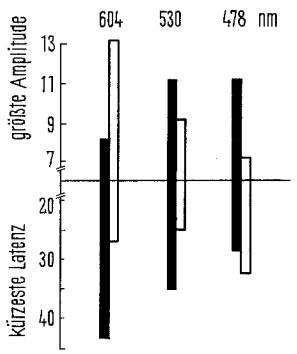
Über antagonistisches Verhalten des durch Lichtreiz evozierten Rindenpotentials (VEP) beim Menschen

Unter dem VEP, «visual evoked potential», versteht man die optisch ausgelösten Potentialveränderungen des optischen Cortex. Derartige EEG-Antworten wurden sowohl bei funktionstüchtigem (CIGÁNEK[1]) als auch erkranktem optischem Sinneskanal untersucht (VAUGHAN, KATZMAN und TAYLOR[2]; COPENHAVER und PERRY[3]; KOOI, GÜVENER und BAGCHI[4]; JACOBSON, HIROSE und SUZUKI[5]; HELLNER und GEORGE[6]). Im Gegensatz zum ERG zeichnet sich das VEP unter anderem durch eine relativ hohe photopische Spektralsensitivität aus (ARMINGTON[7]; DE VOE, RIPPS und VAUGHAN[8]). Über ein antagonistisches Verhalten des VEP einer Hirnhälfte nach Belichtung des ipsi- und kontralateralen Auges ist jedoch unseres Wissens nichts bekannt.

Methode. Die Versuchsperson betrachtete auf einer mattgrauen Tafel einen 11° grossen Lichtfleck, der in einer Frequenz von 1 Reiz pro sec dargeboten wurde; die Reizdauer betrug jeweils 100 msec. Es wurden Lichter des blauen, grünen und roten Spektralbereichs benutzt; die Doppelbandinterferenzfilter (604 nm, 530 nm, 478 nm; Schott und Gen.) waren auf gleiche energetische Wirksamkeit abgestimmt. Die Leuchtdichte des Lichtflecks entsprach 50 cd/m² weissen Lichtes. Die Ableitung erfolgte unipolar mit 8 mm Durchmesser EEG-Silberelektrode, jeweils 3 cm lateral der Mittellinie und 2 cm über der Protuberantia occipitalis externa placiert, gegen das gleichseitige Ohr. Differentialverstärkung (Tectronix, Typ 122; 1 sec Zeitkonstante); Summation von 80 Einzelpotentialen mit Hilfe eines Nuclear Chicago Data Retrieval Computer und Darstellung auf einem XY-Schreiber.



Zusammenfassung der Ergebnisse über Latenz und Amplitude des VEP einer Cortexhälfte nach ipsi (■) und kontralateraler (□) Belichtung der Augen, Häufigkeiten nach Zählstatistik. Es werden antagonistische Verhaltensweisen erkennbar.

Die individuell polyphasischen Kurvenabläufe von insgesamt 124 VEP bei 11 Normalpersonen wurden hinsichtlich ihrer Latenz und Amplitude folgendermassen ausgewertet: 1. Latenz. Bezeichnung der typischen Wellenzüge mit I–IV, Tabellarisierung ihrer Gipfelzeiten; 2. Amplitude. Höher zwischen höchstem und tiefstem Wellenzug, Umrechnung anhand einer Eichgrösse in μV und Tabellarisierung; 3. Vergleich der individuellen VEP nach ipsi- und kontralateraler Belichtung der Augen (I-VEP und K-VEP) und zählstatistische Erfassung der Häufigkeitsverteilung der kürzesten Latenz beziehungsweise grössten Amplitude über alle Personen.

Wie die Figur zeigt, verhalten sich das VEP bei ipsilateraler (I-VEP) und kontralateraler (K-VEP) Belichtung der Augen auf Reizlicht einer bestimmten Wellenlänge unterschiedlich. Im Vergleich zum K-VEP ist die Latenz des I-VEP auf rotes und grünes Reizlicht kurz, auf blaues lang und seine Amplitude auf rotes Reizlicht klein, auf grünes und blaues dagegen gross. Das VEP einer Cortexhälfte verhält sich somit nach Belichtung des ipsi- oder kontralateralen Auges antagonistisch.

Summary. Latency and amplitude of the VEP (visual evoked potential) following ipsi- or contralateral stimulation of the eyes with coloured lights were compared; by a statistical calculation antagonistic mechanisms were detected with regard to the response pattern.

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The Shielding Power of the Rat Skull to Visible Light

Light is considered a very important factor in the life of all animals; glandular as well as metabolic effects of light are well known. Its influence on the reproductive system has been amply demonstrated[1]. The pineal gland has been shown to participate in the gonadal effects of light mediated by the retina[2–4]. Evidence has been accumulating lately of an extra pathway involving the head, but not the eyes, and this non-retinal light exerts an effect on the metabolism of the pineal gland in the immature rat[5,6]. It has been demonstrated that light can penetrate directly through the skull of various animals, but quantitative measurements were not made[7–9]. The purpose of this study is to evaluate the shielding power of the rat skull to visible light.

Material and method. Two white rats (Sprague-Dawley) for each age were used throughout the experiment; no efford was made to sex them. The animals did not belong to the same litter. They were sacrificed with ether and a rectangular flap of the skull, comprising the interparietal, parietal and part of the frontal bone, was cut out along with the skin and this was used as the sample. The light source consisted of a low voltage high current lamp (21.75 V : 5.494 amp.) fed by a regulated D.C. power supply. The lamp output was 202 horizontal candlepower at a colour temperature of 2854 °K when operating at 21.75 V. Light intensities were measured by means of a Cadmium-Sulfide photoconductor type CL705HL manufactured by the Clairex Corporation. Measurements were accomplished by mounting the samples in front of the cell, which was inbedded in a specially constructed black plate. All measurements took place in a black non-reflecting room so that the specimen were subjected to the controlled light source only.

The photoconductor, wired into an amplifier circuit, was able to measure intensities from 0.01 to 100 foot-candles. The response of the CL705HL photoconductor to the wavelength of light closely resembles the bell-shaped response curve of the human eye with the peak spectral response at 5500 Å. Monochromatic light measurements were taken by introducing appropriate Kodak Wratten (KW) filters. The filter combinations were chosen which gave a reasonably narrow band of transmission only few hundred Ångstrom wide. The following combination of filters were used: KW 22 together with KW 70 for 6800 Å; KW 74 for 5400 Å; KW 45A together with KW 2B for 4800 Å.

The bulb and the cell mounted on a special support, facing each other at the same height, were placed on an optical bench. For monochromatic light, the photometer was calibrated to read 1 foot-candle with an appropriate filter between the cell and the bulb. A sample was then introduced between the filter and the cell and the bulb was moved closer until a reading of 1 foot-candle was observed. The percentage transmission was then calculated, utilizing the inverse square law.

Results and discussion. In the interpretation of the results due consideration has to be given to the fact that the samples, besides being of different size, were bigger than the cell so that a different part may have faced the cell for each reading. No attempt was made to clean them, so the small amount of blood smearing the inner surface of the skull was not always the same. However, the readings were not altered to any appreciable value by these techniques so that there may be confidence that the results are reasonably accurate.

The figures represent the mean of several readings whose difference was found to be slight. The Table shows the measurements taken for the skull (skin and bone together). There is, as expected, a striking difference between the adults and young rats, the transparency diminishing with age. Readings (not shown) taken separately for the skull and the skin did not show any appreciable difference up to the age of 5 days. For older animals a striking difference was found, the skin showing much more shielding power than the bone.

It may be assumed with reasonable confidence that for the monochromatic light the figures shown represent the actual amount (%) of monochromatic light crossing the rat skull since both calibration and measurements were accomplished using the same wavelength of light. Some question arises as to the validity of the results with white light. In this case calibration of the instruments was done with white light, while the measurements may have been altered by the samples which themselves may have filtered portions of different wavelengths selectively so that the transmitted light impinging on the cell may not be qualitatively of the same spectral distribution as the incident light impinging on the sample; hence, these measurements become dependent on the spectral sensitivity response curve of the cell. There is no way to overcome this difficulty when using white light. For these reasons the results obtained using white light should not be considered as dependable as the readings obtained utilizing monochromatic light[10].

Percent transmission of light through the skull (bone and skin) of the rat at various ages

Age (Days)	Transmission (%) White	Red	Green	Blue
1	9.0	16.2	12.5	15.2
5	7.5	14.6	10.7	13.7
10	7.0	12.3	10.2	12.5
15	4.5	9.3	6.2	8.2
20	2.5	6.3	3.6	5.0
25	3.1	6.5	4.4	6.0
30	3.0	6.9	4.0	5.8
35	2.7	7.4	3.9	6.1
60	2.3	5.9	3.5	5.2
90	1.5	4.8	2.6	4.2
365	2.2	5.8	3.3	4.9
730	1.2	3.9	2.1	3.3

Riassunto. È stato misurato l'ammontare (%) di luce bianca, rossa, verde e blu che riesce ad attraversare il cranio del ratto a diverse età.

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