

# Artificial Retina

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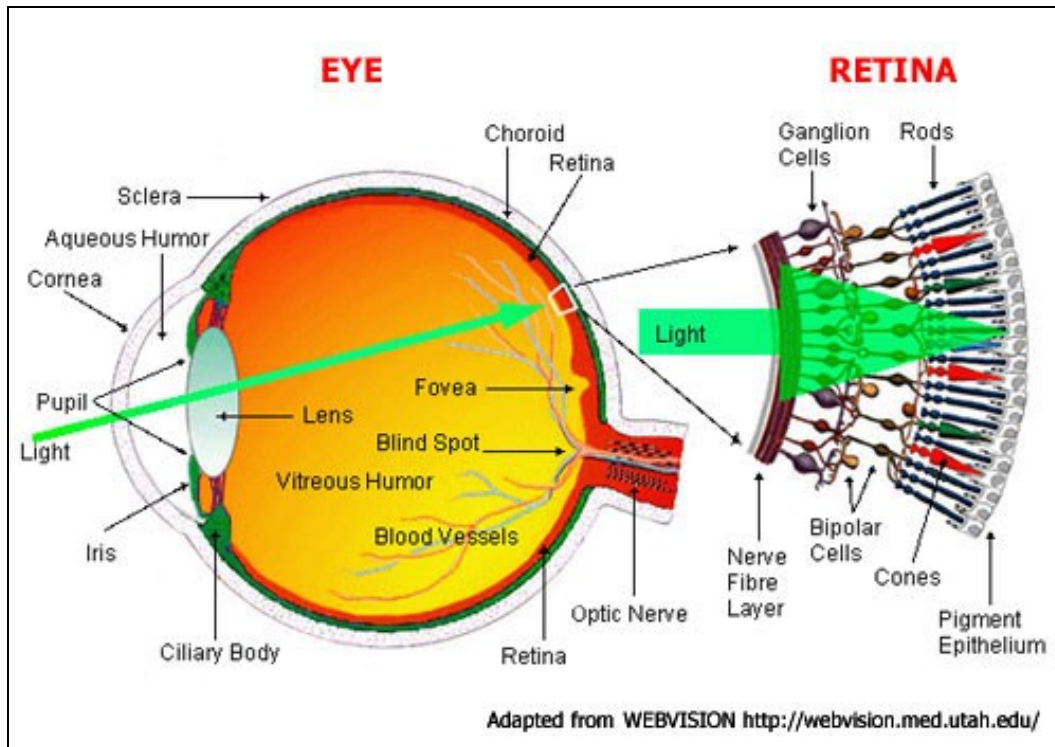
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## Objectives

- Perform a landscape search in the area of Artificial Retina
- Use PCS to derive insights and gain competitive perspective
- Understand the value chain and recent M&A activities

## Introduction

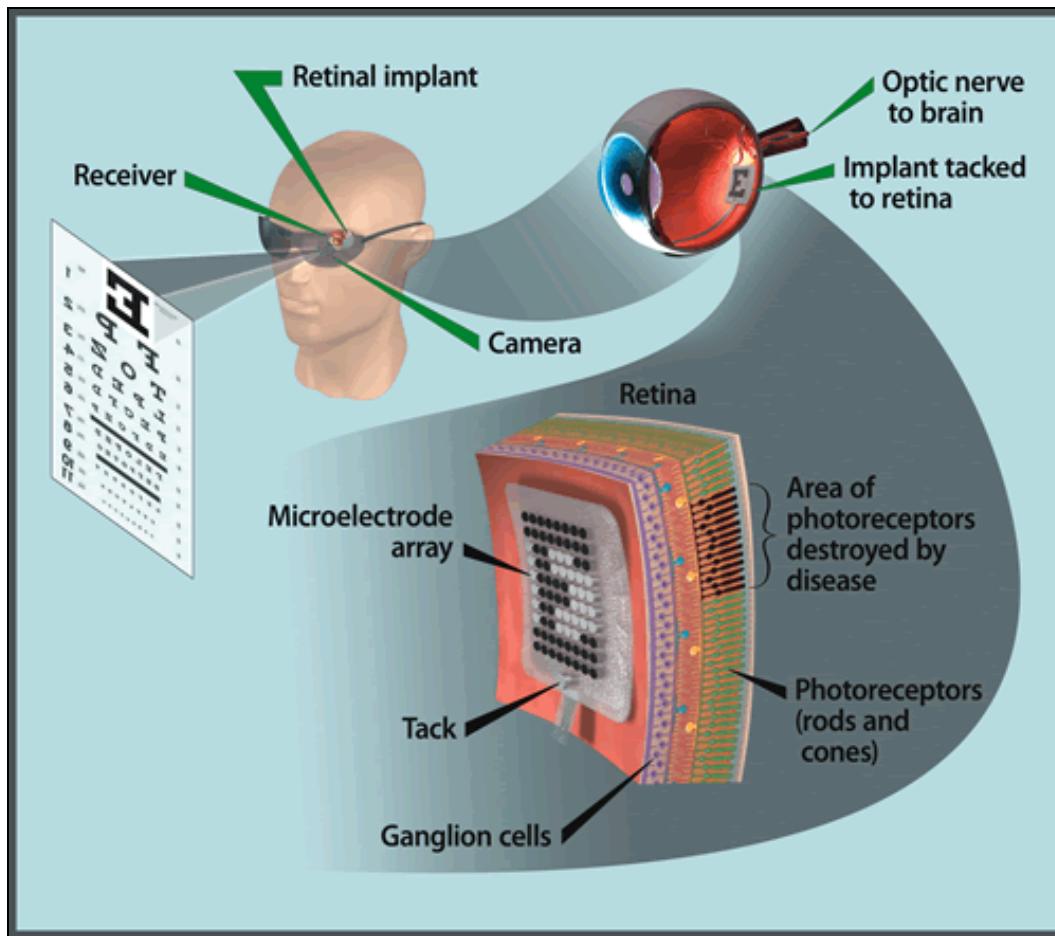
The retina is the third and inner coat of the eye, which is a light-sensitive layer of tissue. The optics of the eye creates an image of the visual world on the retina (through the cornea and lens). Normal vision begins when light enters and moves through the eye to strike specialized photoreceptor cells in the retina called rods and cones. These cells convert light signals to electric impulses that are sent to the optic nerve and the brain.



At least two significant forms of blindness occur because of a loss of the photoreceptive cells of the retina, namely:

- Age-related macular degeneration - results in a loss of central vision, which eliminates a person's ability to read or recognize faces
- Retinitis pigmentosa - results in a slow loss of peripheral and then central vision

With the artificial retina device, a miniature camera mounted in eyeglasses captures images and wirelessly sends the information to a microprocessor (worn on a belt) that converts the data to an electronic signal and transmits it to a receiver on the eye. The receiver sends the signals through a tiny, thin cable to the microelectrode array, stimulating it to emit pulses. The artificial retina device thus bypasses defunct photoreceptor cells and transmits electrical signals directly to the retina's remaining viable cells. The pulses travel to the optic nerve and, ultimately, to the brain, which perceives patterns of light and dark spots corresponding to the electrodes stimulated. Patients learn to interpret these visual patterns. [Artificial Retina Project](#)



## Search in PCS

A search on PCS in the area of Artificial Retina was performed with the following search strategy:

```
tac:((retina* NEAR5 (artificial* OR implant* OR prosthesis* OR chip*1 OR electrode*1 OR (micro ADJ2 electrode*1) OR micro-electrode*1 OR
stimul*6)))
OR
tac:(((artificial* OR prosthesis*) NEAR5 (eye*1 OR visual OR vision)) AND (retina* SAME (stimul*6 OR electrode*1 OR (micro ADJ2 electrode*1)
OR micro-electrode*1)))
AND
allclass:((A61N00010543 OR A61N000136046 OR A61F000214 OR A61F0009007 OR A61F000908))
```

{tac:((retina\*NEARS(artificial\*OR implant\*OR prosthesis\*3 OR chip\*1 OR electrode\*1 OR (micro ADJ2 electrode\*1) OR micro-electrode\*1 OR stimulat\*6))OR(((artificial\*OR prosthesis\*)NEARS micro ADJ2 electrode\*1) OR micro-electrode\*1)))AND tac:((retina\*NEARS(artificial\*OR implant\*OR prosthesis\*3 OR chip\*1 OR electrode\*1 OR (micro ADJ2 electrode\*1) OR micro-electrode\*1 OR stimulat\*6))OR(((artificial\*OR prosthesis\*)NEARS vision))AND (retina\*SAME(stimulat\*6 OR electrode\*1 OR (micro ADJ2 electrode\*1) OR micro-electrode\*1)))AND allclass=((A61N00010543 OR A61N000136046 OR A61F000214 OR A61F000907 OR A61F000908)))

Cluster Cloud CPC Taxonomy

2,029 Patents Found 554 Families Found

Analytics Patents

Expand All Collapse All

#### Neuroprosthetics (1211)

Visual Prosthesis (715)  
Retinal Implant (324)  
Functional Electrical Stimulation (323)  
Prosthesis (113)  
Cochlear Implant (42)  
Neuroprosthetics (39)  
Argus Retinal Prosthesis (27)  
Brain-Computer Interface (12)  
Cortical Implants (11)  
Deep Brain Stimulation (9)  
Brain Implant (7)

#### Blindness (995)

Visual Prosthesis (715)  
Retinal Implant (324)  
Argus Retinal Prosthesis (27)  
Retinitis Pigmentosa (27)  
Diabetic Retinopathy (23)  
Glaucoma (21)  
Retinal Regeneration (11)  
Vitelliform Macular Dystrophy (6)

#### Artificial Organs (969)

Visual Prosthesis (715)  
Retinal Implant (324)  
Cochlear Implant (42)  
Artificial Organ (8)

#### Eye (1107)

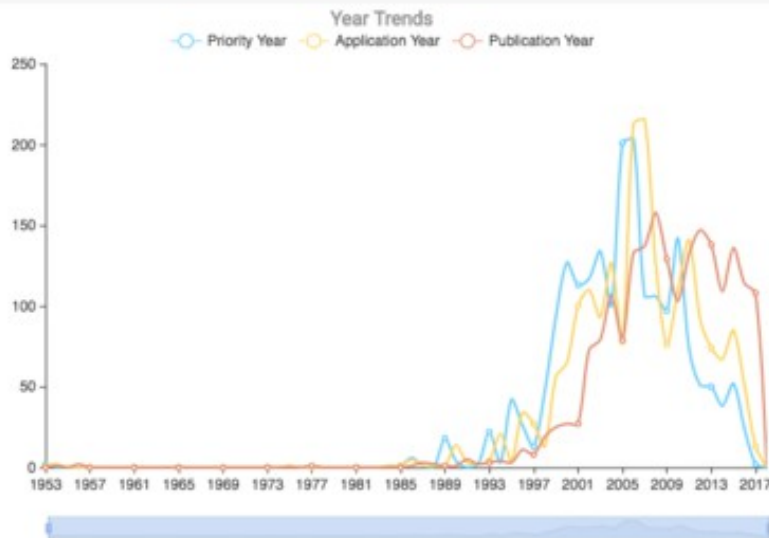
Visual Prosthesis (715)  
Retinal Implant (324)  
Intraocular Lens (112)  
Human Eye (106)  
Eye Movement (29)  
Intraocular Pressure (26)  
Eye (22)  
Foveal (17)  
Eye Tracking (16)  
Saccade (8)  
Pupillary Response (6)  
Rhodopsin (5)

#### Prosthetics (1008)

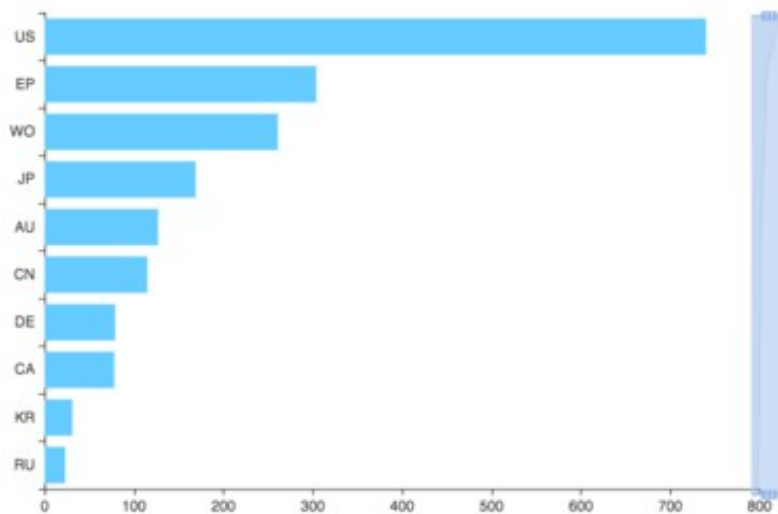
Visual Prosthesis (715)  
Retinal Implant (324)  
Prosthesis (113)  
Implant (Medicine) (61)  
Ocular Prosthesis (10)  
Artificial Organ (8)  
Breast Implant (7)

#### Electrotherapy (343)

Functional Electrical Stimulation (323)



#### Top 10 Geographies



## Description

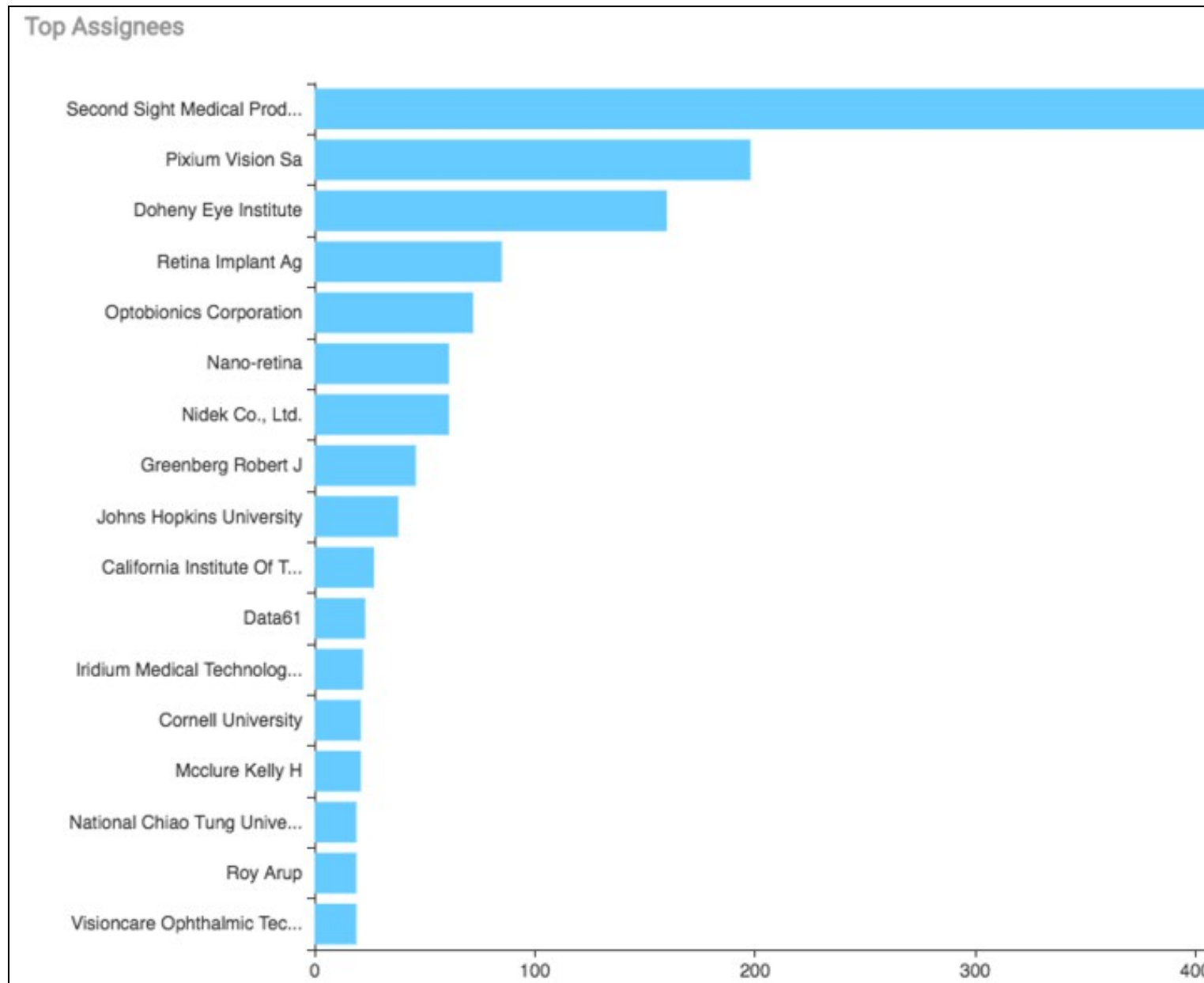
### FIELD OF THE INVENTION

0001 [0001] The present invention is generally directed to medical devices. More particularly, the present invention is directed to an **artificial retina** medical device and method to more efficiently **stimulate** electrically and with higher resolution, neuroretinal cells in partially damaged **retinas** to produce **artificial vision**. The invention provides improved efficiency and resolution of the device by using transretinal electrical current **stimulation** provided by **stimulation** and ground return **electrodes** that are disposed on opposite sides of the neuroretina.

## Claims

1. An **artificial retina** device to electrically **stimulate** **artificial vision**, the **artificial retina** device comprising: a **stimulating** electrode connected with the electrical source; and a ground return electrode connected with the electrical source, wherein the **stimulating** electrode and the ground return electrode are configured to be disposed within the neuroretina.
2. The device of claim 1 wherein the **stimulating** electrode is disposed on one side of the neuroretina and the ground return electrode is disposed on an opposite side of the neuroretina.
3. The device of claim 2 wherein the **stimulating** electrode is disposed on one side of the neuroretina and the ground return electrode is disposed on an opposite side of the neuroretina.

## Top Assignees



- The top companies under top 5 that are big players in Artificial vision devices from North America:
  - ◆ Second Sight Medical Products ? California
  - ◆ Optobionics Corporation ? Illinois
- The top two companies that are big players in Artificial vision devices from Europe:
  - ◆ Pixium Vision - France
  - ◆ Retina Implant AG - Germany
- Three major universities in US, that have also patented technologies in this space:
  - ◆ John Hopkins University
  - ◆ California Institute of Technology
  - ◆ Cornell University

## Top Assignee- Insights

### (A) Second Sight Medical Products Inc.

- They have patents that focus on improving the user comfort and user feedback.



<input type="checkbox"/> <b>US7894909B2</b> Priority Date: 2004-05-25 Application Date: 2007-07-19 Publication Date: 2011-02-22	<b>Retinal prosthesis</b> A retinal prosthesis with an improved configuration by mounting necessary components within and surrounding the eye. ... be mounted in close proximity to a retina inside the ... Families: 11    Assignee: second sight medical prod inc, second sight medical products inc    CPC Class Code: A
<input type="checkbox"/> <b>US7539544B2</b> Priority Date: 1999-03-24 Application Date: 2006-09-14 Publication Date: 2009-05-26	<b>Logarithmic light intensifier for use with photoreceptor-based implanted retinal prosthetics a</b> Supplying enough imaging energy to retinal prosthetics implanted in the eye which operate by having light (external to the eye) ... extent that the individual stimulation sites in the retina give different color perceptions, upon stimulation, colors of the view ... certain amount of color ... Families: 17    Assignee: second sight medical prod inc, second sight medical products inc    CPC Class Code: A

## (B) Pixium Vision SA

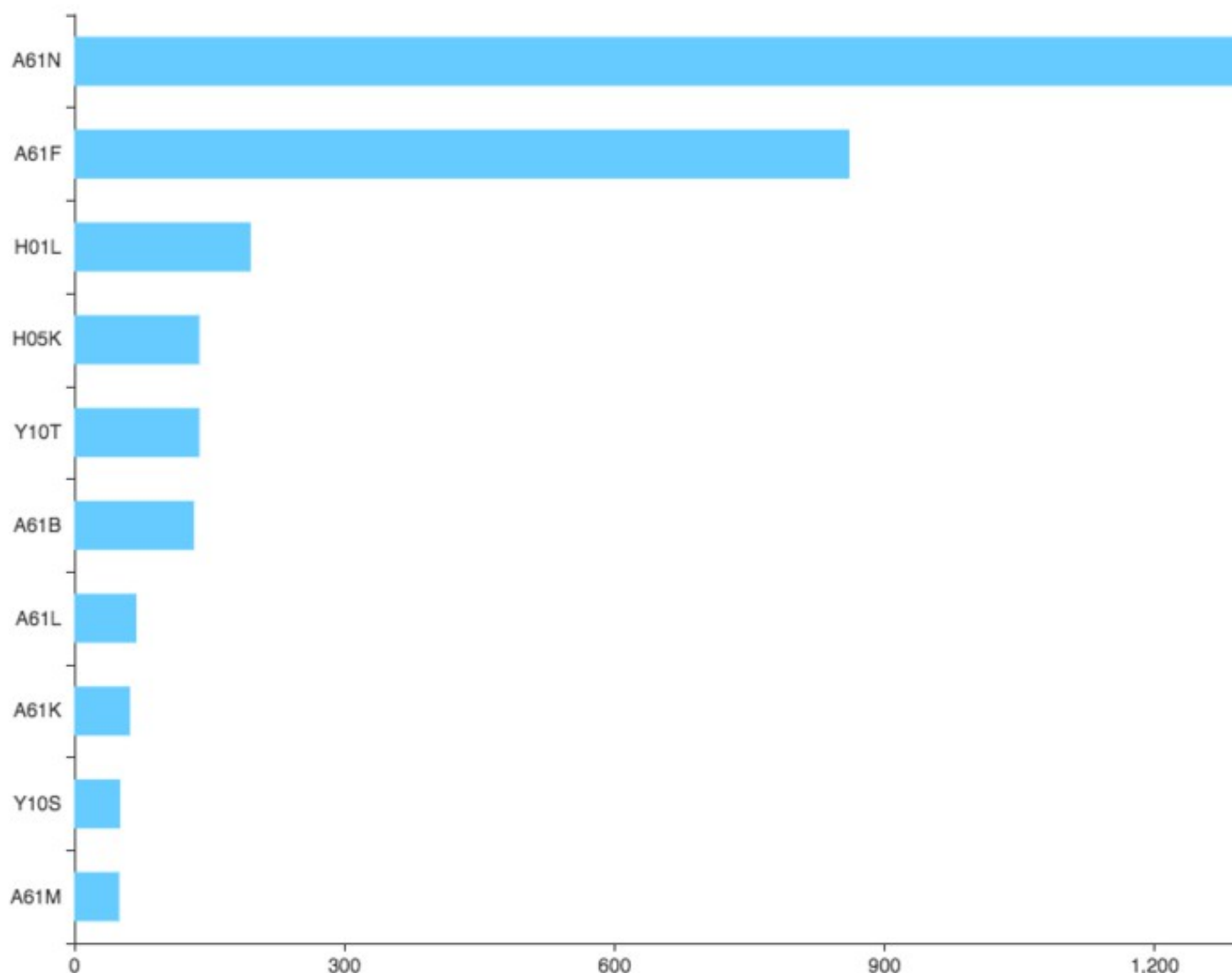
- The patents mostly discuss about the constructional features like, designing photodiodes, mounting and sealing features of a retinal implant.

<input type="checkbox"/> <b>US9002463B2</b> Priority Date: 2008-01-14 Application Date: 2009-01-14 Publication Date: 2015-04-07	<b>Retinal implant with rectified ac powered photodiode</b> The present invention relates to a microelectronics element, such as an optical receiver element, for a medical implant device ... a retinal implant device. The invention also relates to a medical implant device, such as a retinal implant, which incorporates ... Families: 11    Assignee: pixium vision sa    CPC Class Code: A61N 1/3787
<input type="checkbox"/> <b>WO2016202463A1</b> Priority Date: 2015-06-19 Application Date: 2016-06-17 Publication Date: 2016-12-22	<b>Hermetic housing and electronics package for an implant device</b> The present invention further refers to an implantable electronics package with such a housing, an implant, in particular a retinal ... an implant. ... that although parts of the retinal tissue have degenerated most of the retina may remain intact and may still ... general, the electrical power required for ... Families: 3    Assignee: pixium vision sa    CPC Class Code: A61N 1/37229

## Bibliographic Analytics

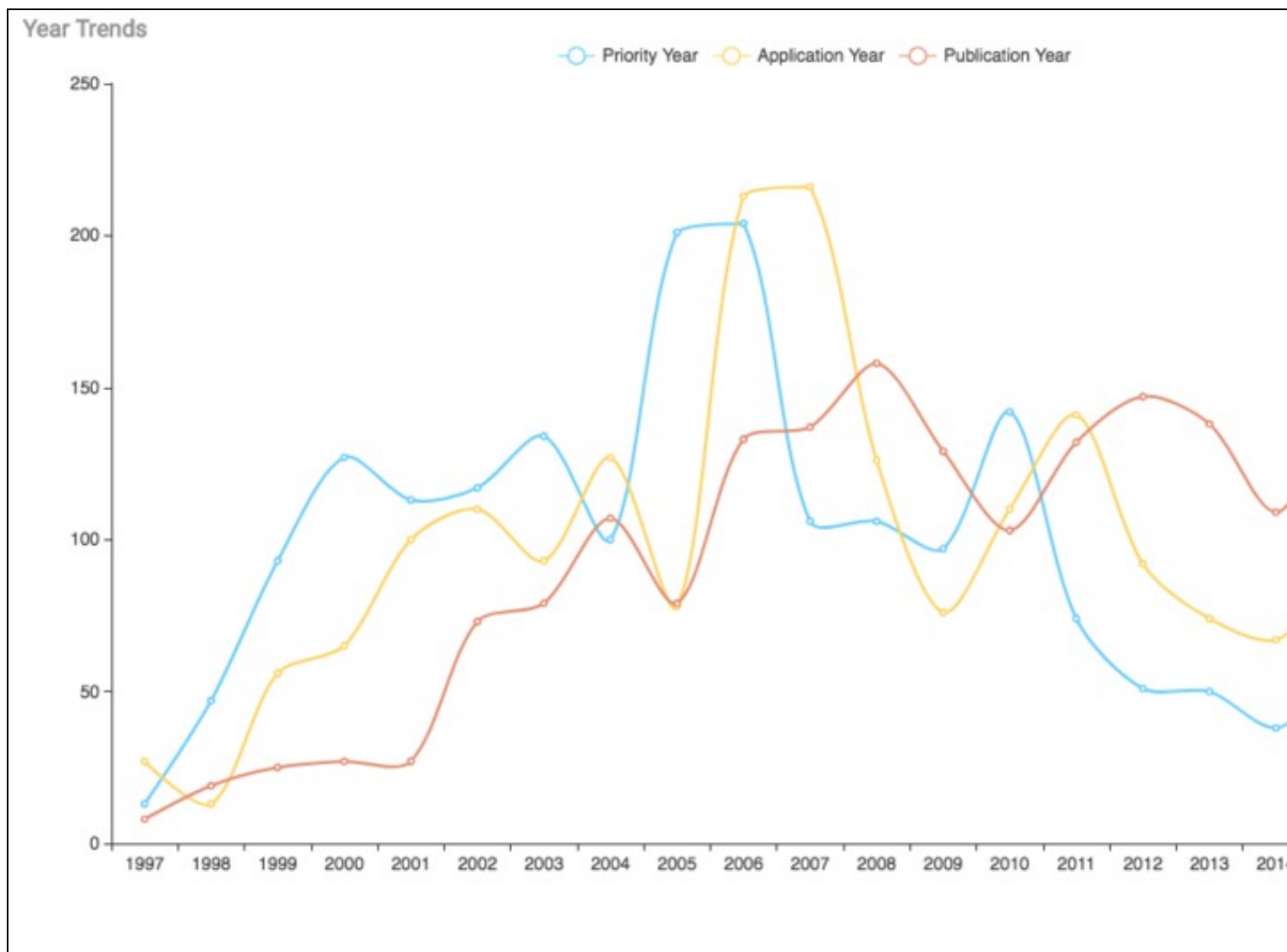
Main CPC?s:

## Top CPC Classes



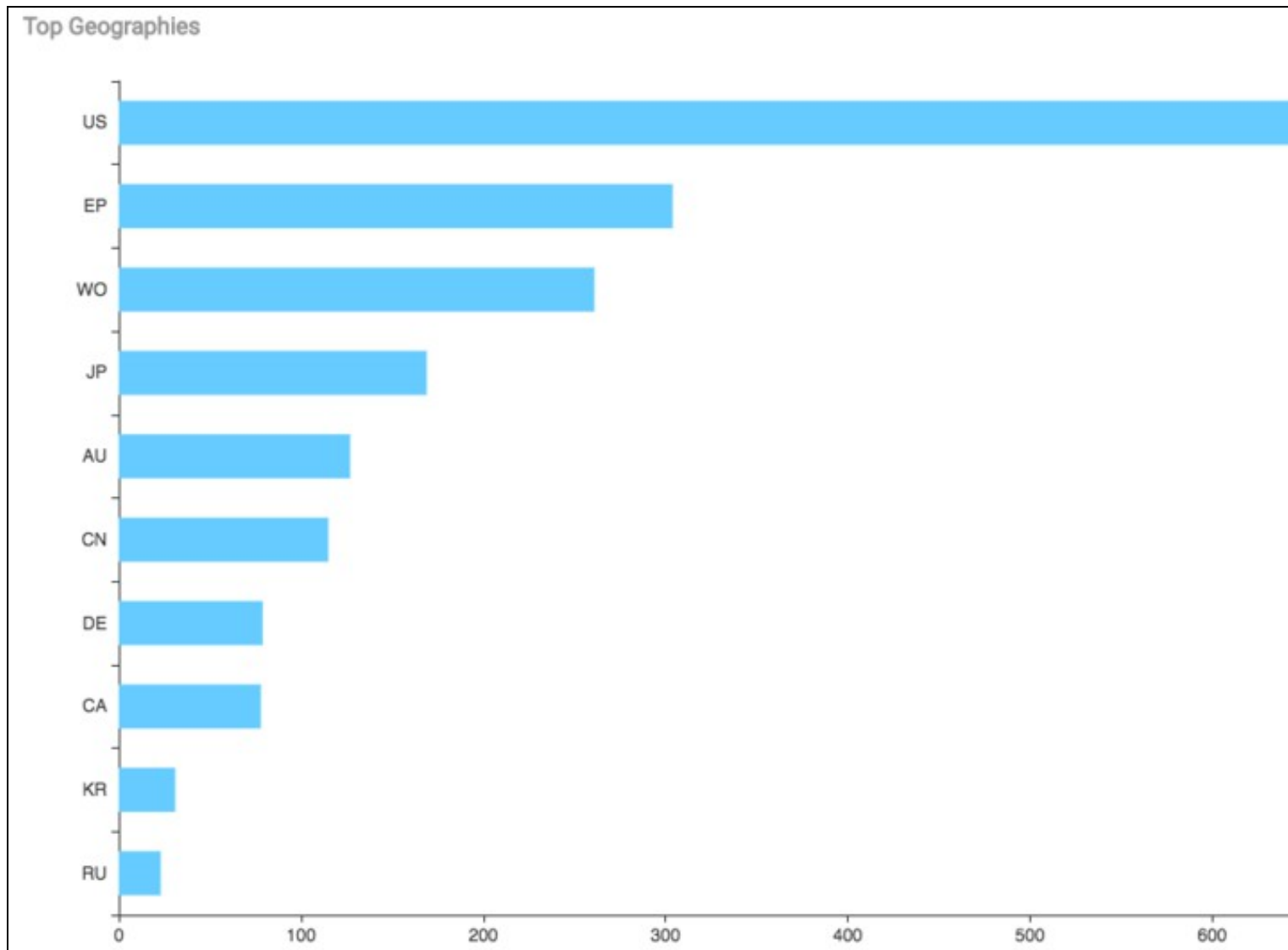
- **A61N** ---> ELECTROTHERAPY; MAGNETOTHERAPY; RADIATION THERAPY; ULTRASOUND THERAPY
- **A61F** ---> FILTERS IMPLANTABLE INTO BLOOD VESSELS; PROSTHESES; DEVICES PROVIDING PATENCY TO, OR PREVENTING COLLAPSING OF, TUBULAR STRUCTURES OF THE BODY, E.G. STENTS; ORTHOPAEDIC, NURSING OR CONTRACEPTIVE DEVICES; FOMENTATION; TREATMENT OR PROTECTION OF EYES OR EARS; BANDAGES, DRESSINGS OR ABSORBENT PADS; FIRST-AID KITS
- **H01L** ---> SEMICONDUCTOR DEVICES; ELECTRIC SOLID STATE DEVICES NOT OTHERWISE PROVIDED FOR
- **H05K** ---> PRINTED CIRCUITS; CASINGS OR CONSTRUCTIONAL DETAILS OF ELECTRIC APPARATUS; MANUFACTURE OF ASSEMBLAGES OF ELECTRICAL COMPONENTS
- **Y10T** ---> TECHNICAL SUBJECTS COVERED BY FORMER US CLASSIFICATION
- **A61B** ---> DIAGNOSIS; SURGERY; IDENTIFICATION

## IP Activity



- IP activity started 20 years and saw a peak in the number of publications in 2008, followed by 2012 and 2015.
- The number of applications shot to the peak value during the period of 2006-2007.

## Geographical Distribution



- Most of the patents in this technology are from US or Europe.
- Japan and China top the Asian subcontinent, in the number of patent filings.

## Technical Insights: CPC Distribution in Top Assignees



## Assignee - CPC Code

Second Sight Medical Products, Inc.	516	100	63	109	
Pixium Vision Sa	198	143	14		
Doheny Eye Institute	158	33		36	
Optobionics Corporation	70	70	7		
Retina Implant Ag	72	45	10		
Nano-retina	61	34	15		
Greenberg Robert J	46			11	
California Institute Of Technology	25	14	3	8	
Cornell University	20	14			
Johns Hopkins University	30				
Nidek Co., Ltd.	35	17			
Data61	22				
Mcclure Kelly H	21			4	
Photogenesis Inc		11			
Roy Arup	19				
Humayun Mark S	17			4	
Regents Of The University Of Colorado					
U.s. Department Of Energy				8	
Heraeus Holding Gmbh				7	
University Of California			9		
	A61N	A61F	H01L	H05K	

- All the product based companies- Second Sight Medical Products, Pixium Vision, Optobionics Corporation and Retina Implant AG have heavy presence on the therapy based classes- A61N, A61F, A61B.
- Second Sight Medical Products has the most number of filings for the printed circuit bases class- H05K.

## Technical Insights: Concepts vs. Top Assignees

### Technology Concepts:

## Assignee - Concept

Second Sight Medical Products, Inc.	399	369	365	366	
Pixium Vision Sa	156	127	121	128	
Doheny Eye Institute	128	111	110	110	
Retina Implant Ag	47	22	22	26	
Optobionics Corporation	53	43	39	42	
Nano-retina	53	53	53	53	
Nidek Co., Ltd.	44			5	
Greenberg Robert J	35	30	30	30	
Johns Hopkins University	32	26	26	30	
California Institute Of Technology	11	11	11	11	
Data61	23	18	18	18	
Iridium Medical Technology Co., Ltd.	3	1	1	10	
Cornell University	4	6	4	4	
McClure Kelly H	21	20	20	20	
National Chiao Tung University	16	16	16	16	
	Neuroprosthetics	Blindness	Artificial Organs	Eye	Pr

- Second Sight Medical Products, Pixium Vision and Doheny Eye Institute patents disclose technologies related to Neuro-prosthetics, Blindness, Artificial Organs and Prosthetics.
- Second Sight Medical Products, Pixium Vision has more patents on Electrotherapy.

## M&A Activity in the Space

- Okuvision and Retina Implant merge together under the parent company Retina Implant AG. [[Retina Implant AG](#), February 2017]
- NIDEK -- Two Sister Companies Merge to Combine Efforts in U.S. Ophthalmic Industry. [[Globenewswire](#), October 2005]

## Powerpoint Presentation

[PCS\\_Artificial Retina](#)