Restoring vision with a neuro-prosthesis for the blind
Reimagining vision restoration with a direct brain interface - Phosphoenix is pioneering ground-breaking technology that enables the blind to ‘see’ again.

**Founded in 2019**

as a spin-off from the Netherlands Institute for Neuroscience (NIN) based on world class research from Prof. dr. Pieter Roelfsema and Prof. dr. Xing Chen (Chen et al, *Science*, 2020)

**Growing team**

our team expanded to 5 full-time team members and a broad advisor base who are highly experienced in medical devices.

**We are actively seeking visionary investors to join our next funding round**

we are thrilled to have received pre-seed financing from top-tier investors in Q3 2022 and are now looking for new investors to join us on our journey.
Blindness severely impacts autonomy and quality of life

- **40M** blind people worldwide
- **115M** by 2050\(^1\)
- **75%** unemployment rate among blind & visually impaired\(^2\)
- **€8B** annual economic cost of blindness in 11 EU countries\(^3\)

---

\(^1\) The Lancet Global Health 2017 5, e888-e897.DOI:10.1016/S2214-109X(17)30293-0 | 2 Reid, F. & Simkiss, P. 1-32 (European Blind Union, 2010).
\(^3\) European Forum Against Blindness. efabeu.org 1-3 (2014).
A neuroprosthesis for the blind
regaining some vision makes *all the difference*

From darkness…

...to prosthetic vision

Our system bypasses the eyes and
**directly interfaces with the brain**
to restore functional and life-enhancing vision

"Within three days I was able to see my arm moving across the front of my face... *I was ecstatic at being able to see something*"

Jens Naumann
patient in Dobelle Artificial Vision Experiment, implanted in 2002

**Why now?**

Breakthroughs in chip design and fabrication technology have fuelled rapid advancements in the field of neurotechnology. Improved electrode design and miniaturization have played a pivotal role in paving the way for these transformative advancements.
The first integrated system to restore sight

Underlying Magic

Leveraging existing technology
Glasses with built-in camera and eye_tracker, wirelessly transmitting video feed

Cutting-edge innovation
Patterned stimulation of nerve cells in parts of the brain responsible for visual perception with a wireless chip

- Wireless data transfer and charging
- Neural stimulator
- High-density, ultra-flexible probes for dense coverage of visual field

Patterned stimulation
The scientific proof-of-concept has been demonstrated in ground-breaking pre-clinical work at the NIN

A brain prosthesis to restore vision

• Low electrical currents applied to a single electrode in the visual part of the brain induce an artificial percept of light, called a “phosphene”.

• We demonstrated that multiple phosphenes can be combined to create a visual percept.

• Normally sighted monkeys implanted with 1,024 electrodes in primary visual cortex could report the shape of electrically induced letters by making an eye movement to one of several visually presented letters.

• These results were replicated in a blind human volunteer in a collaboration with Prof. Fernandez in Elche (Spain).
Maximised visual field coverage
>1,000 electrodes allow blind people to ‘see’ across a larger area in great detail

Minimal surgical risk
surgical procedure is comparable to DBS, which has been performed >200,000 times at complication rates <1%

Increased longevity
flexible electrode and encapsulation technology for an implant that lasts for decades

Improved mobility
wireless power and communication reduce risk of infection and improve quality of life

Smart image processing
advanced algorithms extract the most relevant visual information dependent on the context
Our patented technology offers dense coverage of the visual field

<table>
<thead>
<tr>
<th>Competitive Analysis</th>
<th>Retinal prosthesis</th>
<th>Visual cortex prosthesis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>full coverage of visual field</td>
<td>![checkmark]</td>
</tr>
<tr>
<td></td>
<td>high resolution for reading digits</td>
<td>![checkmark]</td>
</tr>
<tr>
<td></td>
<td>minimally invasive surgery</td>
<td>![checkmark]</td>
</tr>
<tr>
<td></td>
<td>works with injured optic nerve</td>
<td>![x]</td>
</tr>
<tr>
<td></td>
<td>low currents for stimulation</td>
<td>![checkmark]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>surface electrodes</th>
<th>intracortical electrodes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phosphoenix</td>
<td>![checkmark]</td>
<td>![checkmark]</td>
</tr>
</tbody>
</table>

- Full coverage of visual field
- High resolution for reading digits
- Minimally invasive surgery
- Works with injured optic nerve
- Low currents for stimulation

- Volumetric coverage of visual brain region
- >1,000 electrodes enable sight at high definition
- Surgical procedure similar to DBS implantation
- Direct interfacing with the intact brain
- Flexible, penetrating electrodes for low current stimulation
A multi-billion-dollar opportunity

A clear unmet medical need

For many blind individuals there is no existing cure

Eligibility criteria:
- complete blindness
- previous form vision
- medically suitable adults
- no other treatment options

Reimbursement

We will first target Europe and the U.S. and seek reimbursement

Benchmark: a retinal chip (Argus II, Second Sight) with limited functionality was reimbursed in several countries at approx. €100,000¹ / $150,000²

Our visual prosthesis offers hope for millions of blind people

Our system can treat the leading causes of blindness, including glaucoma, diabetic retinopathy, trauma, and age-related macular degeneration (AMD)

3.5M Blind individuals in Europe and the U.S.

2.2M 62% previously sighted with no cure available

8M Expansion to worldwide market
Continuous involvement of stakeholders

The Netherlands has fostered a successful ecosystem for the advancement of neural implants.

**A strong network for innovation**

- Pre-clinical research and neuroscience expertise
- Flexible implant fabrication
- Chip design
- Image processing
- Clinical expertise
- Regulatory affairs
- Manufacturing
- Off-the-shelf products
- Glasses, eye-tracking

**TRL**

- Low
- High

**Continuous involvement of stakeholders**

- Bartiméus
- Visió
- Oogvereniing
- Neurosurgeons
- Ophthalmologists
Path to commercialization

- **Preclinical**: Functional rodent prototype
- **Clinical**: Preclinical validation of neural implant, design freeze for Ph1 study, first NHP data, first clinical data, Ph1 study, pivotal study
- **Regulatory**: Setting up QMS, preclinical validation of chip(s), first in human, FE/CE review
- **Financing**: Pre-seed, Seed, Series A, Series B
- **Market entry**
Impact beyond vision restoration

While our focus is on restoration of vision, the implantable interface has high potential for interfacing with other parts of the nervous system:

- **Restoration of hearing**
  - deafness

- **Restoration of motor movements**
  - paralysis

- **Neuromodulation therapies**
  - Parkinson’s, OCD, depression
Building a winning team

introducing our accomplished management group

Management Team

Dr. Bert Monna
CEO, Co-founder
Entrepreneur, former CEO of Hyperion, SystematIC Design

Prof. Pieter Roelfsema
CSO, Co-founder
Director of the Netherlands Institute for Neuroscience

Prof. Xing Chen
Co-founder
Expert in brain stimulation, Univ. of Pittsburgh

Advisors

Prof. Rick Schuurman
Neurosurgeon, AMC
Expert in DBS

Dr. Edward Young
Medical product specialist
Expert in device safety

Nick Halper
CEO Neuromatch
Expert in business strategy
Join us on our journey!