Intravital Heart Imaging in Quail

Josephine Sibert[1,2], Jasmine Cisneros[2], David Huh[2], Rusty Lansford[2], PhD

1. Lee's Summit High School, Lee's Summit, MO, USA

2. The Saban Research Institute, Children's Hospital of Los Angeles, Bridge Institute, University of Southern California, Los Angeles, CA , USA

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USC University of Southern California

Abstract

Avian embryos have been used for centuries to study development due to the ease of access. Because the embryos are sheltered inside the eggshell, a small window in the shell is ideal for visualizing the embryos and performing different interventions. The window can then be covered, and the embryo returned to the incubator for the desired amount of time and observed during further development. Importantly, because like the human heart the avian heart develops into a four-chambered heart with valves, heart malformations and pathologies that human babies suffer can be replicated in avian embryos, allowing a unique developmental window into human congenital heart disease.

Fetal Alcohol Spectrum Disorders (FASDs) is a condition caused by prenatal exposure to alcohol. A pregnant female ingests alcohol while pregnant causing a birth defect in the child. This syndrome can negatively affect the child in adolescence and adult life with an array of developmental issues, one being heart related birth defects. One in every 1,000 infants are born with the condition in the United States.

Introduction

The avian and mammalian heart transports blood to the lungs and body in a similar manner [*Sturkie's Avian Physiology, 5th ed].* Birds and mammals have atrial and ventricular septa, allowing separation between oxygenated and deoxygenated blood, and complete separation of the systemic and pulmonary circulations. The deoxygenated blood returns from the body to the right atrium through the large caval veins. The deoxygenated blood moves to the right ventricle, where it is pressurized for pulmonary circulation. The blood dumps its CO_2 and acquires O_2 via the lung capillaries. The newly oxygenated blood returns to the left atrium through four large pulmonary veins, as in mammals. The oxygenated blood moves to the left ventricle, where it is pressurized for systemic circulation.

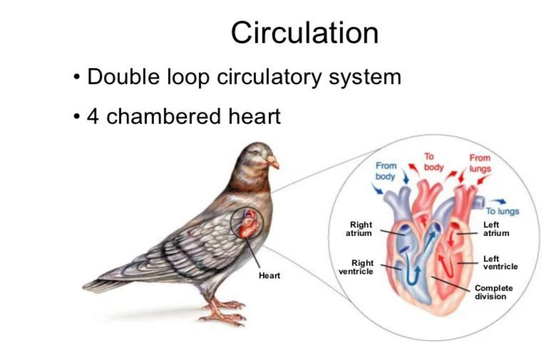

Figure 1. Schematic of adult bird heart

Embryonic Imaging

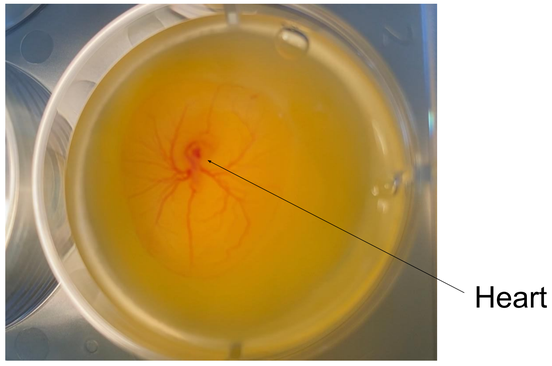

Figure 2. Embryonic day 3 quail embryo

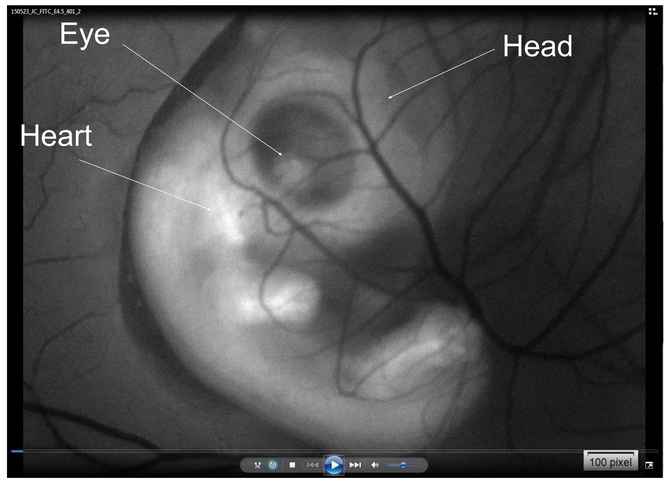

Figure 3. Fluorescent image of transgenic embryonic day 5 quail embryo

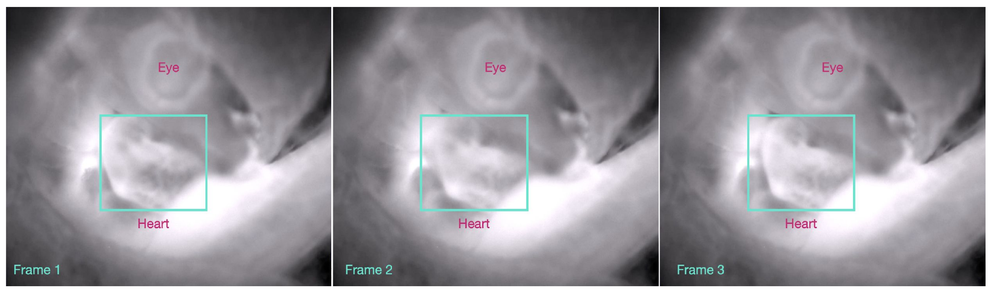

Figure 4. Sequential images of quail embryo heart beating

Change the Tune

Change the Tune is a program dedicated to giving students the chance to explore science. Students get the opportunity to explore the STEM fields through learning from real-time researchers and scientists. In this photo, USC hosted the Change the Tune program, and invited students from the Los Angeles area. Our lab showed students how to open quail eggs and observe quail embryos underneath microscopes.

Figure 5. Change the Tune program at USC

Conclusion

As Fetal Alcohol Syndrome continues to have severe negative effects on infants, research on this subject is important. This condition creates many physical and mental issues for the child as they grow older. Heart birth defects are one of the most common outcomes that stems from this condition. By using quail to study the real time morphogenetic processes, we can discover the exact process stages of embryonic development to provide for future intervention in the human processes which may lead to intervention, prevention, or treatment for heart birth defects.

CONTACT US

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