

Gerald E. Miller

Sensory Organ Replacement and Repair

Sensory Organ Replacement and Repair

© Springer Nature Switzerland AG 2022

Reprint of original edition © Morgan & Claypool 2006

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means—electronic, mechanical, photocopy, recording, or any other except for brief quotations in printed reviews, without the prior permission of the publisher.

Sensory Organ Replacement and Repair

Gerald E. Miller

ISBN: 978-3-031-00484-1 paperback Miller

ISBN: 978-3-031-01612-7 ebook Miller

DOI 10.1007/978-3-031-01612-7

A Publication in the Springer series

SYNTHESIS LECTURES ON BIOMEDICAL ENGINEERING

Lecture #3

First Edition

Sensory Organ Replacement and Repair

Gerald E. Miller

Virginia Commonwealth University

SYNTHESIS LECTURES ON BIOMEDICAL ENGINEERING #3

ABSTRACT

The senses of human hearing and sight are often taken for granted by many individuals until they are lost or adversely affected. Millions of individuals suffer from partial or total hearing loss and millions of others have impaired vision. The technologies associated with augmenting these two human senses range from simple hearing aids to complex cochlear implants, and from (now commonplace) intraocular lenses to complex artificial corneas. The areas of human hearing and human sight will be described in detail with the associated array of technologies also described.

KEYWORDS

Human hearing, Audiology, Hearing Aids, Cochlear Implants, Human vision, Intraocular lens, Cataract surgery, Artificial Cornea, Corneal Transplant

Contents

1.	Sensory Organ Replacement and Repair	1
1.1	Hearing AIDS	1
1.1.1	Anatomy of the Ear and Human Hearing	1
1.1.2	Hearing Loss	7
1.1.3	Hearing Aid Technologies	12
1.2	Middle Ear Replacement	19
1.2.1	Introduction	19
1.2.2	Technology and Replacement Components	20
1.2.3	History of Ossicle Surgery and Replacement	22
1.3	Cochlear Implant	24
1.3.1	Introduction	24
1.3.2	Cochlear Implant Components and Surgery	25
1.3.3	Current Devices and Cochlear Implant Companies	31
1.3.4	Issues Associated with Implant Use	33
1.3.5	History of the Cochlear Implant	34
1.3.6	Regulatory Issues for Cochlear Implants and Recent Research	35
1.4	Intraocular Lens	36
1.4.1	Anatomy of the Eye	36
1.4.2	Cataracts and Their Determination	37
1.4.3	The IOL and Implantation Surgery	41
1.4.4	History of the IOL and Current Research	47
1.5	Artificial and Replacement Cornea	48
1.5.1	Corneal Transplant	49