

# This Week's Citation Classic

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**Roth L M & Eisner T.** Chemical defenses of arthropods.

*Annu. Rev. Entomol.* 7:107-36, 1962.

[Central Res. Labs., United Fruit Co., Norwood, MA and Dept. Entomol., Cornell Univ., Ithaca, NY]

**This paper reviewed the literature dealing with the defensive repugnatorial or odoriferous glands of arthropods, whose liquid or vaporous secretions protect them from predators. Subjects discussed included defensive gland structure, chemical nature of the defensive secretions, effectiveness of the secretions, and medical and commercial implications. [The SC/® indicates that this paper has been cited over 115 times since 1962.]**

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"I became interested in chemical defenses of insects about 40 years ago when I studied the odoriferous secretions of the confused flour beetle for my MS thesis. Then, following four years in the army during World War II, I returned to complete my PhD thesis which dealt with mosquito sexual behavior. After receiving my degree, I helped to establish a basic research entomology laboratory for the US Army Quartermaster Corps, whose interests, at the time, included the investigation of the biologies of insects of economic and medical importance to the armed services.

"We studied insect sex attractants and defensive secretions of several pests long before these chemical compounds were called pheromones and allomones. The late 1940s through the 1960s were the golden years for basic research and I reflect on these times as the BR years, i.e., Before Relevance. (I've heard at least one military man, and others, who said our work should be 'relevant.')

 Not infrequently, we had

problems justifying our research to the military. I recall that during an annual review of our research program, a colonel said, 'I understand you have just identified a defensive secretion given off by a cockroach. Tell me, of what use is this information to a tank commander on maneuvers in the Arizona desert?' I replied that the tank commander would have to wait about ten years for the answer because that was the usual length of time required for basic information to be put to practical use. Shortly afterwards, the colonel was transferred to Korea — and my laboratory was 'phased out.'

"About 1955 I met Thomas Eisner, then at Harvard University, who had become interested in chemical defenses in arthropods. When I was requested to write a review article on the subject, I asked him to coauthor the paper. The paper was begun when I was with the Pioneering Laboratories, US Army Natick Laboratories, in Natick, Massachusetts, and was completed after I left this organization and was with the United Fruit Company Laboratories. Since then, Eisner and his colleagues and students at Cornell University have become leading investigators in this field.<sup>1</sup>

"The only reason I can think of for this paper being cited frequently (which came as a surprise to me) is that it surveyed the literature of the subject at the right time. Rachel Carson's book *The Silent Spring* appeared about this time and in it she stressed the importance of developing new methods of pest control to avoid the widespread use of toxic chemical pesticides.<sup>2</sup> The interest in naturally occurring chemicals which control, or influence, insect behavior has continued, if not increased, over the last two decades.<sup>3-5</sup> Hundreds of sex attractants and defensive secretions have been identified and several of the former compounds have been useful in integrated pest control programs."

1. **Eisner T.** Chemical defense against predation in arthropods. (Sondheimer E & Simeone J B, eds.) *Chemical ecology*. New York: Academic Press, 1970.
2. **Carson R.** *The silent spring*. Boston: Houghton Mifflin, 1962. 368 p.
3. **Beroza M, ed.** *Chemicals controlling insect behavior*. New York: Academic Press, 1970. 170 p.
4. **Roth L M & Alsop D W.** Arthropod venoms. (Bettini S, ed.) *Handbook of experimental pharmacology*. New York: Springer-Verlag, 1978. p. 465-88.
5. **Ritter F J, ed.** *Chemical ecology: odour communication in animals*. New York: Elsevier-North Holland, 1979. 427 p.