	Light	Dark	Light	
H. epiconcha . . .	Gametogenesis including maturation division Medusoid formation *Ca-independent*	Spawning *Ca-dependent*		
H. echinata . . .	Gametogenesis excluding maturation division	Photosensitization for completion of maturation division *Ca-dependent*	Gametogenesis completion *Ca-independent*	Spawning *Ca-dependent*

Schematic comparison of spawning process in relation to photic and ionic conditions between *H. epiconcha* and *H. echinata*

In *H. epiconcha*, darkness alone triggers off the spawning proper (membrane dissolution and pulsation). Clear antagonism between Ca- and Mg-ions exists[4]. Sea water lacking Ca, or with excess Mg, inhibits the spawning, whilst lack of Mg or excess Ca elicits spawning without the period of darkness. Gonophore development and gametogenesis proceed in light without Ca-ions.

The similar reactions of both species to light and ions are shown schematically in the Figure. Thus in both cases the process of maturation (including the maturation divisions) depends on light, but is independent of the presence of Ca-ions. The darkness, on the other hand, stimulates spawning in one case (*H. epiconcha*) and increases photosensitivity in the other (*H. echinata*). In both, events in darkness are profoundly influenced by Ca-ions, but in the former, Mg-ions are inhibitory. Again, discharge of germ cells when triggered either by the dark (*H. epiconcha*) or the light (*H. echinata*) is dependent on Ca-ions.

	Maturation	Spawning
Spirocodon saltatrix . .	dark	independent of illumination
Hydractinia epiconcha .	light	dark
Hydractinia echinata . .	partly in light	dark followed by light

Spirocodon differs in that gametogenesis begins in darkness and spawning follows automatically in due course. The part played by Ca- and Mg-ions is unknown.

[4] M. YOSHIDA, unpublished.

The different ways in which light affects the spawning of hydrozoans are summarized as above.

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Résumé

La ponte de *H. echinata* est influencée par la lumière, qui est nécessaire pendant deux périodes: d'abord pendant la gamétogenèse et plus tard (après une période d'obscurité) pour déclencher la maturation finale et la ponte.

L'effet de la lumière pendant la deuxième période ne suit pas la règle de Bunsen-Roscoe. *H. echinata* est comparée, en ce qui concerne l'action des divers facteurs, avec *Spirocodon* et *H. epiconcha*. La signification des ions de Ca et Mg est examinée.

Some Observations on the Control of the Tongue Muscles

The problem of the proprioceptive innervation of the tongue has for a long time attracted attention, no doubt for the reason that the hypoglossal nerve does not have a posterior root. The major problem, usually attacked with morphological methods only, has been whether there are any muscle spindles in the tongue and – if they are present – by which nerve and posterior root their connection with the central nervous system is established. Ear-

Effect of first illumination period and darkness on spawning. The figures for each experiment are percentages of gonophores in a given batch which spawned

Conditions		♂						♀				
		Serial No. of experiment						Serial No. of experiment				
Illumination (h)	Darkness (h)	1	2	3	4	5	6	1	2	3	4	5
18	1/4	0	0									
18	1/2	0	20	2	0					1		
18	1	11	74					7	32	30		
18	2	36	82					57	64			
18—15	3		99	43	52	76	33	40	60	39	83	78
12	6			19						36		
0	18			0	2	12	11			3	12	2
Number of isolated gonophores used in each batch		120	100	70	90	25	160	40	25	70	30	50

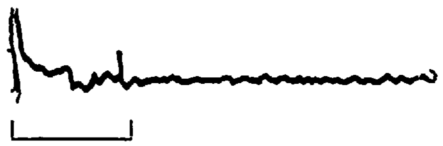
lier investigations have given contradictory results both with regard to the presence of muscle spindles and the route by which a proprioceptive innervation from the tongue should reach the central nervous system. Some authors[1–3] deny the existence of muscle spindles in the tongue muscles of the species they examined. COOPER[4] on the other hand has found spindles in man and monkey, but not in kitten or lamb. LAW[5] has presented a new type of sensory ending which she believes to be proprioceptive in nature. With regard to the route for the afferent fibres to the central nervous system the hypoglossal[2] and the lingual[6], as well as the upper cervical nerves[1], have been suggested.

Our morphological findings in the cat deny the presence of muscle spindles in the intrinsic tongue muscles and this observation, in combination with our electrophysiological experiments, rules out the hypoglossal nerve as the afferent pathway from at least the intrinsic tongue muscles. On the other hand a reflex between the lingual and the hypoglossal nerves has been found which, for the intrinsic musculature of the tongue, may to some extent substitute the proprioceptive reflex mechanism found in all other striated musculature.

Adult cats were used, either decerebrated under ether or anesthetized with chloralose (60 mg/kg body weight intraperitoneally) and some animals curarized only. The lingual and hypoglossal nerves were dissected free and cut near their entrance to the tongue. In this preparation the physiological studies were made. In some cats the tongue and the nerves mentioned were removed and prepared for morphological studies.

As stated above, it has not been possible by our morphological methods to show any muscle spindles in the intrinsic tongue musculature. This is in accordance with the calibre spectrum of the hypoglossal nerve which does not contain as many big fibres as in the muscle nerves of the extremities. Thus these few big fibres cannot account for an innervation of the rather large intrinsic musculature with ordinary muscle spindles. When stimulating and recording from the whole hypoglossal nerve no monosynaptic reflex is found with the method used. These findings indicate that the afferent pathway from the tongue receptors in the intrinsic musculature, whatever type they belong to, must be sought in some other nerve than the hypoglossal. The taste fibres and the general afferent fibres from the anterior two thirds of the tongue are known to pass in the lingual nerve. This nerve is also the afferent pathway for the linguo-mandibular reflex, first described by SHERRINGTON[7] as the jaw opening reflex and later by CARDOT and LAUGIER[8]. This reflex is considered to be nociceptive. On stimulating the lingual and recording from the hypoglossal nerve a reflex is found here called the linguo-hypoglossal.

The shortest latency of this reflex is 7 ms. It is crossed, i.e. the stimulation of the contralateral lingual nerve gives the reflex with practically no further latency. When recording is made from the whole hypoglossal nerve the reflex has two components, the first of which has a lower threshold and a bigger amplitude than the second. The fibres in the afferent path, giving the reflex, are among the fastest in the lingual nerve. To avoid possible artefacts due to simultaneous muscle twitch, the reflex has also been recorded from a single fibre preparation of the hypoglossal nerve in curarized animals (see Figure).



Curarized cat. Linguo-hypoglossalreflex, recorded in isolated filament of the hypoglossal nerve on stimulation of the ipsilateral lingual nerve.

This linguo-hypoglossal reflex, in combination with the morphological findings, indicates that the 'proprioceptive' innervation of the intrinsic tongue musculature is not arranged in the same manner as in ordinary striated musculature. A study of this reflex pathway is going on and a fuller report on its properties and relation to the extrinsic tongue muscles and their organization as well as the morphological findings will be reported elsewhere.

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Zusammenfassung

Es wird gezeigt, dass der Nervus hypoglossus die afferenten propriozeptiven Impulse der inneren Zungenmuskulatur der Katze nicht leiten kann. Ein bisher nicht beschriebener Reflex zwischen N. lingualis und N. hypoglossus wird erwähnt und seine eventuelle Bedeutung für die Propriozeption der Zunge wird besprochen.

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Light Sensitive Nerve in an Echinoid

Clear instances of direct excitation of untreated nerve by visible light are rare[1–3]. In *Diadema antillarum* Philippi, evidence has been presented, to show that the radial nerves are sensitive to decreases in light intensity[4].

The evidence was not conclusive, because the nerve cord was stimulated *in situ* by a relatively large light spot (some 1·5 mm in diameter) and therefore, despite the precautions taken, there remained a possibility (though a slight one) of light spreading, to affect other structures in the preparations.

We have now overcome this by a different technique (Fig. 1). Pieces of test (T), bearing spines and radial nerve were prepared so that a short length of the oral region of the nerve (N) lifted from the test, could be fixed on to a platform of cork painted mat black, which formed part of the clamping device (C). This portion of a preparation is shown in Figure 2.

Minute light spots (S) projected on to the radial nerve, were obtained by passing a beam from a tungsten filament lamp through the objective lens (O) carried on a microscope barrel, to the other end of which was fixed a photo-

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