noch einzelne Punkte vorhanden sind, in denen sich die Wabenoberfläche in Ruhe befindet. Es tritt also der Effekt auf, dass sich die Schwingungsfigur bei wachsender Anregungsstärke ändert, obwohl die Frequenz konstant gehalten wird. Dieses visko-elastische Verhalten der Honigwabe steht im Gegensatz zu einer leeren Wabe, die bei nicht allzu hoher Anregungsstärke als elastisches System betrachtet werden kann.

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Summary. A new method permitting the registration of absolute amplitudes of oscillating beecombs is being introduced. The method depends upon the holographic interferometry and is applied to beecombs being stimulated by frequencies responded to by the stopping-reaction of the bees. The influence of honey filled in the combs is discussed.

R. Paul und W. Gebhardt[5]

Zoologisches Institut und Institut für Angewandte Physik und Elektrotechnik der Universität des Saarlandes, D–66 Saarbrücken 11 (Bundesrepublik Deutschland, BRD), 17. Februar 1975.

A Possible Age-Related Decrement in the Conduction Velocity of *Aplysia* Neuron R2

Unidentified bodies, which appear in the neuronal somata of large *Aplysia* but not immature ones, have been described in two separate anatomical studies[1,2]. It was speculated[1] that the anomalous bodies might be foreign and that they might be involved in aging. However, previously, there has not been any published suggestion of an age-related physiological deterioration of these neurons. The present paper describes a large inter-specimen variation in the conduction velocity of the right giant neuron, R2[3] and relates this variability to the season of dissection and relative ages of the specimens.

Methods. Dr. R. Fay (Pacific Bio-Marine Supply Company, P.O. Box 536, Venice Ca. 90291, USA)[4] was the supplier of *A. californica* used in this study, and his extended observations of the specimen indicate that it is an annual (personal communication). There is a seasonal relationship between size and age in the general population, which is to say that in the spring, most of the supplied animals are small and immature, while in the fall and winter, most are large and sexually adult. The size of specimens, however, does not necessarily reflect their ages, and the basis for dichotomizing the animals discussed here (Figure 2) is their sexual maturity, as judged by visual inspection of the gonads.

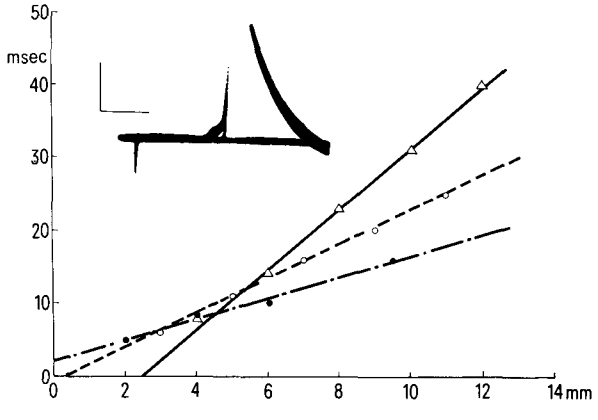

Fig. 1. The latency-distance plots for 3 experiments done in November, January and February; the velocities are respectively 0.24, 0.43 and 0.69 m/sec. The inset shows an EPSP arriving at the intracellular electrode before the very slow antidromic spike in the November experiment. Calibration: 4 mV, 40 msec.

The freshly dissected abdominal ganglion was pinned out in a seawater bath, and the right pleuro-visceral connective was stretched beyond the point where the bundled axons could be seen to uncoil within the connective sheath and lie in a straight line. All velocity measurements were made at 14 ± 1 °C. Intracellular recordings were made using either K_2SO_4- or KCl- filled pipets (2-10 *M*ohm). An extracellular record was also obtained from the anterior, cut end of the right connective, but velocity was normally determined from intracellular latencies consisting of the time between the stimulus artifact and the onset of positive deflection of the trace, associated with the antidromic spike.

Stimulation was accomplished by bringing the cathodal member of a pair of fine, Teflon-coated, silver wires into contact with the right pleuro-visceral connective at the desired distance from the centre of the R2 soma. Distance was determined by looking at the preparation through a measuring eyepiece in the dissecting microscope, the scale being graduated in 100-micron steps. The stimulating electrode was micromanipulated to at least 4 different sites on the right connective, and the latency-distance co-ordinates were recorded for subsequent analysis on Wang programmable calculator. A least-squares, linear regression analysis was performed on the data from each experiment; standard error terms were obtained, but these were always extremely low, and hence, are omitted.

Results and discussion. The discrepancies in velocity measurements are well illustrated by Figure 1, where the data from a fast, a medium and a slow axon have been plotted on the same graph. The slopes of the two most similar lines shown are 9 standard errors apart, and it is apparent that there exists great variability, across animals, in the conduction velocity of this neuron. Of the 8 fastest neurons examined, 7 were from immature *Aplysia*; and a 2-tailed *t*-test (mature vs immature) showed that the axon was faster in immature animals ($p < 0.001$). However a more careful scrutiny of the relationships among conduction velocity, season of

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dissection and sexual maturity revealed that in the spring and late winter, the conduction rate was 0.48 m/sec in all animals, while in the summer and fall, and early winter, diminished conduction rate was only evident in a fraction of the mature specimens examined (Figure 2).

The present report points out larger individual differences in conduction rates than had previously been reported in a study by GOLDMAN[5]. He observed a mean conduction velocity of 0.50 m/sec, with a range of 0.43 to 0.55 m/sec in data obtained from 12 animals; and his measurements were in agreement with earlier work on another species by TAUC[6]. In the work described here, velocities were seen to range from 0.24 to 0.69 m/sec. Since the very slow conduction rates were observed only in adult animals dissected in fall and winter, when a part of the *Aplysia* population appears to be dying of old age (see Methods), the speculation that the velocity diminution is geriatic may be warranted. However, only a mature-immature classification of specimens is permitted in the present paper, and a stronger statement about the age-relatedness of this phenomenon is impossible.

It is interesting to note that only the 3 slowest fibres had substantial, positive X-intercepts (2.3, 2.5 and 2.5 mm respectively). Since the spread of electrotonic currents is greater beyond a conduction block than beyond the active region of a normally propagating spike[7], it is possible that these large intercepts indicate the point of arrest of active propagation. Overdevelopment of membrane invagination 'trophospongium'[2] might cause such a failure.

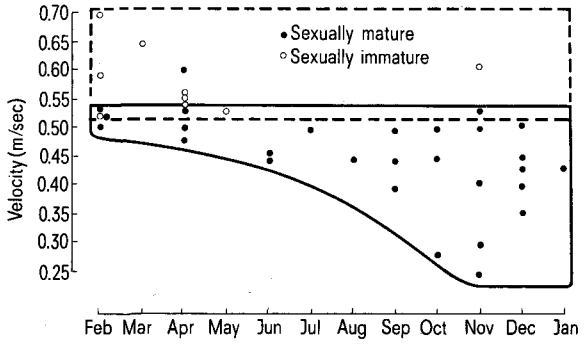

Fig. 2. R2 conduction rates in relation to the season of dissection and the sexual maturity of the specimen. The solid line indicates the hypothesized domain of conduction rates for mature animals, while the dashed line indicates the hypothesized domain for immature animals.

One final observation on the very slow R2 neurons concerns the arrival of synaptic potentials evoked by the same stimulus used to start the antidromic spike. KANDEL and TAUC[8] noted that, in *A. depilans*, an evoked excitatory postsynaptic potential (EPSP) occasionally arrived at the intracellular recording electrode before the antidromic spike elicited by the same, right connective stimulus, and they used this observation as an argument for the monosynaptic nature of the EPSP. I have found that an EPSP from the right connective can arrive at the intracellular electrode sooner than the antidromic spike (Figure 1, inset), but also, that this result reflects only an abnormally slow conduction rate in the R2 axon. That is, in the few preparations where this happened, the conduction velocity of the fibres bringing the EPSP was greater than that of the R2 axon. The velocity of these EPSP fibres was normal, as viewed in the context of measurements on more than 20 preparations.

Summary. In late winter and in spring, the conduction velocity of the R2 axon of *Aplysia californica* is 0.48 m/sec or more in all specimens. However, in the summer, fall and early winter, some sexually mature animals exhibit markedly diminished R2 conduction rates (as low as 0.24 m/sec). It is possible that this reduced velocity is a reflection of the age of the specimen from which the axon is taken.

P. R. HARLEY[9,10]

Department of Psychology and Marine Sciences Laboratory, Memorial University of Newfoundland, St. Johns (Newfoundland, Canada), 10 April 1975.

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[10] M.S.R.L. Contribution Number 176.

Protection of Sea Urchin Embryos Against the Action of Some Neuropharmacological Agents and Some Detergents by Endogenous Gangliosides

It is known that a number of neuropharmacological drugs block the cleavage divisions of early sea urchin embryos and inhibit macromolecular syntheses; these effects result from the suppressing of endogenous acetylcholine and monoamine functions[1-4]. It is also known[5,6] that: 1. increase of the concentration of the embryos strongly diminishes their sensitivity to neuropharmaca as well as to some detergents; 2. this phenomenon is based on the release of highly active endogenous substances which lower the sensitivity of the embryos either to neuropharmaca (An_1-factor) or to detergents (An_2-factor), but do not affect the sensitivity to other development blocking agents; 3. after removal of Ca^{++} from the incubation media, the protective action of these factors persists (against neuropharmaca – partly, against detergents – completely), whereas the protective action described earlier of neurotransmitters[1,2] is not observed.

We have tested the antiserotonins 1-benzyl-2-methyl-3-(2′-aminoethyl)-5-methoxyindole (BAS), 3-(2′-methyl-2′-aminopropyl) indole, 3-indolylacetaldehyde and β-

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