Carotinoiden – berichtet[15,22]. Ähnlich den Befunden an Pflanzen und beim Pinealorgan sind bei den phototropen Farbstoffen zur Umwandlung der Dunkelreaktion stets kürzere Wellenlängen notwendig als zur Rückwandlung der Lichtreaktion.

Welche chemischen Reaktionen im Pinealorgan als Folge der Strahlungsabsorption ablaufen und als reversible Umsteuerung in Erscheinung treten, kann im Augenblick nur vermutet werden. Neben der auf Grund des physiologischen Verhaltens wahrscheinlichen phototropen Isomerisation ist auch an die Möglichkeit der Sekretion einer erregenden und einer hemmenden Überträgersubstanz zu denken, die durch längerwelliges Licht gefördert und durch ultraviolettes Licht gehemmt wird. Die Annahme sekretorischer Tätigkeit des Pinealorgans der Anuren wird durch die Wirkung von Epiphysenextrakten[23] sowie durch den Nachweis antagonistischer langsamer Potentiale gestützt, die bei Einwirkung ultravioletten bzw. langwelligen Lichtes auf das Stirnorgan entstehen und Ähnlichkeit mit den Potentialen von Drüsen besitzen[24].

Summary. The reversible red, far-red reaction which controls germination of seeds or spores, and a large number of light-dependent reactions in algae, mosses and ferns, is compared with the reversible ultraviolet-blue-green reaction, i.e. the chromatic response, of the terminal vesicle of the frog's pineal body (Stieda's organ).

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Limits of Language

A series of conferences was held on 'The nature of the real' at Marquette University in June (1961). FRIEDRICH[1], when recently reviewing topics and 'Leitmotiv' of the proceedings, mentions that 'Not much light was cast during these conferences on how the acausal, relatively random, behavior at the atomic level can be the basis for ordered causal behavior at the macroscopic level. It is difficult to determine where the transition (if it can be called that) occurs between random, acausal behavior and ordered behavior'. The problem raised is one that appears again and again in the pages of scientific journals. Let us offer for consideration comments toward a solution.

Man can be exposed to a succession of similar or near similar stimuli, such as hearing an equally time-spaced succession of sounds or seeing a succession of frames at the movies for example. If the frequency of stimuli is lower than about 15/sec, individual events are perceived. If the frequency of stimuli is increased to about 15 cycles/sec, spatialization of individual events takes place[2]. It is also contained in man's restricted level of attention that he experiences imperceptible atomic events as mental images, whereas an historical event, such as a galaxy with a diameter of 50000 light years, is perceived as a few mm small stationary object.

Could it not be that 'relatively random behavior at the atomic level' and 'causal behavior at the macroscopic level' are statements uttered in a language suitable only for the description of phenomena perceived in a fairly narrow range of frequency.

Mass, frequency and duration are parameters which characterize microphysical or cosmological phenomena, while with the aid of time rates of change we may characterize evolution, learning, perception and hallucinations. These phenomena are registered as exponentially decreasing or increasing in magnitude depending on whether one 'descends' or 'ascends' progressively below or beyond the human attention range. STEBBING's conclusions appear relevant in this context: Nothing but confusion can result if, in one and the same sentence, we mix up language used appropriately for the furniture of earth and our daily dealings with it with language used for the purpose of philosophical and scientific discussion[3].

Even though language precludes unity—a relating of the acausal and the causal—nevertheless there might be another way to approach the problem. WILKINSON[4] addressing himself to the same problem in the context of Bohr's Principle of Complementarity sketches the lines of attack. He recognizes that solution in terms of interaction of the electron with the measuring apparatus is untenable. WILKINSON's approach leads us to recognize, for instance, HEISENBERG's Uncertainty Principle as an informational restriction arising from the formal properties of the symbols of a given language—the purely formal axioms of quantum mechanics—rather than as a 'law' of nature.

WILKINSON argues for extension of the grammatical structure of our language, so that it includes information theory. What is wanted is 'a linguistic *a priori* limitation on the propagation of signals, expressible in a single unitary language which makes use of information-theoretic concepts'[5].

Risking that it may boomerang, we close with: 'Whatever can be said at all, can be said clearly: and what we cannot speak of, we must be silent on'[6].

Zusammenfassung. Unsere Alltagssprache ist nur zur Beschreibung von Phänomenen, welche im menschlichen Wahrnehmungsbereich der Gleichzeitigkeit liegen, geeignet. Die Diskussion von Begriffen, wie z. B. Kausalität und Zufall, erfordert eine sprachliche *a-priori*-Begrenzung der Signalfortbewegung (WILKINSON). Eine solche neue Sprache muss auch informationstheoretische Konzepte enthalten.

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