CUBE
Collaborative
Undergraduate
Biology
Education

ZEBRAFISH

Danio rerio

A CUBE model system presentation

BY - ISHITA, TEJASRI and
SUJITH

OVERVIEW

INTRODUCTION TO ZEBRAFISH

Morphology , classification and remarkable features

IDEAL MODEL SYSTEM

Why we chose Zebrafish?

PAST CUBIST WORK

Standardisation of home setup and egg collection

ONGOING RESEARCH

Zebrafish embryo as a model organism for immunogenic studies ,experimental design

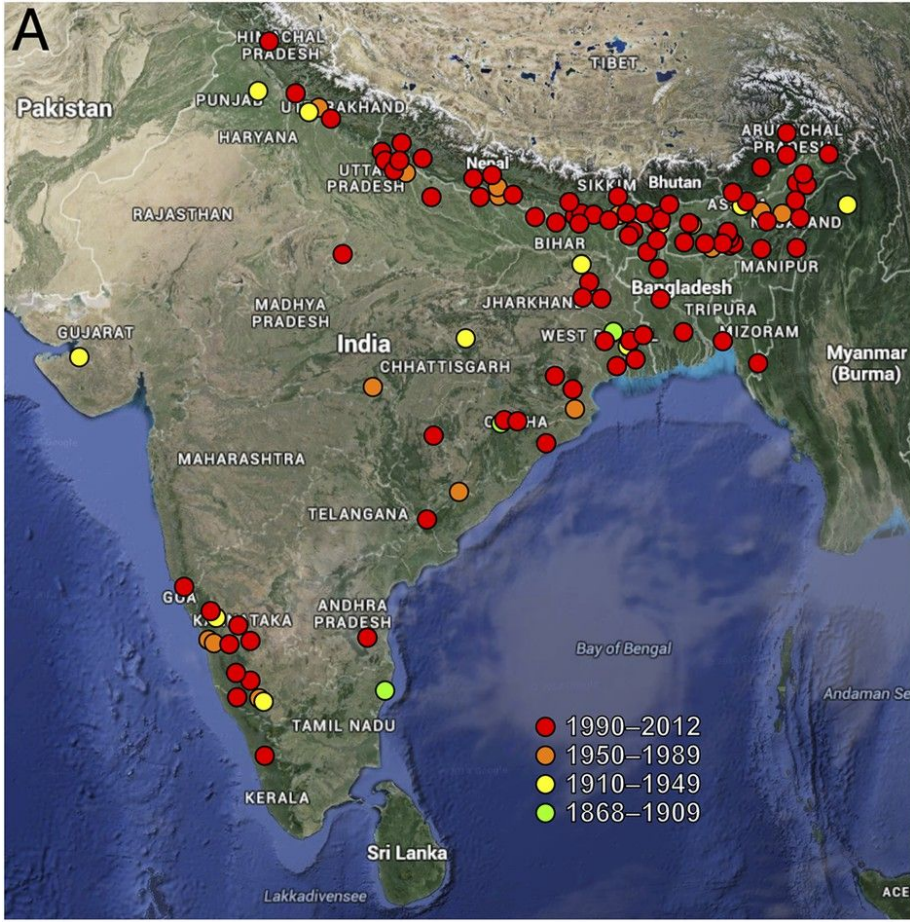
Starring zebrafish

zebrafish (*Danio rerio*) is a freshwater fish native to Southeast Asia.

https://www.yourgenome.org/facts/why-use-the-zebrafish-in-researc

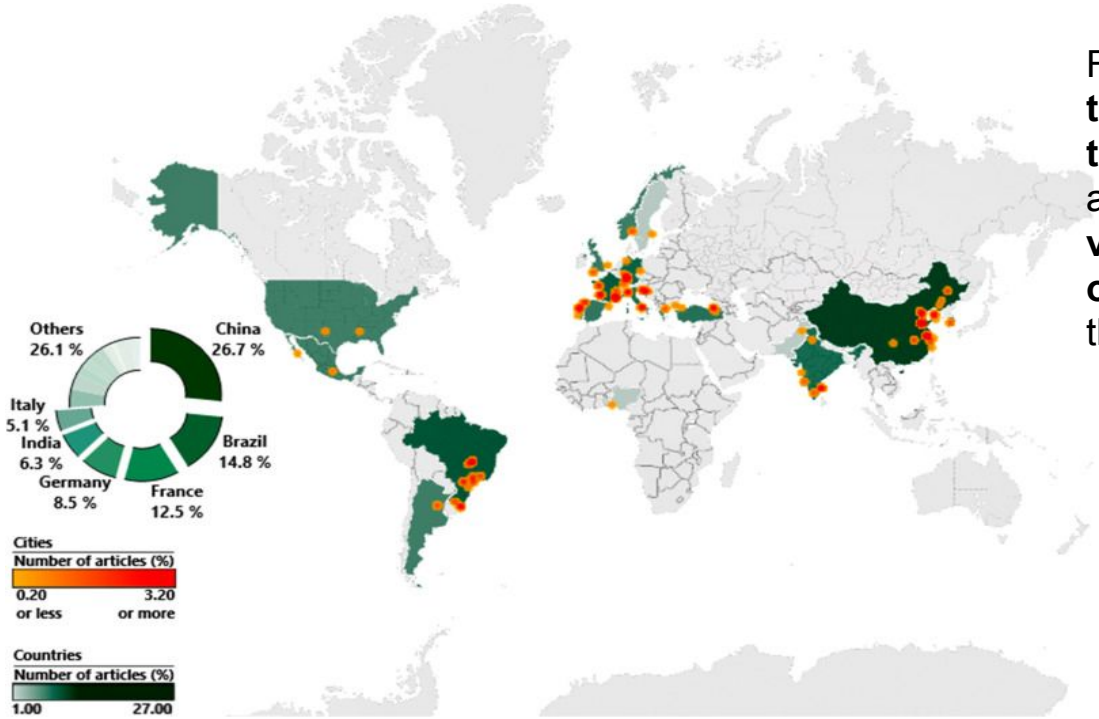
hhttps://www.trawell.in/

ZEBRAFISH MAP



Kakochang waterfall , Kaziranga ASSAM

Zebrafish Map



From being **native to the riverines of the ganga** to being a valuable **vertebrate model organism** all over the **world**

[3]

CLASSIFICATION

- Kingdom: Animalia
- Phylum: Chordata
- Class: Teleostei
- Subclass: Actinopterygii
- Order: Cypriniformes
- Family: Cyprinidae
- Genus: Danio

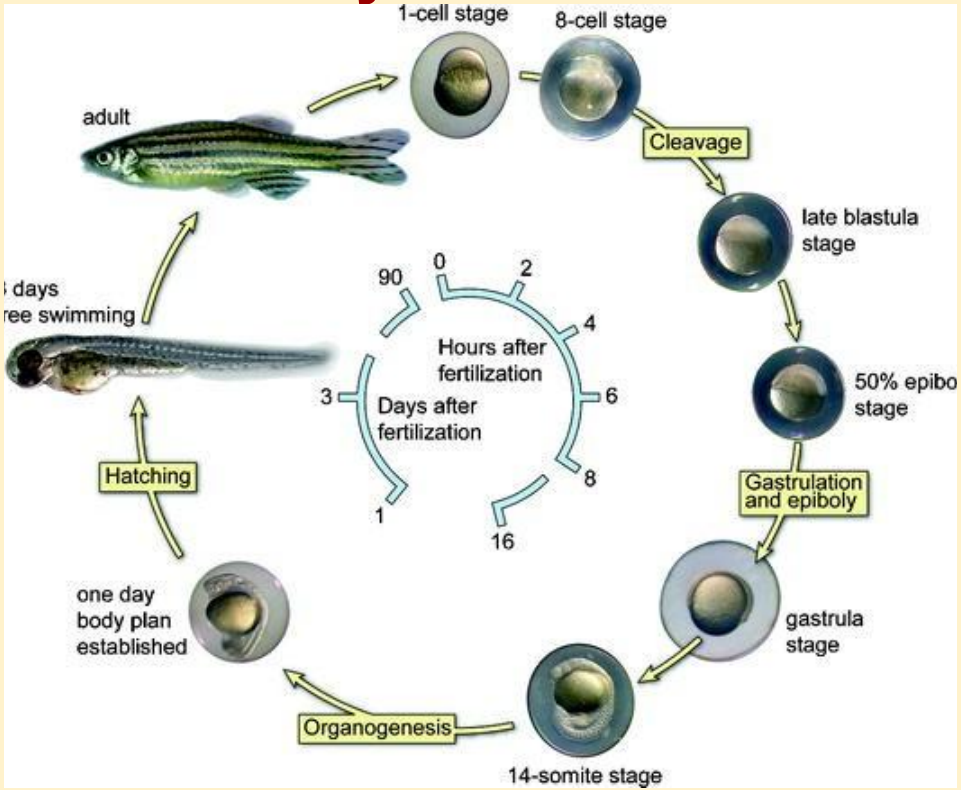
Female zebrafish swollen abdomen

Male zebrafish slender body and smaller size

HUMANS AND ZEBRAFISH ARE OF THE SAME PHYLUM : CHORDATA

https://news.mongabay.com/2015/10/zebrafish-may-hold-key-to-heart-regeneration/

Zebrafish as a model system



Some of its salient features include :

- rapid embryo development
- optically clear
- rapid development
- low space and maintenance cost.

https://www.liebertpub.com/doi/10.1089/zeb.2017.1531

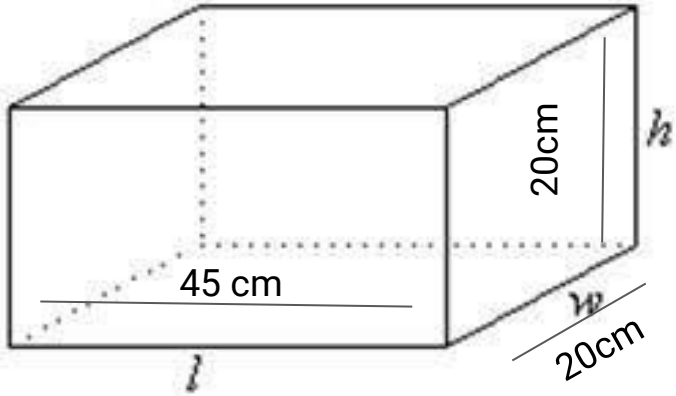
https://images.app.goo.gl/PF1acpyE84Xu7cvE6

WORK OF THE CUBISTS

NELLORE GROUP

Study of the life cycle of zebrafish

Designing and construction of aquarium:



Dimension of Nellore group's aquarium

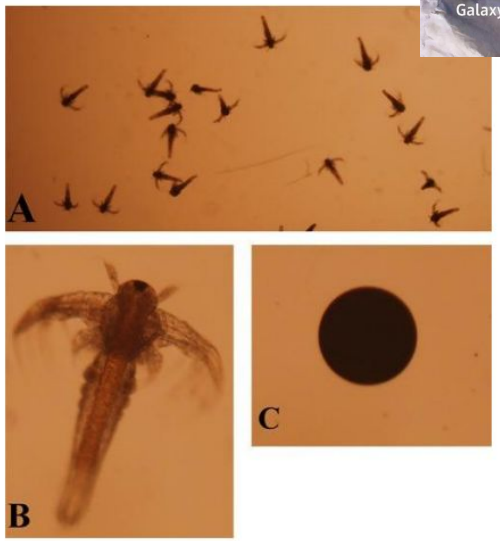
30 litre water capacity

Nellore group's aquarium

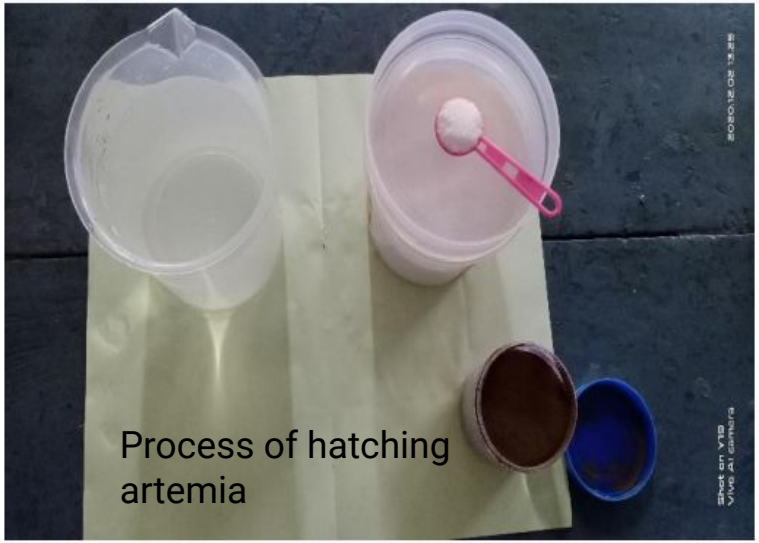
Picture source: Nellore Group Akanksha

Zebrafishes

Hatching Artemia:

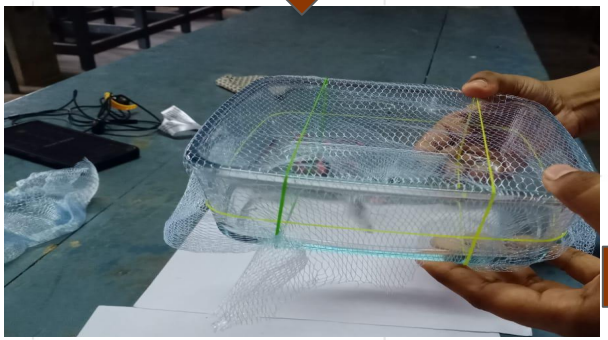


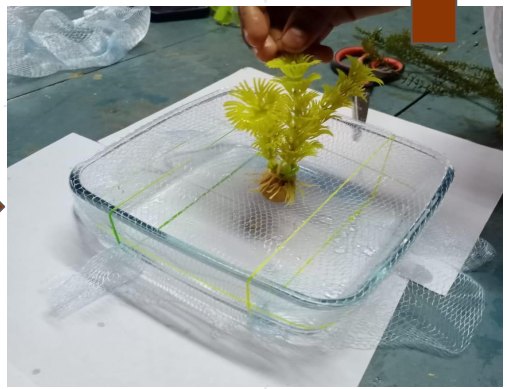
Picture source: Nellore Group Akanksha



Process of hatching artemia

Breeding in zebrafish





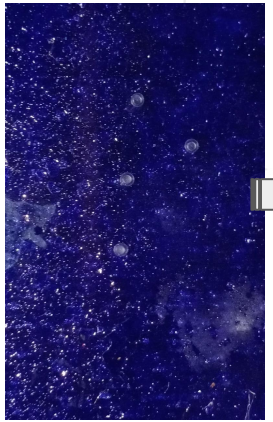
Picture source: Nellore Group Akanksha

Breeding of zebrafish

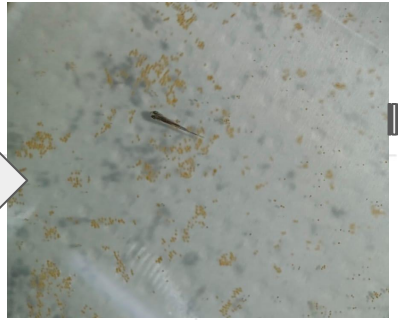
Nellore group’s breeding setup

Larval stages of zebrafish

Collection of eggs



Fertilised eggs



Hatchling

Microscopic view of hatchling

Fry stage (1 month)

Results & Goof ups

Picture credits: Oregon State University

FUTURE PROSPECTS

Angiogenesis

- Process through which new blood vessels are formed from preexisting ones
- Plays a critical role in several conditions including embryonic development,tissue repair and disease.

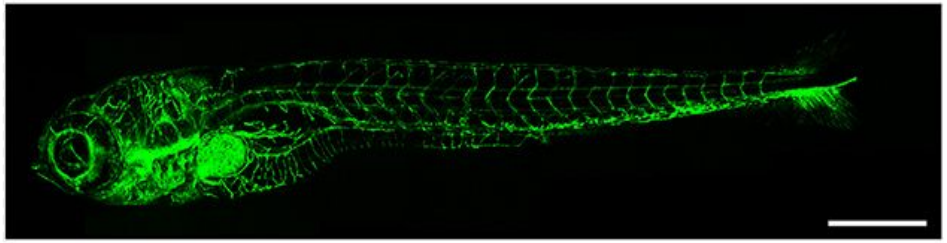


Figure. Vasculature during zebrafish embryonic development
Lawson and Weinstein, 2002

Rat Aortic Ring Assay	Retinal Explant Assay
Chorioallantoic Membrane Assay	Corneal Angiogenesis Assays
Human Arterial Ring Assay	Matrigel Plug Assay

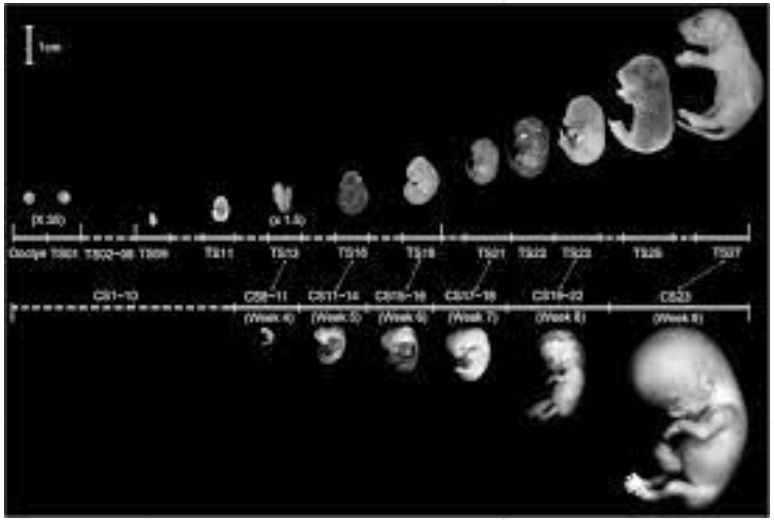
Invivo Models For Angiogenesis

Why ? & How ? Zebrafish..?

- ❏ Biology of vascular cells And how they build the circulatory system.
- ❏ Accessibility of the tissue in live animal.
- ❏ No complex instrumentation required.
- ❏ Tissue specific fluorescent proteins.
- ❏ Fluorescent endothelial cell markers.

doi: 10.3389/fphys.2016.00056

CAN WE COMPARE



Human embryo

VS

Zebrafish embryo

AIM - To study the innate immunity in zebrafish embryo .

HYPOTHESIS - Zebrafish embryo will show innate immune response when introduced to an infection.

EXPERIMENTAL DESIGN

STEP 1- COLLECTING EGGS FROM THE BREEDING SETUP

STEP 2- MAKING TEST AND CONTROL SETUPS WITH REPLICATES

STEP 3- INDUCING INFECTION IN TEST SETUPS

STEP 4- OBSERVATION AND COMPARATIVE ANALYSIS

Innate Immune Response to Infectious Diseases

Beatriz Novoa & Antonio Figueras

Chapter | First Online: 23 September 2011
7493 Accesses | 150 Citations | 3 Altmetric

Part of the Advances in Experimental Medicine and Biology book series (AEMB,volume 946)

Abstract

The zebrafish (*Danio rerio*) has been extensively used in biomedical research as a model to study vertebrate development and hematopoiesis and recently, it has been adopted into varied fields including immunology. After fertilization, larvae survive with only the innate immune responses because adaptive immune system is morphologically and functionally mature only after 4–6 weeks postfertilization. This temporal separation provides a suitable system to study the vertebrate innate immune response *in vivo*, independently from the adaptive immune response. The transparency of early life stages allows a useful real-time visualization. Adult zebrafish which have complete (innate and adaptative) immune systems offer also advantages over other vertebrate infection models: small size, relatively rapid life cycle, ease of breeding, and a growing list of molecular tools for the study of infectious diseases. In this review, we have tried to give some examples of the potential of zebrafish as a valuable model in innate immunity and inflammation studies.

INNATE IMMUNITY

- First line of defense
- Body's ability to recognise pathogens
- Phagocytosis and inflammatory response
- Components of WBC, like, macrophage, neutrophils, NK cells, etc.

Why zebrafish embryo is being used?
But what is this innate immunity?

THANK YOU

Collaborators are always welcome

A gracious appreciation to : ARUNAN SIR, HIMANSHU JOSHI SIR , RAHUL SIR, AND OUR CUBIST.