Phosphoenix

Restoring vision with a neuro-prosthesis for the blind

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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

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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-e897DOI: (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

Leveraging existing technology

Glasses with built-in camera and eye-tracker wirelessly transmitting video feed

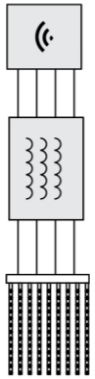
video stream processing

AI algorithms

Patterned stimulation

Cutting-edge innovation

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

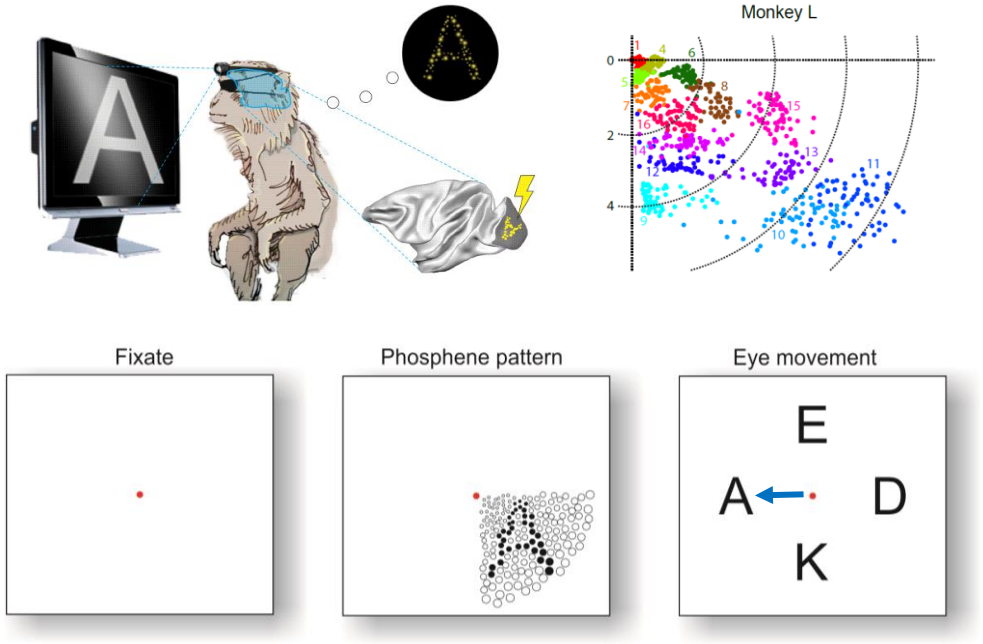


Wireless data transfer and charging

Neural stimulator

High-density, ultra-flexible probes for dense coverage of visual field

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

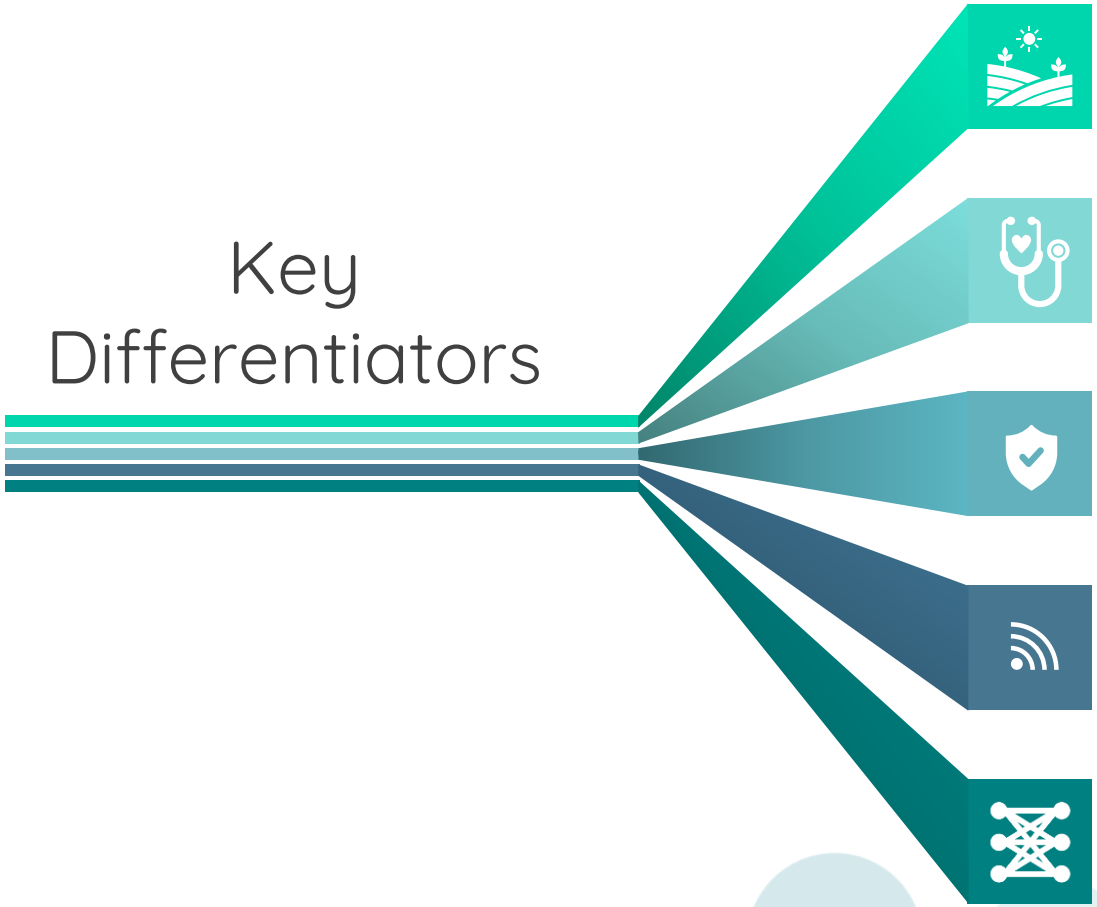


Chen, Roelfsema et al., *Science* (2020)[1]

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)[2].

Key Differentiators



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

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Our patented technology offers dense coverage of the visual field

	Retinal prosthesis	Visual cortex prosthesis			
		surface electrodes		intracortical electrodes		Phosphoenix	
	PIXIUM VISION	Vivani	previously SECONDSIGHT	NEURALINK	ILLINOIS TECH ReVision		
Full coverage of visual field	✗	✗		✗		✓	Volumetric coverage of visual brain region
High resolution for reading digits	✓	✗		✓		✓	>1,000 electrodes enable sight at high definition
Minimally invasive surgery	✓	✗		✗		✓	Surgical procedure similar to DBS implantation
Works with injured optic nerve	✗	✓		✓		✓	Direct interfacing with the intact brain
Low currents for stimulation	✓	✗		✓		✓	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. €100,000[1] / $150.000[2]

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

A strong network for innovation

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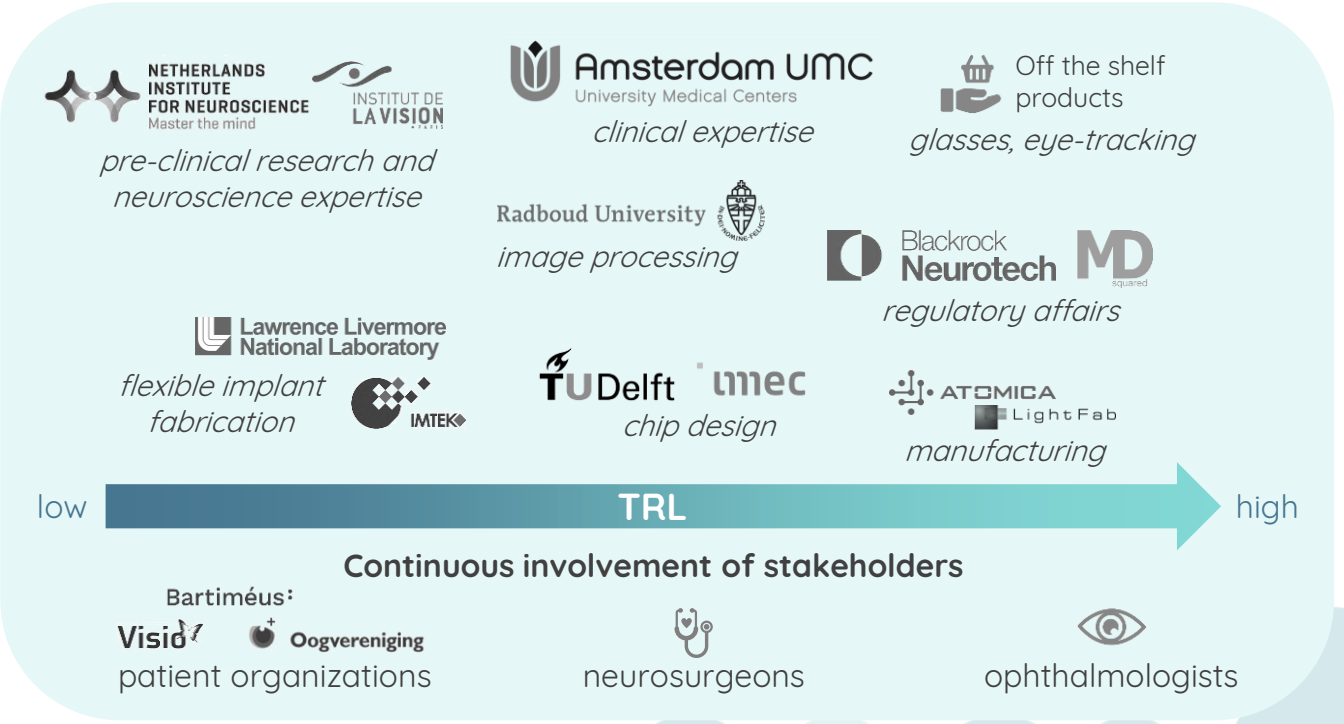
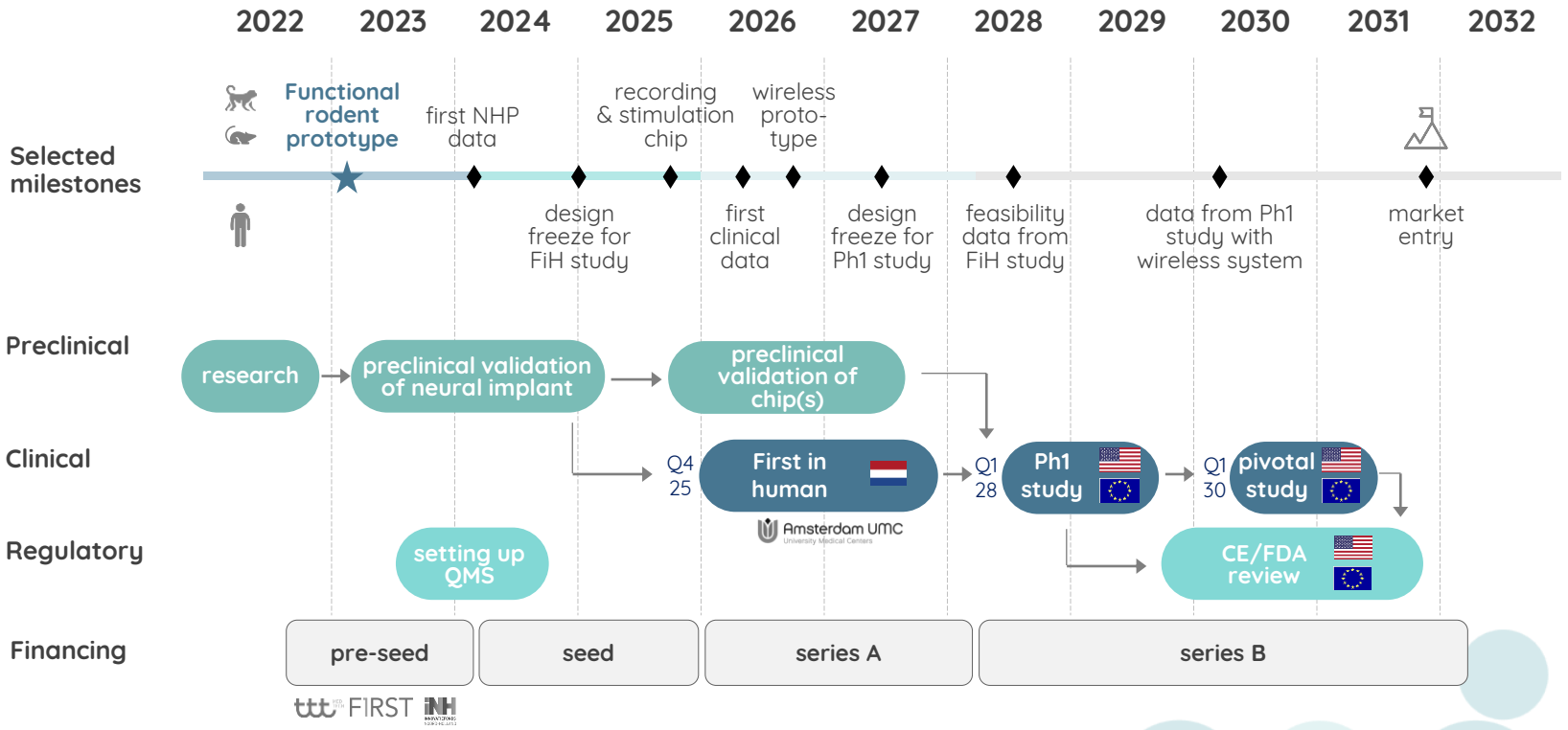
core

neural implant design & assembly

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



Path to commercialization



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

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

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Join us on our journey!

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