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Program/Abstract # 141
A genetic screen for situs abnormalities
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The initially bilaterally symmetrical embryo breaks symmetry in a consistent manner to give the wild type situs solitus embryo. While inversion of the left–right (L–R) axis is completely viable, incomplete conversion has serious health implications often resulting in congenital heart disease. Indeed it is increasingly obvious that low level L–R patterning defects underlie a proportion of human congenital heart defects. Work from many groups has revealed a basic L–R determination pathway comprising a cilia driven leftward flow of liquid in the embryonic node, subsequent activation of the left sided *Nodal* pathway and in turn activation of left sided expression of *Pitx2*. Various gaps however, are apparent in this model. Using a forward genetic approach we have been isolating mouse mutants affecting L–R patterning of the embryo. An initial screen, analysing 135 pedigrees identified 10 single gene defects affecting L–R patterning. This frequency suggests that approximately 64–128 genes control L–R patterning in the mouse. We identified 5 lines that had, in addition to abnormal L–R patterning, complex phenotypes including pulmonary agenesis, exencephaly, polydactyly, ocular and craniofacial malformations. These complex abnormalities are present in human disease syndromes such as VACTERL and SLO syndromes. We present our ongoing analysis of mutations affecting L–R development.

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Program/Abstract # 142
A potential link between fetal exposure to deet and birth defects in chick development
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Teratogens are chemical or environmental agents that cause birth abnormalities in a developing embryo. Deet is a widespread pesticide, which is an active ingredient in most tick and insect repellents. Since embryos have the potential of being exposed to deet, testing the insecticide on developing embryos is of extreme importance. This research project focused on the study of prenatal exposure of deet in chick embryos. The effect of deet on chick development was studied at the physiological level by noting birth weight and abnormal external structures of 7 and 15 day old chick embryos exposed to varying concentrations of the insecticide. The results suggest that even low doses of deet cause physiological defects including microthalmia and hemorrhage as compared to control embryos. Acetylcholinesterase (AChE) is the enzyme that catalyzes the reaction for the neurotransmitter acetylcholine to be broken down into choline and acetic acid at neuromuscular junctions. This enzyme functions to return an activated neuron to its resting state by inhibiting acetylcholine. If AChE activity is suppressed by an inhibitor such as a pesticide, the concentration of acetylcholine increases in the synapse causing the over stimulation of neurons. Expression of AChE in mammalian skeletal muscles has been shown to be controlled at the mRNA stability level. Chick embryos treated with deet will be further evaluated by histochemical procedure and copper thiocholine staining to locate areas of AChE activity in skeletal muscles. Following this analysis, the presence of acetylcholinesterase mRNA in skeletal muscles will be determined using RT PCR.

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Program/Abstract # 143
Analysis of Fgf gene expression patterns in the ear-forming region of the chick
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We are interested in the role of FGF signaling in induction and patterning of the middle ear and tissue interactions within the ear-forming region. These tissues include the epithelium of the inner ear, notochord, neural tube, mesenchyme (neural crest and mesoderm derived), surface ectoderm and pharyngeal endoderm. We wanted to determine the spatial and temporal FGF signaling in this region prior to the morphological appearance of the middle earbone (columella condensation) at 96 h of development. The gene expression patterns of Fgf family members have not previously been analyzed systematically in the chick ear-forming region. We have used in situ hybridization analysis of all the available Fgf ligands at stages 8/9, 14 and 18. Our results demonstrate that Fgf8, 13 and 19 are expressed at stages 8/9. Fgf10, 16 and 18 have expression by stage 14 and within 24 h Fgf 2, 3, 9, 14 and 20 have also turned on expression. Fgfs are expressed in specific tissues within the ear-forming region suggesting that FGF signaling is required for regional cell identity. We are currently analyzing the spatio-temporal expression of the Fgf receptors and undertaking tissue recombination experiments to determine which tissues and FGFs are required for columella condensation.

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Program/Abstract # 144
Expression patterns of cadherin-6B in chick limb development
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Cell adhesion molecules play a role in directing migration, cell signaling, and tissue identification necessary during morphogenesis of the embryo. Cadherin-6B (cad-6B) is a cell–cell adhesion protein known to be expressed in the premigratory neural crest, differentiated vascular and visceral smooth muscle cells, optic tectofugal projection neurons, hair cells and spindle-shaped cells of the cochlea, and a subset of the lateral motor column neurons. This study characterizes the mRNA-level expression patterns of cad-6B in comparison to two other type II cadherins, cad-7 and cad-11, in the embryonic development of chicken limbs from Hamburger and Hamilton stages 21 through 34 using whole mount in situ hybridization. Cad-6B was detected first in the posterior proximal mesenchyme and flank region and observed later in the distal anterior and posterior margins of the outgrowing limb. Cad-6B was also found in neurons innervating the limb, in dorsal–ventral muscle precursors, and weakly in the apical ectodermal ridge. Further analysis of sectioned embryos and immunohistochemistry will provide specific tissue identification.

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Program/Abstract # 145
Influence of biomechanical force on joint development marker gene expression in chick embryo limb bud mesenchyme micromass cultures
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