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Fish toxicologic pathology: the growing credibility gap and how to bridge it

J. C. Wolf

Experimental Pathology Laboratories, Inc., Sterling, Virginia, USA

Abstract

Histopathology is a mainstay of laboratory and environmental fish toxicology studies. This versatile endpoint can be used to screen for effects of chemical exposures, determine no effect concentrations, provide clues to modes/mechanisms of action, evaluate the effectiveness of pharmacologic therapies and environmental remediation efforts, and assess the background health of test subjects. Unfortunately, recent reviews of the literature suggest that the credibility of histopathology findings in peer-reviewed journal articles is often less than desirable, and there is evidence that this situation may be worsening. Key weaknesses include inadequate experimental design, inferior histologic preparation, inaccurate diagnostic interpretation, inexpert manuscript creation, and ineffectual manuscript review. On the brighter side, it is evident that there are multiple stages in the research and reporting process where innovations may be instituted to improve the quality of published histopathology results. This paper will briefly explore the causes of poor data quality in fish toxicology studies, and provide suggestions for bridging the widening credibility gap.

Introduction

The examination of fish tissues for evidence of disease is a discipline that dates back to the dawn of scientific inquiry (Sneiszko, 1975). Yet for most of its existence, the field of fish pathology was focused on infectious disorders caused by parasites, bacteria, and later, viruses. The realisation that cancers and other adverse health disorders in fish might result from exposure to environmental contaminants occurred only as recently as the 1960s, when the relationship between primary liver tumors in trout and aflatoxins in their feed was elucidated (Bailey et al., 1996). Fast forward another half century, and the current technology allows us to investigate complex toxicological mechanisms

using transgenic zebrafish, or screen hundreds of chemical substances simultaneously for safety in fish embryos.

Throughout recent history, however, one of the mainstays of fish pathology has been the ability to evaluate microscopic sections of histologically prepared fish tissues. For example, a recent PubMed search of the terms “fish” and “histopathology” (and excluding hits for “fluorescent *in situ* hybridisation” and “fish oil”) yielded 10,691 responses, with 893 responses alone in 2016 (PubMed, 2017). Given how frequently this technique is employed as a research and diagnostic tool, it would be reasonable to assume

* Corresponding author's email: jwolf@epl-inc.com