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Lee R F, Sauerheber R & Dobbs G H. Uptake, metabolism and discharge of polycyclic aromatic hydrocarbons by marine fish. *Mar. Biol.* 17:201-8, 1972. [Scripps Institution of Oceanography, University of California, La Jolla, CA]

The study was on the uptake, metabolism, and discharge of two polycyclic aromatic hydrocarbons by marine fish. The path of hydrocarbons through the fish included entrance into the gills, transfer to the blood, metabolism by the liver, transfer of hydrocarbons and their metabolites to the bile, and finally excretion. [The SCI® indicates that this paper has been cited in over 110 publications since 1972, making it the 5th most-cited paper published in this journal.]

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"My thesis research at Scripps Institution of Oceanography in the laboratory of A.A. Benson was on sulfonic acid metabolism in algae. While finishing up this research, I came across reports in the newspaper and scientific literature about the effects of oil spills on marine life, since several large spills had recently occurred on both the east and west coasts of the US. After reading these papers, I became interested in the fate of petroleum components in marine animals.

"A study was carried out by using fish in a small aquarium where radiolabeled hydrocarbon (C-naphthalene or benzo(a)pyrene) was added to the water. Dissection of fish after various times revealed radioactivity first entered the gills followed by passage through the blood into the liver. Thin-layer chromatography showed that much of the radioactivity was associated with metabolites and not the parent hydrocarbon. Gary Dobbs was a fellow graduate student at Scripps who was carrying out research on the physiology of fish kidneys. In some

casual conversations with him about the work we were doing, he volunteered to use a technique he had developed to empty the bladder of fish. Using this technique, we sampled the urine at various times and found appreciable radioactivity that was in the form of highly polar metabolites.

"After these experiments, Richard Sauerheber joined the lab as an undergraduate researcher to continue this work while I left to begin a postdoc in the laboratory of S. Patton at Pennsylvania State University. I called Richard with some frequency from Penn State and he continued experiments with fish. He mentioned that after a few days most of the radioactivity was in the gallbladder of the fish. A very cold January walk, for a California boy, to the Penn State library, turned up several papers showing that, in rats, xenobiotic metabolites accumulated in the bile. Thus, feeling our work was of some importance I wrote up a manuscript, sent it to Benson for his review, and soon after we submitted it for publication.

"Since our work, a large number of papers on the uptake and metabolism of polycyclic aromatic hydrocarbons by marine fish have appeared. A recent book by Jerry Neff reviews progress in this field.¹ One tissue we failed to dissect was the brain, which Jack Anderson and Neff, now at Batelle Laboratories, found accumulated hydrocarbons.² D. Malin, U. Varanasi, and co-workers at the National Oceanic and Atmospheric Administration laboratory in Seattle using high performance liquid chromatography have identified the various aromatic hydrocarbon metabolites produced by fish.³ The pharmacokinetic behavior of aromatic hydrocarbons in fish has been recently described.⁴

"I suspect our work is highly cited because we were among the first to examine the metabolism of hydrocarbons by marine animals. Although pleased that the article is heavily cited, it is interesting that the work was always a small side project for all of us. Since that early work on hydrocarbons, I have carried out research on marine invertebrate cytochrome P-450 systems which carry out the oxidation of various xenobiotics and steroids."

1. Neff J M. *Polycyclic aromatic hydrocarbons in the aquatic environment: sources, fates, and biological effects*. London, England: Applied Science Publishers, 1979. 262 p.
2. Neff J M, Cox B A, Dixit D & Anderson J W. Accumulation and release of petroleum-derived aromatic hydrocarbons by four species of marine animals. *Mar. Biol.* 38:279-89, 1976.
3. Gmur D J & Varanasi U. Characterization of benzo(a)pyrene metabolites isolated from muscle, liver and bile of a juvenile flatfish. *Carcinogenesis* 3:1397-403, 1982.
4. Spacie A, Landrum P F & Laversee G J. Uptake, depuration and biotransformation of anthracene and benzo(a)pyrene in bluegill sunfish. *Ecotoxicol. Environ. Safety* 7:330-41, 1983.