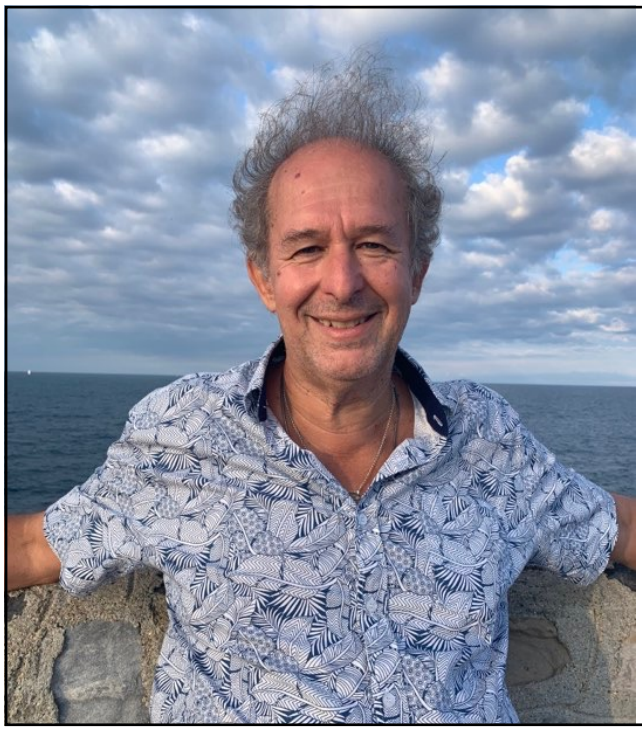


Additional information and assumptions

1

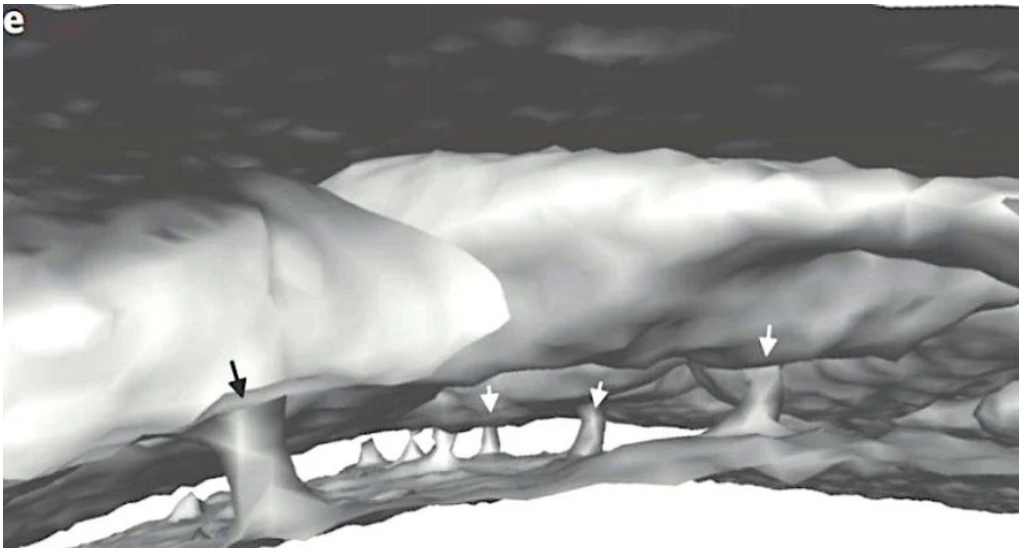
Organ physiology has been known for centuries, but physiology may not yet have revealed all its secrets.

In 2018, tiny channels were discovered that directly connect the bone marrow of the skull to the outer wall of the brain, the dura mater, in both mice and humans.

Normally, red blood cells travel through these channels from inside the skull to the bone marrow, but in the event of a stroke, they are repurposed to transport neutrophils in the opposite direction, from the bone marrow to the brain.

(https://www.nature.com/articles/s41593-018-0213-2)

2



3

In humans, these channels are observed in both the inner and outer layers of bone.

This discovery by researchers of thousands of tiny channels traversing the entirety of the bones of the cranial vault and reaching the brain and meninges could be a significant new finding with far-reaching implications.

4

This communication could very likely allow researchers to consider that photons from external light come into direct contact with the brain, maintaining and modulating its activity.

This could represent an additional pathway for modulation, beyond the modulation linked to the suprachiasmatic nucleus for circadian rhythm adaptations and cutaneous photoreception.

5

Similarly, according to these researchers, light partially penetrates deeper areas through the ear canals, while the auricles are constantly exposed to ambient light, which likely has a modulating effect at this level, namely on the limbic system.

6

Regarding the transcranial light penetration, protocols using transcranial photobiomodulation with near-infrared light for cognitive stimulation show that, despite the study's positive results, more than 99% of the infrared light is absorbed or scattered before even reaching the brain when applied transcranially.

7

The conclusion of the scientists studying the effect of transcranial biophotomodulation is that of the light doesn't actually reach the brain tissue, the observed benefits could stem from indirect effects: modulation of the skin, scalp vascularization, or systemic neuro-immune pathways

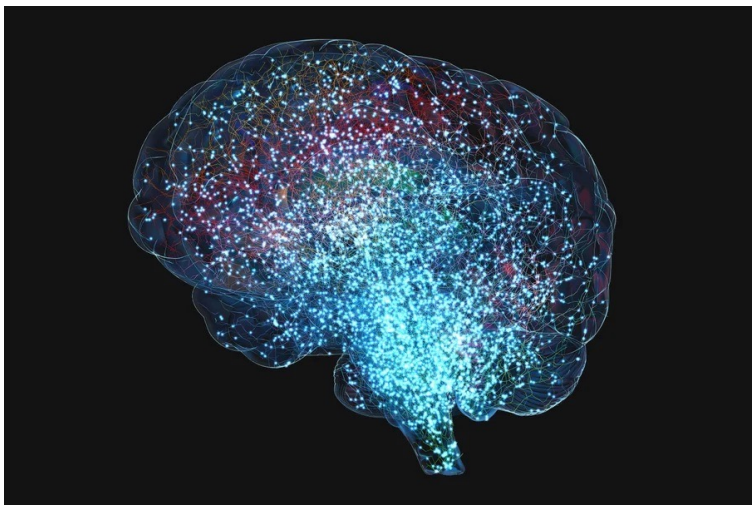
8

BUT in a very recent study published in the journal iScience, researchers detected, for the first time, **biophoton emissions from the human brain outside the skull** and observed that these emissions become more intense during periods of increased neuronal activity.

This clearly demonstrates that photons have the ability to penetrate the skull, and therefore, the hypothesis of photonic modulation through direct action on the skull seems plausible.

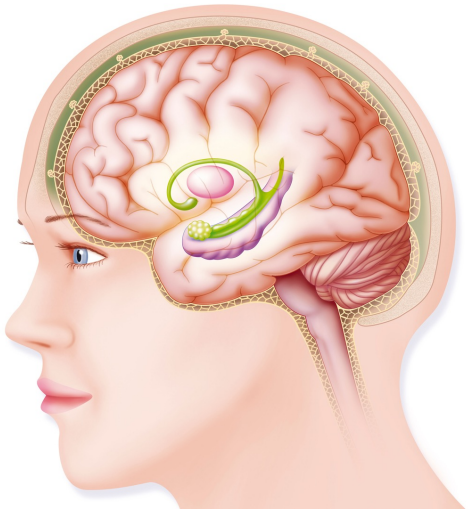
9

https://www.scientificamerican.com/article/your-brain-is-glowing-and-scientists-cant-figure-out-why/



10

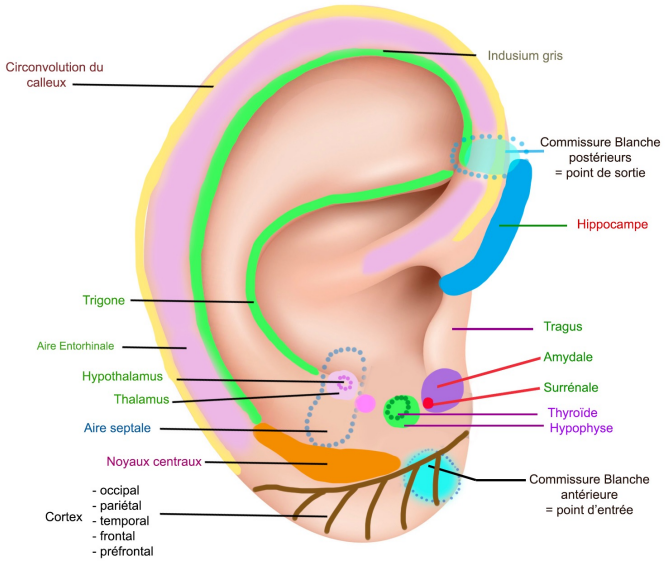
One might be struck by the topographical proximity of the ear's location to the internal location of the limbic system, as shown in the following diagram :



11

According to the research of Professor Pierre Magnin, the auricle is an interface of the limbic system. Indeed, through rigorous and repeated joint measurements of the RAC-VAS, electroencephalograms, and measurements of partial blood gas pressures, he succeeded in establishing correspondences between certain auricle areas and functional structures of the limbic system.

12



13

Within this limbic system, the hypothalamus plays a crucial role, being, in the words of Pierre Magnin, the "command gateway" with its hypothalamic nuclei.

Indeed, the autonomic nervous system is dependent on the hypothalamus: the parasympathetic system is activated by the anterior and medial part of the hypothalamus, while the sympathetic system is stimulated by the posterior and lateral part.

14

Metabolism is therefore regulated by the hypothalamus: anabolism by the anteromedial part, catabolism by the posterolateral part, especially since the hypothalamus is directly connected to the pituitary gland for hormonal regulation, and since other nuclei also regulate hunger, thirst, and satiety.

15

The auricular points or zones corresponding to the different organs are located near the auricular areas of limbic influence (entorhinal cortex, fornix, corpus cortica, corpus callosum and gyrus of the corpus callosum, septum, hippocampus, hypothalamus, pituitary gland).

In our approach, these points allow us to understand their expression within a limbic context, that is, to explore them in their functional dimension, and not solely in terms of lesions.

16

The use of different colors reveals this aspect of the functional state of physiology at the time of the examination, potentially indicating a developing disorder, a diagnosed illness, or persistent traces of a past disease or dysfunction.

17

In the field of physiology, Pierre Magnin considered the ear as a SONAR that gathers information from the internal world and also captures information from the external world, which then interacts with and modulates the information from the internal environment.

Recent studies (at the end of this document) concerning exposition to Transcranial Bright Light through ear canals seem to confirm Pierre Magnin's hypothesis and also suggest that brain possesses photosensitive properties.

18

In the context of pathology, it is the input of external energy to the auricle that acts as a signal giving orders to the limbic system, which in turn triggers a repercussion of orders at the local or systemic level. Through this input, we solicit the brain's collaboration in these corrective processes.

19

Because of its initial point of impact at the limbic level, our method allows us to act on the body's major functions simultaneously with the lesions:

- Respiratory function
- - Digestive function
- - Endocrine function
- - Mobility
- - And their essential corollaries, namely cellular respiration and redox reactions, thermodynamic potential, and the management of potential energy.

20

If the sympathetic nervous system is activated, energy will be produced and released to combat chaos and/or illness.

If, on the other hand, the parasympathetic nervous system is activated, energy will be stored to replenish the reserves needed to confront a new disorder.

21

Studies results on transcranial bright light application through ear canals.

22

Recent studies have shown that transcranial bright light through ear canals:

- Gives good results in Seasonal Affective Disorder: the results showed a significant, at least 50% reduction of depressive symptoms in 74-79% of the patients according to the BDI in all three treatment groups as well as a significant improvement of cognitive performance compared to baseline (in a randomized controlled double-blind dose-response study).

23

- Transcranial bright light exposure via ear canals does not suppress nocturnal melatonin in healthy adults (in a single-blind, sham-controlled, crossover trial)

- Stimulating brain tissue with bright light alters functional connectivity in brain at the resting state

Lateral visual and sensorimotor networks showed **increased functional connectivity in the light stimulus group compared to sham controls**. The lateral visual network demonstrated slowly increasing functional connectivity on average and the same temporal characteristic was shared by diverse cerebellar brain regions.

24

Findings from this study together with the plausible photoreceptor candidates **suggest that the brain possesses photosensitive properties**, which will have interesting implications for the modulation of brain function and understanding the basic physiology of the brain.

25

World Journal of Neuroscience > Vol.2 No.2, May 2012

Stimulating brain tissue with bright light alters functional connectivity in brain at the resting state

Light is considered to modulate human brain function only via the retinal pathway, a way of thinking that we aimed to challenge in the present study. Literature provides evidence of inherent phototransduction for instance in the rat brain and there are potentially photosensitive opsin proteins like melanopsin and panopsin in the human brain too. In order to investigate a short term response, functional connectivity changes of the brain were studied in the resting state with functional magnetic resonance imaging during bright light stimulus via the ear canal. Lateral visual and sensorimotor networks showed increased functional connectivity in the light stimulus group compared to sham controls. The lateral visual network demonstrated slowly increasing functional connectivity on average and the same temporal characteristic was shared by diverse cerebellar brain regions. Hypothetical phototransduction signal pathways leading to responses in brain function are discussed as well as some observed effects and their possible link to the findings. Findings from this study together with the plausible photoreceptor candidates suggest that the brain possesses photosensitive properties, which will have interesting implications for the modulation of brain function and understanding the basic physiology of the brain.

26