To Infinity Egg Beyond: Novel Systems for Hyper-Customizable Egg Models

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The Framework for Embryonic Analysis Through Hyper-customization Enhancement Research (FEATHER) enhances avian egg studies, enabling custom egg modification while preserving embryo viability. FEATHER features four sequentially integrated prototypes: WAVE (laser-based Windower for Avian Eggs) allows for custom-sized shell openings and shows 94% efficiency in creating windows without damaging the inner shell membrane. STACCs (Self-healing & Transparent Air-Cell Caps) allow access to the egg cavity while preventing fungal cross-contamination during incubation. STACCed eggs showed similar water loss and embryo viability when compared to non-STACCed control eggs, even after various interventions including albumen aspiration, saline injection, and wire probe insertion. STACCs also improved image quality and illumination by reducing glare and increasing embryo photokinesis. TREBEL (Treatment Evaluation using Binary Enhanced Logic) is a novel adaptation of a binary allocation riddle. A multi-layer perceptron network (MLP) can identify the most impactful treatment while using fewer experimental groups than treatments. TREBEL MLP trained on synthetic data showed 86% accuracy in predicting the most impactful of 3 treatments using 2 model organisms; in vivo validation testing is underway. MFii (Multi-Field Imaging Incubator) is the first-of-its-kind device that allows for magnified visualization of the embryonic air-cell vasculature from outside the incubator, preventing condensation and embryonic perturbation. Together, WAVE, STACC, TREBEL, and MFii offer a novel toolkit for in-ovo modifications with uses ranging from gender identification to disease modeling and vaccine development, pushing the boundaries of precision medicine, agriculture, and consumer food enhancement.

Awards Won:
Third Award of $1,000
China Association for Science and Technology (CAST): Award of $1,200