Table 1. Serotonin and monoamine oxidase in lung. The figures for serotonin content represent the average values obtained in several animal experiments, and those in parentheses give the number of animals used. The figures for monoamine oxidase activity represent the average values obtained on two or more animals.

Species	Serotonin content (μg/g)	Monoamine oxidase activity (μg destroyed/g hr)
Mouse	1.9 (12)	960
Rat	2.3 (9)	960
Rabbit	2.1 (11)	1200
Guinea pig	0.2 (10)	1800

be responsible for some of the manifestations of the anaphylactic reaction. Humphries and Jaques (*3*) demonstrated that addition of purified antigen and antibody to normal rabbit platelets suspended in plasma released both serotonin and histamine from the platelets. Herxheimer (*4*) reported a relationship between tolerance to serotonin and desensitization in the guinea pig. Waalkes *et al.* (*5*) have recently shown that serotonin, as well as histamine, is released in rabbit blood (*in vitro* and *in vivo*) during anaphylactic shock.

Since serotonin is a potent bronchoconstrictor (*6*), the studies reported here were undertaken to determine whether it may play a part in the pulmonary aspects of anaphylaxis.

The serotonin content of lung homogenates was determined spectrophotofluorometrically (*2*). 5-Hydroxytryptophan (5HTP) decarboxylase activity was measured by the procedure of Clark *et al.* (*7*), and monoamine oxidase activity was measured by the procedure described by Sjoerdsma *et al.* (*8*).

Serotonin was found in relatively high concentration in lung. The amounts present in lung of several animal species are shown in Table 1. Not only was serotonin itself found to be present in lung, but also the enzymes which make it (5-hydroxytryptophan decarboxylase) and destroy it (monoamine oxidase). The latter was found to be present in high concentration (Table 1). The decarboxylase activity was relatively weak, less than 15 μg of 5-hydroxytryptophan being converted to serotonin per gram of lung, per hour, in any of the species investigated.

It is of interest that guinea pig lung contains little if any serotonin, whereas mouse lung contains relatively large amounts. It is known that mouse lung contains little histamine, whereas the histamine content of guinea pig lung is relatively high (*9*). These findings may explain some interesting observations that have been made in the past. Thus, in guinea pigs, the pulmonary aspects of anaphylactic shock appear to be completely explained on the basis of histamine release, and antihistaminic agents can block the effects almost completely (*10*). On the other hand, antihistaminic agents have little influence on anaphylactic shock in the mouse (*11*). Lysergic acid diethylamide, an inhibitor of the actions of serotonin on smooth muscle, has been reported to protect against an anaphylactic-type response (*12*). In rats and rabbits and in other species in which both serotonin and histamine are present in lung, both agents should be considered in explaining the pulmonary effects seen in anaphylaxis.

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References

1. I. H. Page, *Physiol. Revs.* 34, 563 (1954); V. Erspamer, *Pharmacol. Revs.* 6, 425 (1954).
2. D. F. Bogdanski *et al.*, *J. Pharmacol. Exptl. Therap.* 117, 82 (1956).
3. J. H. Humphries and R. Jaques, *J. Physiol.* 128, 9 (1955).
4. H. Herxheimer, *ibid.* 128, 435 (1955).
5. T. P. Waalkes *et al.*, *J. Pharmacol. Exptl. Therap.*, in press.
6. J. H. Comroe *et al.*, *Am. J. Physiol.* 173, 379 (1953).
7. C. T. Clark, H. Weissbach, S. Udenfriend, *J. Biol. Chem.* 210, 139 (1954).
8. A. Sjoerdsma *et al.*, *Proc. Soc. Exptl. Biol. Med.* 89, 36 (1955).
9. S. M. Rosenthal and H. Tabor, *J. Pharmacol. Exptl. Therap.* 92, 425 (1948).
10. P. Armitage, H. Herxheimer, L. Rosa, *Brit. J. Pharmacol.* 7, 625 (1952).
11. M. A. Fink and M. V. Rothlauf, *Proc. Soc. Exptl. Biol. Med.* 90, 477 (1955).
12. M. A. Fink *ibid.* 92, 673 (1956).

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First Discovery of Marine Wood-Boring Copepods

Marine wood borers are known to occur in the following animal groups: Pelecypoda (for example, *Teredo, Bankia,* and *Martesia*) and the crustacean orders Isopoda (for example, *Limnoria*) and Amphipoda (for example, *Chelura*) (*1*). The wood-boring habit has not been previously reported for the crustacean order Copepoda; however, Bocquet (*2*) recently described an algal-boring harpacticoid copepod, *Diarthrodes feldmanni,* from France.

While studying the biology of marine wood borers (*3*), we discovered several species of copepods that had wood material in their digestive tracts. These copepods were found in culture dishes in which populations of *Chelura terebrans* Philippi had been maintained but had died. Despite cleaning of the dishes, new woody fecal matter continued to be deposited and copepods were found browsing on the surface of the wood in a manner similar to that of *Chelura terebrans* (*4*).

Individual copepods were isolated and reared through several generations in petri dishes that were supplied only with sea water and chips of Douglas fir. Fecal matter similar in composition to that of *Chelura terebrans* (*4*) was produced by the copepods. Unlike the active borers *Teredo* and *Limnoria,* the copepods made no discrete holes.

Five species of wood-boring harpacticoid copepods belonging to the genera *Tisbe, Amphiascus,* and an unknown genus were isolated from test blocks collected in Los Angeles and Long Beach harbors, California (*5*).

Wood blocks were suspended at ten stations in Los Angeles and Long Beach harbors for 28-day intervals from November 1955 to November 1956. Copepods were observed throughout the year at many of the stations. However, the greater number of specimens was taken during the winter months. This may be the result of lower water temperatures, generally higher amounts of dissolved oxygen, and lesser quantities of fouling organisms settling on the blocks. It is possible that the copepods need certain amounts of debris or fouling organisms for protection. Test blocks that were grooved prior to use contained a greater number of specimens than smooth blocks; this was similar to what was observed with *Chelura* (*4*). Correlation with temperature and dissolved oxygen in Los Angeles and Long Beach harbors showed that the animals were present on the test blocks when the sea water temperature ranged from 15° to 20°C and when the dissolved oxygen content of the water was above 1.1 ppm. The animals did not occur on the wood blocks when the dissolved oxygen was lower than 1.1 ppm at the time of collection.

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References and Notes

1. W. T. Calman, *Brit. Museum Nat. Hist. Econ. Ser.* 10, 1 (1936).
2. C. Bocquet, *Bull. soc. zool. France* 78, 101 (1953).
3. This report is contribution No. 188 from the Allan Hancock Foundation, University of Southern California.
4. J. L. Barnard, in *Essays in the Natural Sciences in Honor of Captain Allan Hancock* (Univ. of Southern California Press, Los Angeles, 1955), p. 87.
5. A report on the systematics and the biology of these copepods is in preparation.

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