CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)

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Project Number

33668

Project Title

A Molecular Study of Ror2/Wnt Signaling Pathways and Their Effects on Facial Deformities During Embryonic Development

Abstract

Objectives/Goals

Research suggests that there is a correlation between the absence of the membrane receptor protein, Ror2, and the presence of facial deformities, such as cleft lip and cleft palate; however past studies do not present an explanation for why these abnormalities occur. My hypothesis is that the absence of Ror2 causes abnormal activation of the Wnt3A/β-Catenin Pathway leading to facial deformities.

Methods/Materials

This study examines the correlation between the absence of Ror2 and the presence of facial deformities on a more intimate molecular level. Protein and RNA analyses were conducted to identify the specific signal transduction pathways that are activated or repressed in the mutant (Ror2-/-) and heterozygous (Ror2+/-) Ror2 mouse models. Mouse embryonic fibroblasts of ages 11.5, 12.5, 1225, and 14.5 days were studied for representative proteins.

Results

The heterozygous (het) mice served as the control group. Western Blot protein analyses and qRT-PCR DNA analyses revealed that β-catenin, the protein produced by activation of the Wnt 3A pathway, was present in significantly greater quantities in the null sample than in the het. These results prove that there is an explicit link between the absence of the Ror2 receptor and the activation of the Wnt3a/β-catenin pathway, ultimately causing facial deformities.

Conclusions/Discussion

· The null group was more responsive to the Wnt3a/β-catenin pathway than the het group, supporting my hypothesis that abnormal activation of the Wnt3a/β-catenin pathway, in the absence of Ror2, leads to facial deformities.

· Conversely, the het group was more responsive to the Wnt5a/p-JNK pathway than the null, further validating my hypothesis that in a het embryo, Wnt5a binds to the Ror2 receptor, leading to a normal facial phenotype.

· Studies of E13.5 and E14.5 embryos support the two conclusions above, with statistically significant data.

· More data points need to be collected from the E12.5 and E11.5 data sets before an accurate conclusion for pathway activation in E11.5 and E12.5 embryos can be made.

· The E11.5 study shows a clear distinction between the het and null Ror2 pathway activation, where previous physiological studies showed no phenotypic distinction at this stage. This novel find proves that the origin of facial deformities affects genetic defects at the molecular level, even before these phenotypic

Summary Statement

My project studied Ror2/Wnt signaling pathways on the molecular level to understand what specific pathway activity leads to facial deformities, such as cleft lip and cleft palate.

Help Received

Used lab equipment at Stanford University under the supervision of Dr. Erika Yeh; Mentor taught me basic lab skills; Mentor and I would discuss my results and offer insight during troubleshooting, etc. during weekly lab meetings