

CONTENTS

<i>Preface to the Second Edition</i>	<i>page vii</i>
<i>Preface to the First Edition</i>	<i>ix</i>
<i>Author's Note</i>	<i>x</i>
1 FIELD OBSERVATIONS OF MIGRATION	I
Examples of migration. Ringing. Visible and audible migration. Radar. Form and process of migration. Probable use of astronomical clues.	
2 EXPERIMENTAL EVIDENCE FOR BEARING- AND-DISTANCE NAVIGATION	10
Transplanting of young birds. Adoption of foster homes. Displacement of migrants. Inborn nature of migration orientation. Directional training in Pigeons. 'Nonsense' orientation.	
3 THE PHYSICAL BASES OF DIURNAL ONE-DIRECTION NAVIGATION	22
Use of caged migrants. Automatic registration. Possible effects of Earth's magnetic field and rotation. Sun-compass orientation. Artificial sun. Time compensation. Clock shifting. Shifts in longitude and latitude.	
4 THE PHYSICAL BASES OF NOCTURNAL ONE-DIRECTION NAVIGATION	41
Utilization of stars. Independence from time. Orientation by star pattern. Interrelations between time, longitude and season. Planetarium experiments. Evolution. Moon orientation.	
5 HOMING EXPERIMENTS	54
Pigeons. Variation in ability. Seasonal effects. Non-breeding wild birds. Breeding wild birds. Outstanding feats. Conditions for fast homing. Individual variations. Random and biased search. Determination of homeward track. Aerial pursuit.	
6 HOMING ORIENTATION	76
Techniques. Pigeons. Time required for orientation. Confusion with 'nonsense' orientation. Effect of distance. Sun-compass and landmarks. Inborn ability. Limitation of experience. Wild birds, free-flying and caged.	

7	THEORIES OF SENSORY CONTACT WITH HOME AND OF INERTIAL NAVIGATION	<i>page 94</i>
	Direct vision. Atmospheric sensitivity. Extrasensory perception. Inertial navigation theory. Practical tests. Stable 'instrument bed'.	
8	THEORIES OF NAVIGATION BY GEOPHYSICAL 'GRIDS'	101
	Grid navigation. Earth rotation. Coriolis force. Earth's magnetic field. Tests of magnetic sensitivity. Conjugate point experiments. Radio and radar transmissions. Unknown factors.	
9	THEORIES OF NAVIGATION BY ASTRONOMICAL 'GRIDS'	112
	Development of theories. Evidence for use of sun. Sun co-ordinates versus sun-compass. Planetarium evidence for use of star co- ordinates. Basic theory of astronavigation.	
10	THEORIES OF NAVIGATION BY A 'GRID' DERIVED FROM THE SUN'S CO-ORDINATES	122
	Sun arc extrapolation hypothesis. Theoretical difficulties. Rate-of- change of altitude hypothesis. Ambiguities. The two hypotheses compared.	
11	FIELD TESTS OF THEORIES OF NAVIGATION BY THE SUN'S CO-ORDINATES	132
	Making use of seasonal changes in sun altitude. Conflicting results. Impairment of homing by restricting view of horizon. Effect of massive time shifts. Conflicting results. Effect of small time shifts.	
12	THE ANATOMICAL AND PHYSIOLOGICAL LIMITATIONS OF THE AVIAN EYE	142
	Movement detection and measurement. Extrapolation. Retinal structure. Dioptric apparatus. Resolution. Dark adaptation.	
13	MOTION, TIME AND MEMORY	152
	Stability of head. Blind flying. Gravity receptors. Temporal stereotypy of movements and calls. Circadian rhythms. Accuracy versus rigidity. Memory excellence. Functions of bi-coordinate navigation.	
	<i>Scientific names of species mentioned</i>	164
	<i>References</i>	167
	<i>Index</i>	193