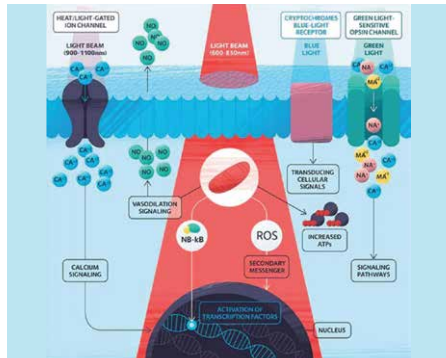


  
VIELIGHT



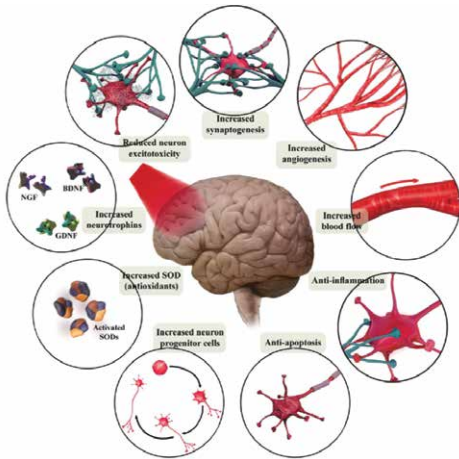
| Neuro Pro 2  
| Practitioner's Guide

## WHAT IS PHOTOBIMODULATION (PBM)? WHY USE IT WITH THE BRAIN?



**Photobiomodulation (PBM)** is a therapeutic approach that utilizes red to near-infrared light to influence cellular function, primarily by targeting mitochondria the cell's energy-producing organelles.

When applied to the brain, this light can help optimize energy metabolism and encourage better self-regulation.



### Brain Photobiomodulation

Research indicates that brain photobiomodulation heals damaged brain cells, improves cerebral blood circulation, reduces inflammation and toxicity, and regenerates damaged brain cells.

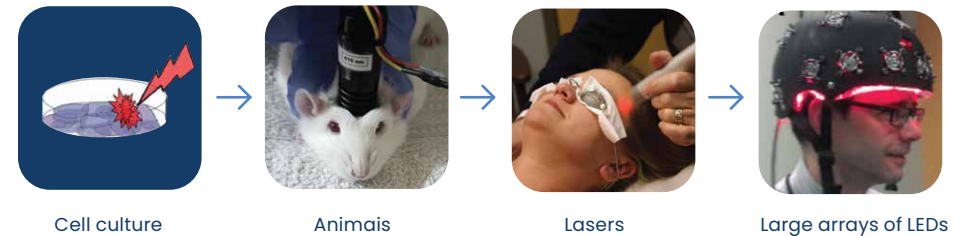


Want to learn more about photobiomodulation?  
Visit [the science section on Vielight's website](#).

Much of the early **PBM** research was conducted on cells, animals, or with lasers, often using imprecise parameters – incorrect wavelengths, power levels, or target locations.

*Hamblin, M.R. Photobiomodulation for Alzheimer's Disease: Has the Light Dawned? Photonics 2019, 6, 77.*

These studies showed safety, but the results weren't consistent or clinically translatable.



**PBM** follows a biphasic dose-response:

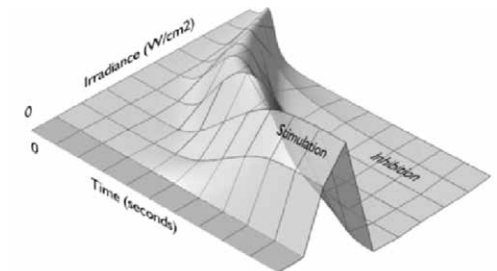
- Too little > no measurable effect
- Too much > potential suppression or fatigue
- An appropriate, calibrated dose > therapeutic benefit

To achieve this, several variables must be carefully balanced:

- Irradiance (light intensity)
- Power density (contact)
- Wavelength
- Pulse frequency and duty cycle
- Light source (LED vs. laser)
- Target location on the brain

PBM isn't about applying more light – it's about applying the right light, in the right way, at the right time.

*Chung, H., Dai, T., Sharma, S. K., Huang, Y. Y., Carroll, J. D., & Hamblin, M. R. (2012). The nuts and bolts of low-level laser (light) therapy. Annals of biomedical engineering, 40(2), 516-533.*



## WHAT IS IRRADIANCE? WHY IT MATTERS?

- **Irradiance ( $mW/cm^2$ )** refers to the **power density** of light delivered per unit area – basically how intense the light is on the target tissue. It's not the same as total energy dose (mW) – irradiance determines how effectively light penetrates and stimulates the brain with the appropriate wavelength.
- **Reaching neural mitochondria:** For brain photobiomodulation, you need enough irradiance to penetrate the skull and stimulate cytochrome c oxidase in neural mitochondria – boosting ATP production, calcium signaling, antioxidant response, blood flow, and cellular repair
- **Tissue attenuation is steep:** Because light is exponentially absorbed by scalp, skull, and cerebrospinal fluid, only a fraction reaches neurons. Adequate irradiance counters this drop-off to ensure therapeutic impact. Read [the related research](#).
- **Sunlight isn't enough:** Natural sunlight with a near-infrared irradiance of  $50 mW/cm^2$  may not offer sufficient irradiance for brain targets – specialized devices with proper output are needed.



**Choose devices that guarantee true irradiance levels** (not just total output) near the scalp and brain. A large total output (mW) without sufficient irradiance ( $mW/cm^2$ ) will not penetrate the skull, due to the lack of energy density behind each photon.



**Calibrate** ensuring effective power density reaches the cortex – novice users should avoid underpowered devices.



**Match wavelength + irradiance:** Devices working around 810–1100 nm with optimized irradiance penetrate best – this is the ideal therapeutic zone. Read [the related research](#).



**Adjust duration vs. intensity:** You can deliver the same total energy via high irradiance & short application, or vice versa – but only high density ensures that light isn't scattered/absorbed before reaching neurons.

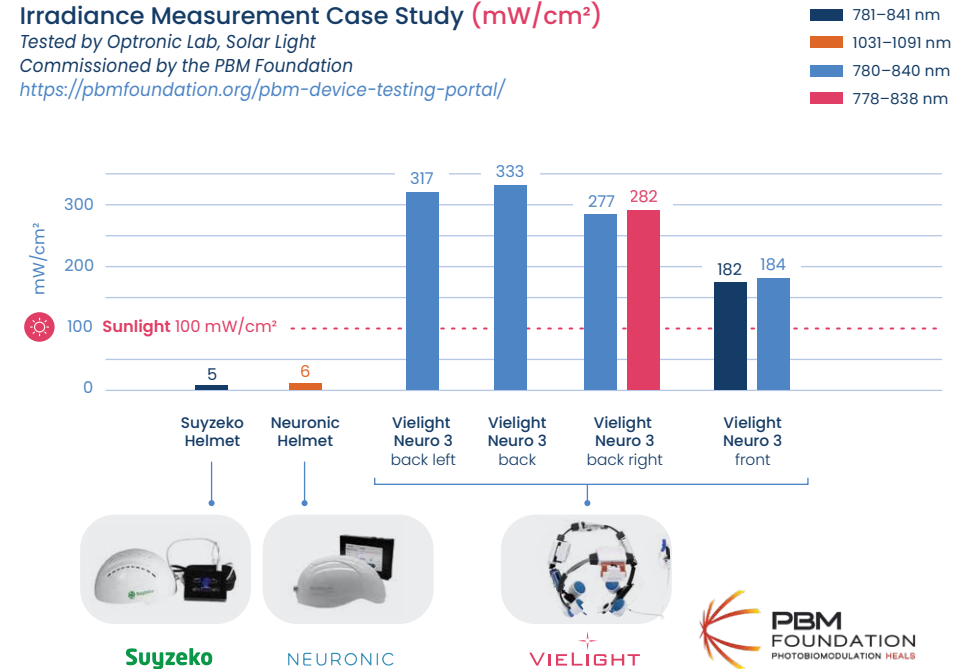
## REAL LIFE EXAMPLE

### Irradiance Measurement Case Study ( $mW/cm^2$ )

Tested by Optronic Lab, Solar Light

Commissioned by the PBM Foundation

<https://pbmfoundation.org/pbm-device-testing-portal/>



As part of their testing program to standardize irradiance reporting, the PBM Foundation benchmarked the **Vielight Neuro 3** against two PBM helmets – the **Suzyeko NIR helmet** and the **Neuronic Neuradiant** – in collaboration with two photonics engineering firms. Both **MegaLab** and **Optronic Lab** conducted independent tests, yielding strongly similar and replicable results.

- Read [the independent test report from Optronic Lab](#).

- Read [the independent test report from MegaLab](#).
- View [Megalab's testing methodology](#).

When compared against the irradiance of peak natural sunlight (which is free) our **Vielight Neuro generates 200-300% the irradiance of sunlight** without the negative side effects of UV rays. The tested **PBM helmets generated less than 9% of peak natural sunlight's irradiance on average**.

## THE NEURO PRO 2 SYSTEM: STRUCTURE, SETTINGS, AND PROTOCOLS

The **Neuro Pro 2** is a photobiomodulation device built for clinical flexibility. It uses:

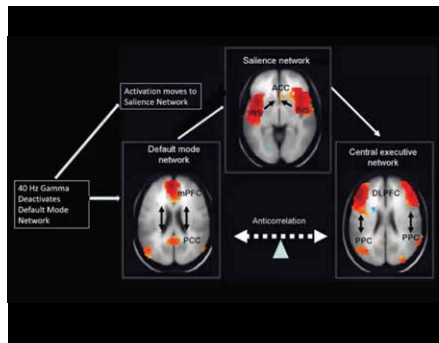
- 10 near-infrared LEDs positioned around the scalp
- 2 intranasal LEDs for deeper limbic access
- Fixed wavelength of 810 nm
- Customizable power, frequency, and individual LED activation



Each LED is placed to engage specific large-scale networks:

- Default mode network
- Salience network
- Central executive network

These networks are central to attention, regulation, and cognitive switching. The **Neuro Pro 2** was designed to stimulate them efficiently – based on internal R&D and clinical insight.

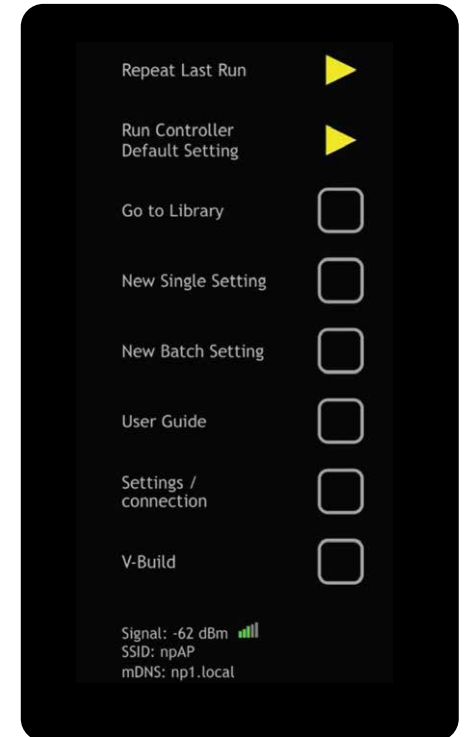


### Full customization via graphical interface

With the device's interface, clinicians can:

- Turn individual LEDs on/off
- Adjust frequency per LED (from 1 Hz to 9,999 Hz)
- Sweep frequencies across a range (e.g. 8–12 Hz for alpha band)
- Apply power sweeps that gradually increase intensity over time
- Select different LEDs for asymmetric conditions (e.g. post-stroke use on one hemisphere)
- Use cross-frequency coupling (e.g., delta-gamma pairing (4 Hz + 40 Hz) at one site)

This allows for precise modulation based on client condition, energy level, or response to prior sessions.



### Built-in protocols for immediate use

The **Neuro Pro 2** includes pre-loaded clinical protocols, including:

- Alpha/gamma protocols
- A meditation protocol developed by Dr. Sanjay Manchanda

- 5 protocols developed by Penijeane Gracefire, focused on practical clinical application

You can start with these protocols or build your own – the interface is designed for both plug-and-play use and advanced customization.



To explore the Manchanda and Gracefire protocols in more detail, visit [the Vielicht protocol library](#).

## HOW PBM REACHES THE BRAIN: ANATOMY, DELIVERY, AND CLINICAL STRATEGY

When applying neuromodulation tools – Including **PBM** – one of the key questions is:

How do we deliver stimulation effectively, safely, and in the right sequence alongside other modalities?

### PBM and the challenge of brain access

Reaching the brain with light is more complex than treating skin – skull bones block much of the infrared spectrum. That’s why anatomical access points matter.

Key pathways include:

- Intranasal (via sinus cavity): reaches frontal and limbic areas with minimal bone interference
- Occipital: thinner bone, often used in traditional PBM
- Visual pathways: historically explored in other modalities (like audiovisual entrainment), but not used in Vielight devices

These insights shaped Vielight’s design – especially the intranasal module for deeper, non-invasive brain access.

### From device design to clinical use

The **Neuro Pro 2** was developed to deliver precise, multi-site stimulation across the scalp, supported by flexible frequency control and targeted LED activation. Rather than focusing on isolated points, the system encourages clinicians to think in terms of engaging whole-brain networks.

This network-based approach enables a shift from treating localized symptoms to supporting dynamic regulation across interconnected regions. With Neuro Pro 2, you can:

- Select specific cortical regions and frequency bands
- Stimulate in patterns that recruit and synchronize functional networks
- Support both autonomic balance and higher-order cognitive function

This design aligns with the same principles used in neurofeedback:

we’re not just “lighting up” the brain – we’re creating intentional, structured, and adaptive network effects that can evolve over time as the client’s system responds.

## PBM AND NEUROFEEDBACK: FOUNDATIONS, STRATEGIES, AND CLINICAL INTEGRATION

### PBM as a metabolic foundation for neurofeedback

In brain-based therapies, we often focus on connectivity – but without metabolic power, connectivity can’t happen. The brain needs energy to activate, regulate, and form new pathways.

PBM supports this by enhancing:

- Mitochondrial function
- Cellular energy production
- Synaptogenesis (the creation of new neural connections)

With more energy available, the brain becomes better at:

- Recruiting activity
- Building networks
- Sustaining focus and engagement in neurofeedback

In this way, PBM serves as a metabolic primer – preparing the system for more effective learning and change.

Not all clients respond quickly to neurofeedback. Low metabolic resources or mitochondrial issues can block progress.

PBM helps fill this gap by providing foundational energy support and enabling network engagement.

### Integrating PBM into neurofeedback practice

One of the most valuable ways to use the **Neuro Pro 2** is by combining it with other therapeutic tools, especially neurofeedback.

**Photobiomodulation (PBM)** supports metabolic energy, while neurofeedback builds connectivity and regulation. Using them together amplifies outcomes – especially for clients who need extra support for network engagement.

### Layering information into the brain

Unlike earlier steady-state PBM devices, the **Neuro Pro 2** allows you to work with:

- Pulsed near-infrared light, not just continuous light
- Adjustable pulse frequencies, like 10 Hz (for flexibility) and 40 Hz (for persistence)
- A fixed 810 nm wavelength, known to support both neural engagement and mitochondrial function
- Custom frequency layering, enabling more complex, multi-dimensional input



## USING THE NEURO PRO 2 INDEPENDENTLY: LED TARGETING AND INTENSITY



The **Neuro Pro 2** can be used as a standalone tool, giving full control over:

- Which LEDs are active (scalp and intranasal)
- Power level per LED
- Session duration

You can run all LEDs at once for global coverage, or select a few with higher power for focused work. This flexibility lets you tailor the session based on client needs and fatigue response.

### Why intranasal access matters

The intranasal LEDs provide direct access to frontal and limbic regions with more power than earlier standalone devices — useful for regulation and deep brain support.

### Dosing tips

Session strength depends on:

- Number of active LEDs
- Power per LED
- Length of exposure

Both high-power short sessions and low-power longer sessions can be effective. Choose based on the client's tolerance and goals.

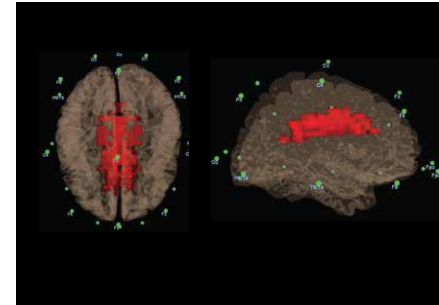
### Adjusting protocols to client fatigue

Not every client will tolerate full intensity or long sessions. And that's okay.

- Starting with lower power or fewer LEDs is not a downgrade — it's smart practice
- Some clients may need to ramp up gradually over multiple sessions
- Others may never tolerate high-power stimulation due to limited metabolic capacity

Brains are people. And people have different fatigue profiles.

## TARGETING BRAIN REGIONS: FOCUS ON THE ANTERIOR CINGULATE



When designing **PBM** protocols, it helps to connect brain regions with their functional roles — and then match LED placement accordingly.

### Why the ACC matters

- Involved in attention, emotional regulation, and motivation
- Connects subcortical and cortical structures
- Plays a central role in state switching and sensory-motor integration

The ACC is like a gateway for communication between thinking and feeling systems.

### Anatomical targeting with PBM

Because the ACC sits just behind the sinus cavity, it can be reached more effectively with intranasal LEDs — one of the few non-invasive ways to target deep midline structures.

Other circuit-related targets include:

- Posterior cingulate > linked to visual integration and memory
- Middle cingulate > bridges sensorimotor processing
- Base of skull (cerebellum) > connected to subcortical loops via the basal ganglia

### Practical takeaway

Even though **PBM** and EEG neuro-feedback are non-invasive, they can influence full brain-body circuits. You don't need to directly reach the basal ganglia — targeting the ACC or cerebellum may influence those loops indirectly through connected pathways.

If you can't access a deep structure directly, stimulate part of the circuit — and let the system adapt.

## DESIGNING PROTOCOLS WITH NEURO PRO 2: ADVANCED FEATURES

The **Neuro Pro 2** offers a wide range of programmable features that allow you to design highly customized sessions — even without real-time feedback.

### Frequency sweeps: Supporting brain flexibility

With frequency sweeps, you can guide the brain through a range of states:

- Start low (e.g. 7 Hz) and gradually increase > promote engagement
- Start high (e.g. 40 Hz) and gradually reduce > promote relaxation
- Target mid-range frequencies (e.g. 10–15 Hz) > support state flexibility

You can also define:

- Step size (e.g. 1 Hz vs. 5 Hz jumps)
- Step duration (how long the frequency holds – from 1 second to several minutes)

Use small steps for smooth transitions. Use larger jumps to “interrupt” rigid states.

|                            |     |
|----------------------------|-----|
| FREQUENCY SWEEP            |     |
| Start frequency            | Hz  |
| End frequency              | Hz  |
| Frequency step size        | Hz  |
| Step duration              | sec |
| POWER SWEEP                |     |
| Start power                | %   |
| End power                  | %   |
| Power step size            | %   |
| Step duration              | sec |
| CROSS FREQUENCY COUPLING * |     |
| Frequency                  | Hz  |
| Coupling delay             | min |
| Stop coupling              | min |
| Phase A (by default)       |     |
| Notes                      |     |

### Power sweeps: Managing client fatigue

Power sweeps allow you to modulate intensity across a session:

- Start strong, then taper off > for clients with limited capacity
- Or gradually ramp up power > to build tolerance

This gives you flexibility to run longer sessions without overwhelming the system.

### Multi-stage protocols: Batch mode

The interface lets you build modular session stages:

- Each stage can include a frequency sweep, power sweep, or both
- You can sequence stages to:
  1. Start gently
  2. Peak mid-session
  3. Cool down at the end

Think of it like assembling session “Legos” – reusable building blocks for smarter pacing.

### Phase A/B control: Introducing variability

Each LED can be assigned to phase A or phase B. This allows for:

- Simultaneous but different patterns across regions
- Creating asynchronous pulsing, which helps:
  1. Break up state persistence
  2. Encourage new network dynamics
  3. Prevent overstimulation

### Cross-frequency coupling: Two signals in one LED

Unique to **Neuro Pro 2**, this feature allows you to:

- Pulse two frequencies in the same LED
- For example: run 11 Hz globally, and overlay 44 Hz only on selected LEDs

Cross-frequency coupling is applied only to LEDs assigned to phase A, so you can precisely target where the second frequency lands.


Use this to pair fast (e.g. gamma) and slow (e.g. alpha) rhythms in ways that mimic natural brain dynamics.

## FAQ: CLINICAL USE OF PBM AND NEUROFEEDBACK

### When should I use PBM – before, during, or after neurofeedback?

There's no single right answer. Most practitioners start with **PBM** before a neurofeedback session to increase engagement. But you can also:


- Use it during (e.g., intranasal LEDs while EEG is running)
- Use it after for calming and downregulation

 Start by observing how each client responds. Some are energized, others fatigued. Let their system guide the timing.

### How do I get started using Vielight in practice?

Start simple. Use the built-in protocols and follow the printed quick-start guide that comes with the **Neuro Pro 2**.


- Try **PBM** sessions separately at first
- Watch for signs of fatigue or stimulation
- Then decide how to combine with neurofeedback, if desired

 You don't need to customize right away. Even default settings can be effective.

### Who benefits most from PBM + neurofeedback?

**PBM** supports metabolic energy, neurofeedback supports connectivity. Together, they help when:


- A client has low energy, poor resilience, or slow response to neurofeedback
- Neurofeedback alone isn't producing results after 8–10 sessions
- You suspect underlying fatigue, inflammation, or energy-access issues

 Think of PBM as charging the battery, and neurofeedback as building the network.

### What do clients typically report feeling?

Responses vary:

- Some feel deeply relaxed within minutes
- Others report nothing – but family notices better sleep, calm, or focus
- A few may feel temporarily wired or panicky due to nervous system resistance to relaxing

 Always observe behavior and ask open-ended questions – not everyone can describe their internal state.


### Are there any contraindications?

Yes – the main one is frequent or recurring nosebleeds, due to vasodilation effects. Otherwise, **PBM** is considered safe and non-invasive in clinical trials.

### Is Vielight safe for kids?

- Use low power, short sessions, and proceed with extra caution
- Vielight technology has been used safely in an IRB-approved Autism study for children within the 5–15 age range


To learn more about this study, visit [the published article on MDPI](#)

 Early brain development is a delicate stage. Consult available research before applying PBM to young children.

### What if I don't have EEG? How else can I assess clients?

Start with functional interviews and observation:

- Are they struggling to engage (focus, memory, action)?
- Or to relax (sleep, calm, anxiety)?

 Match frequency and LED placement to support the state they're lacking. The included protocol guidebook gives suggestions based on these needs.

Most of what we do clinically relies on asking, observing, and adjusting – just like any good therapy.

Over time, patterns emerge that help you fine-tune your approach. You don't need high-tech tools to recognize when a client is stuck, fatigued, or shifting in the right direction.



This guide is based on clinical insights and examples shared by Peniyean Gracefire during the 2025 Vielight webinar on Neuro Pro 2 and PBM integration.

Watch [the full webinar on YouTube](#)

**Peniyean Gracefire**, MA, LMHC, BCN, qEEG-D, is a licensed mental health counselor and neurotechnology expert specializing in EEG-based neurofeedback and cortical network regulation. She is known for pioneering the integration of transcranial photobiomodulation with neurofeedback and shaping clinical standards in neuromodulation.