Gavin Herbert Eye Institute
Accelerating Ophthalmology
Innovation in Orange County — and Around the World

Roger F. Steinert, MD
Interim Dean, School of Medicine
Irving H. Leopold Professor and Chair
Professor of Biomedical Engineering
Director, Gavin Herbert Eye Institute
University of California, Irvine
The Medical Demographic Tsunami

Median Age: 1900 to 2050

Forecast

Source: US Census Bureau
U.S. Elderly Dependency Ratios

Age 65 and over divided by age 15-64*

<table>
<thead>
<tr>
<th>Year</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1982</td>
<td>17.4</td>
</tr>
<tr>
<td>1992</td>
<td>19.3</td>
</tr>
<tr>
<td>2002</td>
<td>18.5</td>
</tr>
<tr>
<td>2012</td>
<td>1:5</td>
</tr>
<tr>
<td>2022</td>
<td>1:4</td>
</tr>
<tr>
<td>2032</td>
<td>1:3</td>
</tr>
<tr>
<td>2042</td>
<td></td>
</tr>
</tbody>
</table>

* dshort.com
## Eye Disease Prevalence in the U.S.

**Aging of the Baby Boomers**

<table>
<thead>
<tr>
<th>Eye Disease</th>
<th>2005</th>
<th>2020</th>
<th>Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Macular Degeneration</td>
<td>1.8 m</td>
<td>2.9 m</td>
<td>161%</td>
</tr>
<tr>
<td>Glaucoma</td>
<td>2.2 m</td>
<td>3.3 m</td>
<td>150%</td>
</tr>
<tr>
<td>Diabetic Retinopathy</td>
<td>4.1 m</td>
<td>7.2 m</td>
<td>176%</td>
</tr>
<tr>
<td>Cataract</td>
<td>20.5 m</td>
<td>30.1 m</td>
<td>147%</td>
</tr>
</tbody>
</table>
Estimated Specific Prevalence Rates
Visual Impairment and Blindness
Estimated Specific Prevalence Rates
Age-related Macular Degeneration
Estimated Specific Prevalence Rates

Open-angle Glaucoma
At 80 Years Old, Your Chance Of Having:

- Cataract 68%
- Macular Degeneration 35%
- Glaucoma 8%
Mission of the Gavin Herbert Eye Institute

Develop programs, technologies and clinical solutions that enhance visual health and performance for patients in Orange County and around the world through cooperation with medical professionals, the vision care industry and the community.
The Gavin Herbert Eye Institute at UCI

- 70,000 square feet
- Total building cost - $39.5M
  - 100% funded by philanthropy
- First patient: Sept 17, 2013
- First surgery: Oct 14, 2013
- Patient volume: 21% increase in the first 6 months
Features

- 2 operating rooms and 2 more on line in 2015
- Clinical exam rooms, clinical/translational research spaces, refractive and oculoplastic center, optical shop
- SightLife corneal tissue bank
- Large and small conference rooms; resident and fellow offices; teaching lab; administrative and faculty offices
Leaders Preparing Leaders

- Ten ophthalmologists on the list of “Best Doctors in America®” compiled by Best Doctors, Inc.

- Innovators, with dozens of U.S. and international patents for discoveries and developments related to eye health.

- First in Orange County to implant a miniature telescope to improve vision in patients with end-stage age-related macular degeneration.

- Pioneered use of a femtosecond laser, rather than a steel blade, for a laser-based approach to corneal transplant surgery.
12 basic science professorial faculty plus associate researchers

- Research groups in retina, cornea, glaucoma and wound healing
- Among the top ten percent of institutions receiving National Institutes of Health grants for vision research

Anthony Nesburn, MD
James Jester, PhD
Science

- Multi-photon laser imaging techniques
  - James Jester, PhD
- Discloses ocular structures that influence outcomes of surgery and drugs
  - LASIK
  - Glaucoma
Retinal Degeneration

- Age is the dominant factor in macular degeneration
- Demographic tsunami
AMD At UC Irvine: Basic And Translational Research

Cris Kenney, MD, PhD
Director of Research

Henry Klassen, MD, PhD
Stem cell retinal regeneration
Pharmaceuticals

- Effective treatment for aggressive neovascular disease entered clinical practice over past decade
- Frequent injections into eye
- Time release delivery systems
- Better agents
  - Toxicity research model of Cris Kenney, MD, PhD and Barry Kuppermann, MD, PhD
**Stem Cells**

- Implant cells that can re-grow damaged tissue

**Challenges**

- Control of cell growth and differentiation
- Retinal progenitor stem cells
  - Henry Klassen, MD, PhD at GHEI
  - $17M CIRM grant to get to Phase 1 clinical trials for RP
- Neurotrophic benefit!
How to replace photoreceptors?
Retinal Progenitor Cells (RPCs)

- From the developing neural retina
  - RPCs are immature cells
  - Like stem cells, but self-renewal ends automatically
  - Perhaps why the retina loses the ability to regenerate?
- Can be transplanted
  - Migrate
  - Integrate
  - Differentiate into retinal cells

RPCs are the cells that make the retina, so they know what to do!
Implantable Miniature Telescope: How it Works

Scarred Macula
Central Visual Field Projection (Natural Lens/IOL)

Telescope Implant
Central Visual Field Projection

Marjan Farid, MD and Sam Garg, MD
Field of View

3X Wide Angle Implant = 20°

3X External Telescope = 8°

3X implant field of view 625% of external telescope
(1,111% if mounted on spectacles)
Corneal collagen cross-linking for keratoconus

The figures above show the parallel corneal layers (white) and the collagen cross-linking (red) which are increased after Corneal Cross-Linking treatment.
Current Cross-Linking vs. Accelerated/Pulsed Cross-Linking

- Control with no dose
- Standard Cross-Linking
- New Technology

GHEI Cornea Division: Drs. Farid, Garg, Wade, and Steinert
Developing materials with natural anti-microbial characteristics using nanotechnology:

Artificial Cornea Project
Nanopatterned Polymer Surfaces with Antibacterial Properties

Collaborators at UCIrvine Biomedical Engineering

- Elena Liang
- Nicole Ing
- Albert F. Yee, PhD
Introduction

- Nanostructures on the surface of cicada wings can kill bacterial cells through physical surface topography.

Bacteria on line gratings
Bacteria on round pillars
Summary
GHEI Collaboration Opportunities

- Basic science
- Translational/clinical science
- Consulting at all stages of development and marketing
- Conference facilities
- Resident education
Gavin Herbert Eye Institute Today: Leaders Teaching Leaders

- 9 ophthalmology residents
- 13 post-residency clinical fellows
- UC Irvine School of Medicine students

Linda Lippa, MD
Goal

Prevent or reversing most forms of blindness by the year 2020.
In the End, It’s About Patients

- Access to:
  - Internationally renowned doctors and scientists
  - New treatments
  - Advanced clinical research
  - The right treatment at the right time
Thank you!