

ZEBRAFISH PHENOTYPE ATLAS

Purpose: The Tanguay Lab conducts developmental toxicity utilizing the rapidly developing zebrafish. To take advantage of the dynamic model, embryos are exposed to a gradient of concentrations per a chemical from 6 hours post fertilization (hpf) until 120 hpf (5 days). Zebrafish embryos at this life stage contain an acellular matrix (a chorion) that is removed enzymatically prior to exposure. At 120 hpf, the exposed larvae are evaluated for mortality, 16 morphological endpoints, and a tactile response. Although all data collected from this screen are collected as dichotomous data (present/absent), this phenotype atlas serves as a guide to demonstrate the varying degrees of severity in an endpoint.









Morphological Endpoints:

Endpoint	Abbreviation	Definition
Axis	AXIS	Curved or bent axis in either direction
Brain	BRAI	Brain malformations or necrosis
Caudal Fin	CFIN	Caudal fin – malformed or missing
Circulation	CIRC	No circulation or blood flow
Eyes	EYE	Eyes malformed, missing or smaller/larger than normal
Jaw	JAW	Malformed jaw
Notochord	NC	Notochord distortion
Otic	OTIC	Malformed or missing otic
Pericardial Edema	PE	Malformed or missing pectoral fin
Pectoral Fin	PFIN	Malformed or missing pectoral fin
Pigment	PIG	Lack of pigmentation, overpigmentation
Snout	SNOU	Shortened or malformed snout
Somite	SOMI	Malformed or disorganized, missing somites
Swim Bladder	SWIM	Failure of swim bladder to inflate
Trunk	TRUN	Shorten, malformed or missing trunk
Yolk Sac Edema	YSE	Yolk sac edema or shorten yolk sac extension









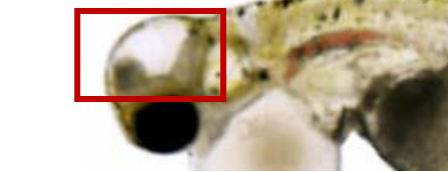
AXIS



	Normal Body axis of larvae is linear from snout to caudal fin
	Normal Body axis of larvae is linear from snout to caudal fin
	Borderline Slight curvature in body axis
	Mild Slight curvature in body axis
	Moderate Noticeable curvature in body axis
	Severe Noticeable bend in body axis. Trunk is at a 90 degree angle to the rest of the axis.
	Extreme Noticeable curve in body axis. Trunk is at a greater than 90 degree angle to the rest of the body
	Extreme Noticeable curve in body axis. Trunk is greater than 90 degree angle to the rest of the body





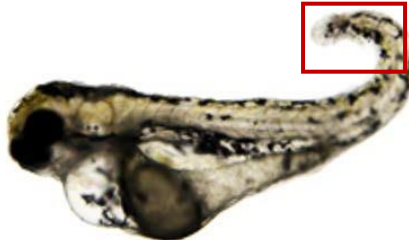


BRAIN



	<p>Normal</p>
	<p>Abnormal Cranial swelling, edema</p>
	<p>Abnormal Cranial swelling, cloudy grey tissue, edema</p>
	<p>Abnormal Cranial swelling, cloudy grey tissue</p>
	<p>Abnormal Cranial swelling, large dark cellular mass</p>
	<p>Abnormal Cranial swelling, large dark cellular mass</p>
	<p>Abnormal Cranial swelling, cloudy grey tissue</p>

CAUDAL FIN



	<p>Normal</p>
	<p>Abnormal Curvature in peduncle region Slight bend and blunt caudal fin</p>
	<p>Abnormal Tissue reduction</p>
	<p>Abnormal Excess tissue growth</p>
	<p>Abnormal Atypical tissue growth</p>
	<p>Abnormal Atypical tissue, misshapen</p>
	<p>Abnormal Atypical tissue, curvature in peduncle region</p>









CIRCULATORY SYSTEM



A lateral view of a normal zebrafish embryo, showing a clear body axis, yolk sac, and tail.	<p>Normal</p>
A lateral view of a zebrafish embryo showing hemorrhaging in the pericardium and yolk sac, indicated by white arrows.	<p>Abnormal Hemorrhaging in pericardium and yolk sac</p>
A lateral view of a zebrafish embryo showing hemorrhaging in the body cavity, indicated by a white arrow.	<p>Abnormal Hemorrhaging in body cavity</p>
A dorsal view of a zebrafish embryo showing cranial hemorrhaging, indicated by white arrows.	<p>Abnormal Cranial Hemorrhaging</p>
A dorsal view of a zebrafish embryo showing hemorrhaging around the eyes, indicated by a white arrow.	<p>Abnormal Hemorrhaging around the eyes</p>









EYES



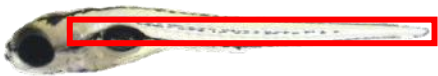
	Normal
	Normal Dorsal view
	Abnormal Two different proportional sizes
	Abnormal Smaller than normal eyes
	Abnormal Swelling round the eyes
	Abnormal Two different proportional sizes
	Abnormal Larger than normal eyes
	Extreme Missing eyes









JAW



	Normal
	Abnormal Jaw is protruding past the snout.
	Abnormal Jaw is protruding past the snout.
	Abnormal Jaw is irregular and misshapen
	Abnormal Jaw is misshapen and extended from snout
	Abnormal Jaw is misshapen and disconnected from snout
	Abnormal Jaw is protruding past the snout.
	Abnormal Jaw is irregular and misshapen

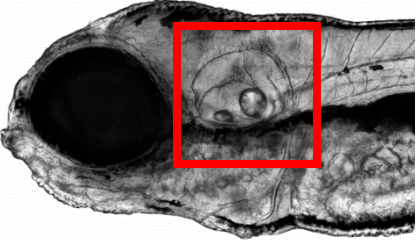
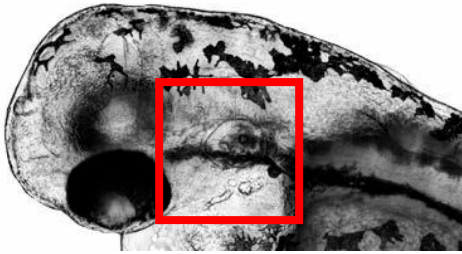
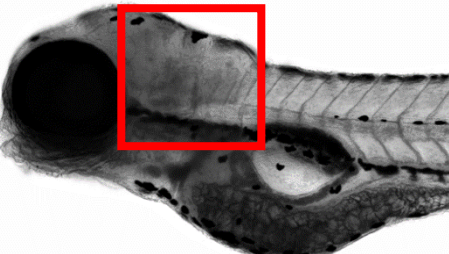

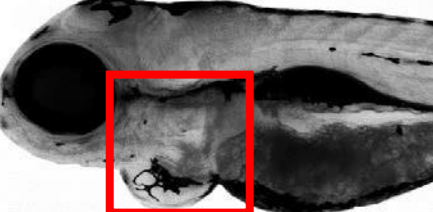

NOTOCHORD



	Normal
	Normal Dorsal view
	Abnormal Dorsal view-notochord is undulated
	Abnormal Notochord is undulated
	Abnormal Notochord is undulated
	Abnormal Notochord is undulated
	Abnormal Notochord is undulated
	Abnormal Notochord is undulated







OTIC VESICLE



	<p>Normal Spherical shape is distinct.</p>
	<p>Abnormal - Small Physical features are still visible yet malformed in size or shape.</p>
	<p>Abnormal - Missing Otic vessel is barely noticeable yet unrecognizable.</p>
	<p>Abnormal - Missing Obscure presence.</p>
	<p>Abnormal - Missing Outlines are vague and undefined.</p>
	<p>Abnormal - Large/Swollen The vessel has lost shape and its internal organelles.</p>

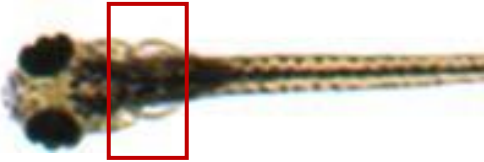

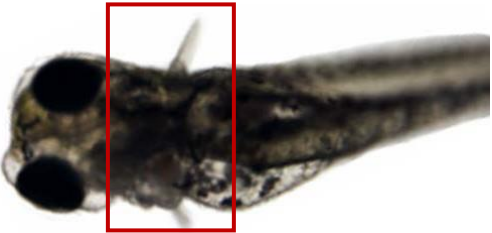
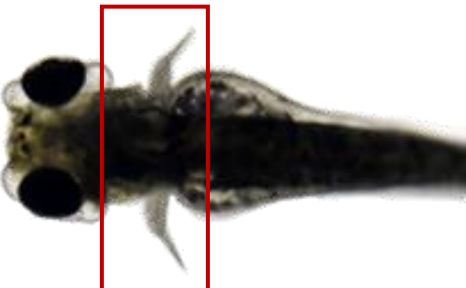


PERICARDIAL EDEMA



	Normal
	Mild Moderate swelling of pericardium
	Moderate Swelling of pericardium
	Moderate Swelling of pericardium
	Severe Swelling of pericardium
	Extreme Severe swelling of pericardium







PECTORAL FINS



	<p>Normal</p>
	<p>Abnormal - Dorsal View Curled fins</p>
	<p>Abnormal - Dorsal View Varying sizes</p>
	<p>Abnormal - Dorsal View Extended</p>
	<p>Abnormal - Dorsal View Extended; not parallel with body.</p>
	<p>Abnormal - Dorsal View Extended; not parallel with body.</p>









PIGMENT



	<p>Normal</p>
	<p>Abnormal Overall absence of pigment. Groups of melanocytes create irregular dark spots.</p>
	<p>Abnormal Overall absence of pigment. Groups of melanocytes create irregular dark spots.</p>
	<p>Abnormal Overall absence of pigment</p>
	<p>Abnormal Absence of any melanocytes</p>
	<p>Abnormal Absence of any melanocytes</p>






SNOUT



	Normal
	Abnormal Protruding well beyond eyes, misshapen
	Abnormal Snout is recessed, possibly missing or reduction of tissue
	Abnormal Snout is small, appears as if there is missing or reduced tissue
	Abnormal Snout tissue is irregular and misshapen
	Abnormal Protruding Appears as if there is excessive or swollen tissue
	Abnormal Snout tissue is irregular and misshapen Appears as if there is missing or reduction in tissue
	Abnormal Snout tissue is irregular and misshapen Appears as if there is excessive or swollen tissue Protruding




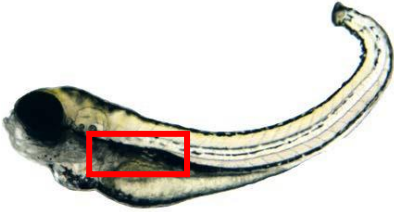
SOMITES



	<p>Normal Chevron shaped</p>
	<p>Abnormal Somites are undefined</p>
	<p>Abnormal Somites are undefined Appear distended Not chevron shaped</p>
	<p>Abnormal Somites are undefined Appear distended Not chevron shaped</p>
	<p>Abnormal Somites are undefined Appear distended Not chevron shaped</p>





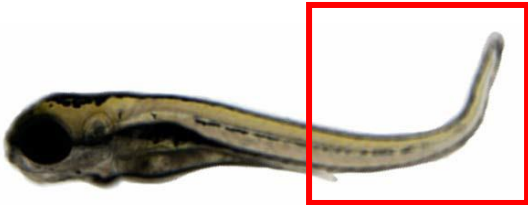

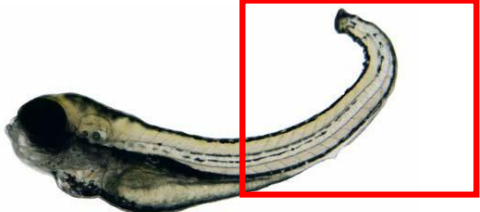
SWIM BLADDER



	Normal Swim bladder is present and inflated
	Mild Swim bladder is slightly deflated
	Severe Swim bladder is deflated
	No presence Completely deflated.









TRUNK



	Normal
	Abnormal Overall trunk length is abbreviated
	Abnormal Curvature in trunk. Distance from yolk sack to caudal fin is abbreviated
	Abnormal Curvature in trunk.
	Abnormal Curvature in trunk.
	Abnormal Curvature in trunk. Distance from yolk sack to caudal fin is abbreviated. Overall trunk length is short Trunk tissue misshapen and irregular
	Abnormal Bend in trunk. Trunk tissue misshapen

YOLK SAC EDEMA



	Normal
	Abnormal Yolk sac is swollen and enlarged
	Abnormal Yolk sac is swollen
	Abnormal Yolk sac is swollen
	Abnormal Yolk sac is swollen Yolk sac is extended down trunk
	Abnormal Yolk sac is swollen Yolk sac is extended down trunk
	Abnormal Yolk sac is swollen Yolk sac is extended down trunk
	Abnormal Yolk sac is swollen Yolk sac is extended down trunk