ABSTRACT

Extensive collections of histopathology materials from studies of marine and freshwater mollusks, crustaceans, echinoderms, and other organisms are archived in the Registry of Tumors in Lower Animals (RTLA), the U.S. Environmental Protection Agency, NOAA’s National Marine Fisheries Service, and other agency or academic institutions. These collections are valuable resources for scientists seeking to understand health/disease in diverse species, train new invertebrate pathologists, predict risks from biotic/abiotic stressors (e.g., toxicant impacts on organisms in multiple locations), determine disease status through DNA extraction and analysis, supply data for historical reconstructions (e.g., when a virus first affected a host species), examine trends in parasite distribution and prevalence, and improve interpretation of host/parasite population fluctuations for modeling ecosystems. However, they are in danger. For example, RTLA’s collection (www.pathology-registry.org) now at Experimental Pathology Laboratories, Sterling, VA, formerly National Cancer Institute funded, lacks current funding for maintenance or processing of additional case submittals. To ensure future availabilities of these irreplaceable resources, online databases with cross-linking records of materials for search and retrieval—as is being developed for the EPA’s Atlantic Ecology Division’s collections—can provide access, but these collections need cross-agency support to improve their database capabilities, maintain histo-slides, and provide hands-on examination and study.

EDUCATION & TRAINING

HISTOLOGY FOR ENVIRONMENTAL SCIENTISTS

Developed Dr. Esther Peters and offered by George Mason University, Department of Environmental Science and Policy, Spring Semester 2007.

This advanced laboratory course introduced students to the basics of histology and how investigations of organism structure and function using light microscopy provides environmental problem. Graduate students learned how to interpret various pathologies using case studies learned from various archived collections which involved current issues in environmental science—community diversity, population dynamics, toxicology, and global changes.

Environmental scientists often play the role of crime scene investigators, attempting to tease out the cause(s) of ecosystem degradation (the crimes) by examining changes occurring in the diversity and health of the organisms living in a particular ecosystem (the victims). One of the most useful tools in this endeavor is the study of cells, tissues, organs, and organ systems. Microscopic anatomy, also known as histology, provides a visual record and bridge between changes occurring in cells and organisms as a result of exposure to physical, chemical, and biological stressors, and the impacts to populations, communities, and ecosystems. Pathologists learn in medical school to apply histo-techniques to help solve human health issues, but scientists are not often trained in this field to help solve animal health and ecosystem condition issues.

COMPARATIVE MORPHOLOGY

Dissected Pacific white shrimp, Litopenaeus vannamei, with hemopathological abnormalities. The mass has multiple cysts on its surface. The specimen was found in a culture panel contributed to the RTLA by Dr. Alan Hanson on 6/14/2005, Texas Veterinary Medical Diagnostic Laboratory. The H&E-stained tissue section shows aberrant eosinophilic figures in some areas, and extensive hemolymph-filled stroma of the interior of the mass. This contribution proved valuable in confirming the neoplastic status of this ParaXanthomonas spp. submissions to the RTLA in the 1970s. All of these shrimp lesions were diagnosed as epidermal papillomas.

DISSEMINATED NEOPLASIA

There are 47 cases of soft-shell clam, M. arenaria, with bloomed lesions in the RTLA from the last 40 years submitted from Maine, Rhode Island, Maryland, and California. Analysis under transmission electron microscopy (TEM) of lesions seen in Connecticut archived clams has revealed herpesvirus. The extracted viral DNA is currently being sequenced.

Are these cases all herpesvirus?

RESEARCH

There are 47 cases of soft-shell clam, M. arenaria, with bloomed lesions in the RTLA from the last 40 years submitted from Maine, Rhode Island, Maryland, and California. Analysis under transmission electron microscopy (TEM) of lesions seen in Connecticut archived clams has revealed herpesvirus. The extracted viral DNA is currently being sequenced. By extracting viral DNA from paraffin blocks with modern scientific technology, researchers can use archived materials from the past to compare with lesions seen in present day to determine etiologies and see trends.

SUMMARY

Archived collections of tissues from diverse organisms exist around the world. These collections are not only in natural history museums or tissue registries developed for specific study purposes, but also in universities, state agencies, public and private research laboratories, and even in individual researcher’s basements. Tissues have been preserved and processed into stained sections for histological examination for more than 150 years. These resources can be invaluable for studying changes in the ecology, morphology, physiology, biochemistry, systematics, genetics, parasites, and diseases of species over long time periods. Identification of these irreplaceable resources and development of online databases with cross-linking records of materials for search and retrieval will be critical to future scientists. Cross-agency support is needed to make the records available on the Internet, as well as to maintain the histo-slides and related materials, and only dedicated efforts will keep them accessible for continued examination with innovative technologies by inquiring minds.

Are BRANCHIAL LESIONS IN ARCHIVED SOFT-SHELL CLAMS CAUSED BY THE SAME VIRUS? DNA COULD BE THE KEY TO UNLOCK THIS TREASURE CHEST!