

Fig. 1. Hemoglobin patterns of eels, 30 min. at 200 V. between electrodes. 1, American eel; 2, European eel; 3, Japanese eel

in toto. On the other hand, even if it was possible to demonstrate complete genetic identity of the two groups, this would only necessitate the adoption of the first part of Tucker's hypothesis, namely, the one-species conception. The question, however, of whether European eels make the return journey to the Sargasso Sea would still be left as a problem for physiologists and marine biologists to solve.

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¹ Schmidt, J., *Phil. Trans. Roy. Soc.*, B, 211, 179 (1922).

² Tucker, D. W., *Nature*, 183, 495 (1959).

³ Sick, K., *Nature*, 192, 894 (1961).

⁴ Fechheimer, N. S., *Nature*, 188, 247 (1960).

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WHILE I am in substantial agreement with the conclusions of Dr. Sick *et al.*, I feel that there is still an important point to be emphasized. The hemoglobin tests show a close affinity between the American and European eels as opposed to the Japanese. They are therefore in striking contrast to the biometric criteria hitherto applied by taxonomists of Schmidt's school¹, for these, on the contrary, showed an apparently close relationship between the European and Japanese species as opposed to the American:

	Vertebral counts		
	Range	M	μ
<i>A. rostrata</i>	103-111	108	107.23
<i>A. anguilla</i>	110-119	115	114.73
<i>A. japonica</i>	112-119	116	115.82

The hemoglobin tests, in fact, show a reasonable distinction between Atlantic and Pacific species while

the meristic characters do not; so much the worse for the latter as taxonomic criteria which, in any event, are already known to be subject to environmental modification by temperature and salinity differences².

Serological investigations may also be useful, provided due regard is paid to matching the physiological conditions of the fishes to be compared.

All these studies may usefully be extended to the several Indo-Pacific groups of *Anguilla* species¹, for it seems very probable that their relationships are open to a similar interpretation to that which I have postulated for the Atlantic ones².

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ENTOMOLOGY

Effect of Oxygen on Cyanide Poisoning in Insects

CYANIDE toxicity is closely associated with respiratory inhibition and, in many forms of life, death is attributed to disruption of oxidative metabolism through inhibition of the enzyme cytochrome oxidase. In insects also, cyanide inhibits the terminal oxidase, and it has been shown that in the insect heart cyanide sensitivity is closely associated with aerobic metabolism¹.

The chemical exclusion of oxygen as brought about by enzyme inhibition has led to the effective use of oxygen in the therapy of cyanide poisoning in mammals². Apparently, for reasons not fully understood, the application of pure oxygen tends to compensate for the oxygen chemically excluded from the organism. If the lethal effects of cyanide on insects are the result of interruption of respiratory metabolism then, by analogy, one might expect beneficial effects when oxygen is applied. It was found, however, that oxygen produced detrimental effects on insects after they had been fumigated with hydrogen cyanide: oxygen increased the toxic effects of cyanide while complete exclusion of it decreased these effects and allowed more insects to recover.

Adults of *Sitophilus granarius* (L.) and larvae of *Tenebrio mauritanicus* (L.) were exposed to gaseous hydrogen cyanide and then placed either in pure oxygen, pure nitrogen or air for 46 hr. Greater mortality occurred in those insects exposed to oxygen than in those from which it was excluded (Table 1).

Investigation of the respiratory response of the treated insects in the different concentrations of oxygen showed that respiration resumed soon after application of oxygen, but it was delayed for several hours when the insects were left in air (Fig. 1). Insects deprived of oxygen for 46 hr. began to respire immediately on return to air.

Table 1. MORTALITY OF INSECTS PLACED IN OXYGEN, NITROGEN AND AIR FOR A PERIOD OF 48 HR. AFTER TREATMENT WITH HYDROGEN CYANIDE (36 MG./L.)

Insect species	Time exposed to hydrogen cyanide (min.)	Mortality (per cent)		
		O ₂	Air	N ₂
<i>S. granarius</i> adults	1	80	28	17
	2	78	55	36
	3	97	50	43
	4	97	51	45
<i>T. mauritanicus</i> larvae	1	7	6	3
	2	47	3	11
	3	60	11	31
	4	86	31	31

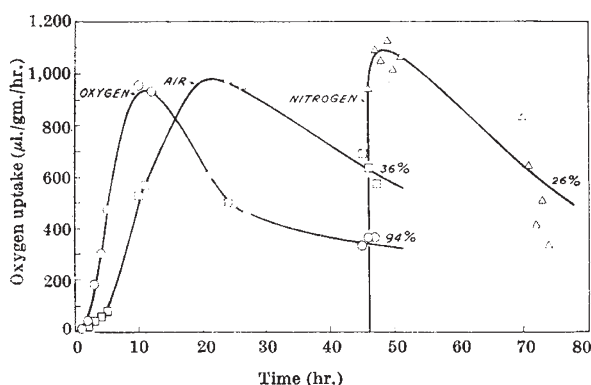


Fig. 1. Oxygen consumption of *S. granarius* adults treated with gaseous hydrogen cyanide (36 mgm./l. for 3 min.) then placed in pure oxygen, air or pure nitrogen for 46 hr. (Percentage mortality of insects indicated at end of each curve)

These results show that respiratory inhibition as brought about by cyanide poisoning could be partially overcome by increasing the oxygen concentration, but rapid resumption of aerobic metabolism after treatment was detrimental to the insect. It may be that, in oxygen, active metabolism is resumed while the enzyme catalase is still inhibited, thus allowing toxic peroxide to accumulate. On the other hand, the delay in the resumption of aerobic metabolism, as brought about by exclusion of oxygen, may be beneficial in either or both of two ways: it may allow detoxifying mechanisms to remove cyanide from the sites of action and/or it may allow for vital substances, depleted by cyanide poisoning, to be regenerated.

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Blood Feeding by *Philoliche (Dorcaloemus) silverlocki* Austen (Diptera, Tabanidae)

THE feeding of *Philoliche (Stenophara) inornata* Austen and *P. (Stenophara) schwetzi* Austen has been described by Schwetz¹. Schwetz found that in these two species the proboscis, including the labrum and enclosed stylets, was used as a whole for both flower feeding and blood sucking.

Oldroyd² has suggested that in the sub-genera with a shorter labium in which the stylets reach as far as the labellæ (as, for example, in *Dorcaloemus*), the labium and stylets may similarly be used as a compound-piercing organ.

Observations were made by me on specimens of *Philoliche (Dorcaloemus) silverlocki* Austen attracted to bait cattle but feeding on human beings near the Lundi River in the south-east of Southern Rhodesia during the flight season of this species (January-March 1961). These flies invariably attacked men in the region of the ankle and cattle on the lower part of the legs. They appear to show a preference for dark-coloured skin, as Africans were attacked far more frequently than Europeans in the same party.

When attempting to feed on man the flies would hover around the ankle, touching the skin with the

tip of the proboscis. If the flies alighted on the skin penetration of the skin would commence immediately. At first it appeared that, as suggested by Oldroyd and the observations of Schwetz, the whole proboscis, including the labium and labellæ, was inserted as a unit, but further close observations with the aid of a low-power binocular microscope showed conclusively that this was not the case, but that the labellæ were applied close to the point of puncture and the labium became folded back close under the head as the stylets were driven more deeply into the skin with rapid vibratory movements. On one specimen observed the labium became displaced to one side after the uptake of blood had commenced with apparently no adverse effect on the process.

The flies often probed two or three times before starting to feed; but once feeding commenced it was completed in about 1 min. When the proboscis was withdrawn the labellæ appeared to be used to clean the stylets and the whole proboscis was wiped rapidly with the forelegs.

When the proboscis was withdrawn either after probing or feeding, a large drop of blood usually exuded from the site of the puncture. After-effects at the site of the puncture were usually negligible, but on occasion considerable local irritation occurred.

Fed flies were observed resting on nearby vegetation.

The feeding method was also observed in the closely related species *Philoliche (Dorcaloemus) medialis* Oldroyd and appeared to be identical to that described above.

These observations indicate that the feeding process in *Dorcaloemus* is closely comparable with that in *Chrysops* as described by Gordon and Crewe³. It would appear that the flexing back of the labium during feeding is the more general mechanism in the Tabanidae while the insertion of the whole proboscis as a unit is a less-common adaptation that requires further investigation.

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Lactate Dehydrogenase in Some Insect Muscles

IN the metabolism of mammalian muscle lactate dehydrogenase plays a key part by catalysing, during contraction, the formation of lactate from pyruvate, the major glycolytic product. On relaxation the reverse process occurs and pyruvate is metabolized via the tricarboxylic acid cycle. While there is evidence¹⁻³ that glycolysis is the major source of energy for muscular contraction in some insects, it is clear that other insect muscles directly utilize fats⁴⁻⁶. As lactate dehydrogenase is not a component of the enzyme systems involved in fat metabolism, it is apparent that the concentration of lactate dehydrogenase in an insect muscle offers an insight into the metabolism of the contractile process.

We have determined the lactate dehydrogenase concentrations in the muscles of four insect species; all members of the order Orthoptera. Two of these species, the praying mantis (*Orthodera ministralis*)