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Citation Classics

Bligh E G & Dyer W J. A rapid method of total lipid extraction and purification. *Can. J. Biochem. Physiol.* **37**: 911-917, 1959.

Lipid decomposition studies in frozen fish have led to the development of a *simple, rapid,* and *reproducible* method for the extraction and purification of lipids from biological materials. The method has been applied to fish muscle and may easily be adapted to use with other tissues. [The *SCI*® indicates that this paper was cited 2,554 times in the period 1961-1977.]

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"The Bligh and Dyer method has certainly been widely used, and it is most gratifying to have it identified as a Citation Classic. It all began back in the 1950s at the Halifax Laboratory of the Fisheries Research Board of Canada, where Dr. William J. Dyer and his group were investigating the deterioration of fish muscle proteins during frozen storage. The group's pioneering work attracted international attention and stimulated a great deal of research in similar laboratories around the world. They had found that protein denaturation in frozen fish muscle contributed substantially to consumer rejection of frozen seafoods and that it was accompanied by lipid deterioration, particularly hydrolysis. When I returned to the group in 1956, following graduate work at McGill University, my task was to investigate the role of lipids in the continuing research program on deterioration in frozen-stored fish.

"On initiating this lipid study, the well-known need for a gentle and reliable method for extraction and purification of total lipid from biological tissues became acute. We were working with cod muscle, where the highly unsaturated lipids rarely exceeded 1 % wet weight and consisted primarily of protein-bound phospholipid. Existing procedures were unsatisfactory and attention was focused on the use of mixtures of chloroform and methanol to isolate the lipids from moist biological materials.

"Examination of the chloroformmethanol-water phase diagram led to the hypothesis that 'optimum lipid extraction should result when the tissue is homogenized with a mixture of chloroform and methanol which, when mixed with the water in the tissue, would yield a monophasic solution. The resulting homogenate could then be diluted with water and/or chloroform to produce a biphasic system, the chloroform layer of which should contain the lipids and the methanol–water layer the nonlipids.' The hypothesis was readily confirmed by experimentation and the method was proven to be very effective. It was enthusiastically accepted by the scientific community, and after 19 years, it is still being used extensively in research laboratories throughout the world, on a host of biological materials.

"I would mention that as a small government research laboratory, we were not encouraged to do fundamental research but in the course of providing a research and development service related to the problems of the Canadian seafood industry, we were continualy faced with situations where basic scientific knowledge was inadequate. This is even more true today as the world directs greater attention toward the oceans and their resources. Although Dr. Dyer is now retired, his colleagues continue to pursue the challenges in fisheries science at the Halifax Laboratory where I am now Director."