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Fish-An Ideal Model for Immunology Teaching and Research

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Editorial

Immunology has become a 'hot area' for biomedical teaching and research. This is because of the increasing occurrences of infectious, autoimmune and malignant diseases and the rat-race to find aetiology of them and cure for them. From the time Immunology was recognized as a subject area in biology, mammalian models like mouse, rat, guinea pig and rabbit are the favourite organisms for bio-medical teaching and research. In developing countries like India where immunology is taught as a required course in undergraduate and postgraduate programmes in bio-medical and life sciences, the students seldom have a first-hand experience in animal handling for experimental purposes. This is because of the cost involved in maintaining good animal house with qualified technicians and veterinarians. Apart from these issues, clearance from Institutional Animal Ethical Committee (IAEC) is also becoming increasingly difficult. At this juncture, Nile tilapia, *Oreochromis niloticus* is proposed and recommended here as a suitable model for laboratory teaching of Immunology [1,2]. As a widely cultured species, Nile tilapia is fairly available throughout the world especially in Asia, Africa and South America. The fish is fairly sturdy and easily adaptable to laboratory conditions. It can survive over a broad temperature (eurythermal) and salinity (euryhaline). Nile tilapia weighing 30-50g is very much suitable for demonstrating various immunological techniques like, dissection of lymphoid organs, separating lymphocytes from blood and lymphoid organs, raising hyper immune serum, serum non-specific and specific immunological mechanisms (serum lysozyme, myeloperoxidase and antiprotease activities, production of reactive oxygen species(ROS) and reactive nitrogen intermediate (RNI) by phagocytes, production and estimation of antibody etc.).

The advantages of using fish model for teaching immunology discussed above hold good for immunology researchers as well. Here, Zebrafish is one of the best options available for immunology researchers [3,4]. Complete genome of zebrafish is available and it shares many homologous genes with human beings. The perception of 'lack of complete immune system' in lower vertebrates like fishes is fast diminishing due to the sincere efforts of fish immunologists who deciphered and delineated the structure and function of immune system of fish. Zebrafish is proven to possess all the repertoires of cell-mediated and humoral immune mechanisms that are present in humans. Zebrafish has the same set of cytokines and chemokines (TNF, IFN, CXC etc.) that are present in humans. Recently, it has been proved that zebrafish possess subsets of T-lymphocytes ($CD4^+$, $CD8^+$ T cells etc.) similar to that of mammals and T-cell dependent antigenicity. Apart from these, zebrafish are small and easier to maintain. They require far less space, facilities and technicians compared to that for mammalian models. Genetic manipulations are generally fast and reliable in zebrafish compared to that of mice and guinea pigs. The fascinating part is the transparency of fish which aids in performing cutting edge techniques like whole organism in-situ hybridisation (WISH) and many other microscopic manipulations. The small genome of zebrafish makes it a favourite candidate for reverse genetics which is not possible with a mouse or chimpanzee. Research with zebrafish is really high throughput as you can add 10-15 embryos/well in a 96-well plate and give as many as treatment that one can

envisage. Due to the resilient work of scientists, zebrafish can now be used to model some of the human diseases as well! Couple of established disease models include tuberculosis and muscular dystrophy. Hence, zebrafish is not lesser than any mammalian model to study immunology and in fact it is better than mammalian models in terms of duration and ease of experimentation, maintenance, manipulations and ethical clearance.

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