

*This document only includes an excerpt of the corresponding thesis or dissertation. To request a digital scan of the full text, please contact the Ruth Lilly Medical Library's Interlibrary Loan Department (rlmlill@iu.edu).*

Neural Centers and Pathways Involved in  
Startle, Orienting, and Middle-ear  
Reflex Responses to Acoustic Stimuli

by

Chi-Kong Chan

Submitted to the faculty of the Graduate School  
in partial fulfillment of the requirements  
for the degree of Doctor of Philosophy  
Indiana University  
June, 1983

Accepted by the faculty of the Graduate School, Indiana University, in partial fulfillment of the requirements for the Doctor of Philosophy degree in Neural Sciences.

Doctoral Committee:

William D. Neff, Chairman  
Professor William D. Neff

Conrad Mueller  
Professor Conrad Mueller

Dolores M. Schroeder  
Professor Dolores Schroeder

James C. Swihart  
Professor James Swihart

## ABSTRACT

### Neural Centers and Pathways Involved in Startle, Orienting, and Middle-ear Reflex Responses to Acoustic Stimuli

Chi-Kong Chan  
Neural Sciences  
Indiana University

The neural centers and pathways involved in three different reflex responses to acoustic stimuli were studied in the cat. Head orienting response was observed, and startle and middle-ear responses were monitored with muscle electrodes. The effect of lesions placed at different parts of the auditory pathways in the brain were studied. An anatomical method involving retrograde neuronal transport was used to locate the motoneurons of the middle-ear muscles.

Bilateral lesions placed at the lateral lemniscus (LL), or at levels above it, did not diminish the startle response. While destroying one cochlea raised the threshold of the response, startle remained a bilateral phenomena in these one-eared animals. Transecting the trapezoid body (TB) near the median plane abolished the response in the otherwise normal animals.

Accuracy of the head orienting response towards a sound source was temporarily impaired by unilateral lesions of LL or the brachium of the inferior colliculus (BIC). The impairment became permanent if the lesions were bilateral. In the brainstem, permanent deficits resulted after unilateral

transection of the ventral stria or the cochlear nerve, or after transection of the trapezoid body near the median plane. No deficit was produced by either unilateral or bilateral transections of the dorsal and intermediate striae.

Bilateral ablation of the auditory cortex had little permanent effect on the accuracy of the orienting response and did not change the threshold of the startle response. However, these lesions affected the habituation courses of both responses.

The middle-ear acoustic reflexes were affected, but not abolished, by transections of the lateral lemniscus. Crossed reflexes of both the stapedius and the tensor tympani muscles were abolished only after the LL was bilaterally transected in addition to the trapezoid body being transected near the median plane.

Of the three responses studied, the orienting response was the one most affected by transections of pathways above the brainstem level while the startle response was the least affected.

## TABLE OF CONTENTS

ACKNOWLEDGEMENTS . . . . .	ii
PREFACE . . . . .	iii
PART I: STARTLE REFLEX . . . . .	1
Introduction . . . . .	2
Methods and Procedure . . . . .	7
Results . . . . .	18
Summary of Results . . . . .	51
Discussion . . . . .	54
PART II: THE ORIENTING REFLEX . . . . .	60
Introduction . . . . .	61
Methods and Procedure . . . . .	72
Results . . . . .	81
Summary of Results . . . . .	147
Discussion . . . . .	151
PART III . . . . .	157
Introduction . . . . .	158
Methods and Procedure . . . . .	162
Results . . . . .	170
Summary of Results . . . . .	194
Discussion . . . . .	196
SUMMARY OF PARTS I, II, AND III . . . . .	199
REFERENCES . . . . .	202
APPENDIX . . . . .	213
ABBREVIATIONS . . . . .	220
VITA . . . . .	222