBRARY
R.G. MENZIES LIBRARY BUILDING NO:2
THE AUSTRALIAN NATIONAL UNIVERSITY
CANBERRA ACT 0200 AUSTRALIA

TELEPHONE: +61 2 6125 4631
FACSIMILE: +61 2 6125 4063
EMAIL: library.theses@anu.edu.au

USE OF THESES

This copy is supplied for purposes
of private study and research only.
Passages from the thesis may not be
copied or closely paraphrased without the
written consent of the author.

TRANSMISSION AT THE MAMMALIAN
NEUROMUSCULAR JUNCTION

By

A.W. LILEY

Thesis submitted for the degree of Doctor of
Philosophy in the Australian National University

1956

I hereby declare that, with the exceptions of Fig. 26C obtained in collaboration with K.A.K. North and Fig. 40R provided by Professor J.C. Eccles, all of this thesis is my own original work.

The following papers have appeared or are in the course of publication:-

LILEY, A.W. (1956a). An investigation of spontaneous activity at the neuromuscular junction of the rat. *J. Physiol. (Lond.)*. 132, 650-666.

LILEY, A.W. (1956b). The quantal components of the mammalian end-plate potential. *J. Physiol. (Lond.)*. 133, 571-587.

LILEY, A.W. (1956c). The effects of presynaptic polarisation on the spontaneous activity at the mammalian neuromuscular junction. *J. Physiol. (Lond.)*. in the Press.

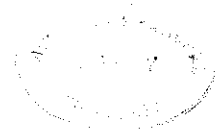
LILEY, A.W. (1956d). Spontaneous release of transmitter substance in multiquantal units. In course of publication.

A. W. Liley
.....

A.W. LILEY

TABLE OF CONTENTS

	Page
<u>INTRODUCTION</u>	1
<u>METHODS</u>	4
(A) Tissues	4
(B) Histology. Localisation of end-plates	4
(C) Solutions	6
(D) Drugs	6
(E) Apparatus	6
(F) Instrumental noise and artefacts	10
(G) Measurement of frequencies and amplitudes	10
(H) Statistics	14
<u>SECTION 1. SPONTANEOUS ACTIVITY AT THE NEUROMUSCULAR JUNCTION</u>	
<u>OF THE RAT</u>	16
Introduction	16
Results	16
Discussion	27
<u>SECTION 2. THE QUANTAL COMPONENTS OF THE MAMMALIAN END-PLATE</u>	
<u>POTENTIAL</u>	28
Introduction	28
Results	28
Part I. Quantal nature of the end-plate potential	28
Part II. Facilitation at the mammalian neuromuscular	
junction	37
Discussion	39



<u>SECTION 3. THE EFFECTS OF PRESYNAPTIC POLARISATION ON THE</u>	
<u>SPONTANEOUS ACTIVITY AT THE MAMMALIAN NEURO-</u>	
<u>MUSCULAR JUNCTION</u>	45
Introduction	45
Results	45
Part I. Effect of electrotonic polarisation of motor	
terminals on miniature discharge frequency	45
Part II. Effect of potassium concentration on	
miniature potentials	49
Discussion and test of hypothesis	50
<u>SECTION 4. GIANT POTENTIALS AT THE MAMMALIAN NEUROMUSCULAR</u>	
<u>JUNCTION</u>	60
Introduction	60
Results	60
Discussion	65
<u>SECTION 5. THE EFFECTS OF GLUCOSE DEPRIVATION AND PHLORIDZIN ON</u>	
<u>THE MINIATURE DISCHARGE AT THE MAMMALIAN NEURO-</u>	
<u>MUSCULAR JUNCTION</u>	70
Introduction	70
Results	71
Discussion	74
<u>SECTION 6. THE EFFECTS OF POTASSIUM ON TRANSMISSION AT THE</u>	
<u>MAMMALIAN NEUROMUSCULAR JUNCTION</u>	77
Introduction	77
Results	78
Discussion	80

GENERAL DISCUSSION

86

SUMMARY AND CONCLUSIONS

91

ACKNOWLEDGEMENTS

REFERENCES

FIGURES AND LEGENDS