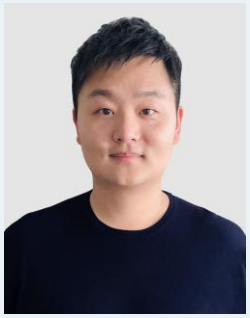
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**RESEARCH & COLLABORATION PROFILE |**


**KEY WORDS: Epithelial tissue closure, embryonic wound healing, epithelial sheet migration, chick embryos**


**Research Snapshot.** The Developmental Biology & Tissue Regeneration Lab uses embryonic systems as a model to uncover the molecular and cellular principles of tissue regeneration and wound healing. During embryonic development, several tissues close in ways that closely resemble wound healing (e.g., embryo expansion, neural tube closure, ventral body-wall closure), and defects in this closure cause congenital malformations. Embryonic wounds also heal remarkably faster and without scarring compared to adult wounds, yet the underlying principles remain poorly understood. By studying cell shape, cell-cell communication, collective cell migration, and mechanical force during tissue closure, the lab aims to uncover strategies for fast, scar-free wound healing with translational potential for clinical wound care.

## RESEARCH EXPERTISE

- **Tissue closure during embryo development:** epiboly (embryo expansion), neural tube closure, ventral body-wall closure, frontonasal closure, and related epithelial-closure events, and the malformations that arise when these processes fail.
- **Epithelial wound healing in embryos:** the cellular and molecular basis of the rapid, scar-free healing of embryonic wounds, in contrast to adult tissue repair.
- **Migration of epithelial sheets:** collective cell migration, and the distinct roles of leader and follower cells during epithelial sheet movement.
- **Chick embryos as a test model:** applications in drug testing, cancer-cell metastasis, and CAM (chorioallantoic membrane) assays.

## RECENT RESEARCH HIGHLIGHTS

- **Long-range signalling and embryonic polarity (Nat. Commun. 2024):** showed that propagating calcium-firing activity shapes long-range BMP gradients that establish embryonic polarity, linking cell-cell communication to tissue-scale patterning.
- **Edge-cell mechanics of embryo expansion (Open Biology 2022):** identified molecular characteristics of the edge cells that drive epiboly-like expansion of the chick embryo, establishing a new model for studying tissue-closure movements.
- **Interpretation of positional information of cells (Development 2022):** demonstrated that embryonic epiblast cells assess positional information in relation to their neighbours (“Neighbourhood watch” model)

## POTENTIAL COLLABORATION RESEARCH

**Best-fit collaborator areas:** developmental biology & morphogenesis | wound healing & regenerative medicine | cell/tissue mechanics & imaging | cancer cell biology & metastasis | dermatology & clinical wound care

- **1. Tissue closure & morphogenesis:** joint analysis of the cellular and molecular events driving natural and induced tissue-closure processes, comparing common and divergent strategies across embryonic systems.
- **2. Scar-free wound healing:** translating the mechanisms of fast, scar-free embryonic wound healing into strategies for improving adult skin wound treatment.
- **3. Collective cell migration & cancer metastasis:** joint study of leader/follower cell dynamics in epithelial sheet migration, with applications to cancer cell invasion and metastasis.
- **4. Chick embryo & CAM-based disease models:** collaboration with biomedical research groups using chick embryo and CAM assay platforms for drug testing and translational wound-healing research.

## SELECTED RECENT PUBLICATIONS


- **Developmental Biology 2025, 519, 13-20 —** Development and functions of the area opaca of the chick embryo.
- **Nature Communications 2024, 15, 1463 —** Regulation of long-range BMP gradients and embryonic polarity by propagation of local calcium-firing activity.
- **Open Biology 2022, 12(9), 22014 —** Molecular characteristics of the edge cells responsible for expansion of the chick embryo on the vitelline membrane.
- **Development 2022, 149(12), dev200303 —** The extraembryonic area opaca plays a role in positioning the primitive streak of the early chick embryo.
- **Development 2022, 149(10), dev200295 —** “Neighbourhood watch” model: embryonic epiblast cells assess positional information in relation to their neighbours

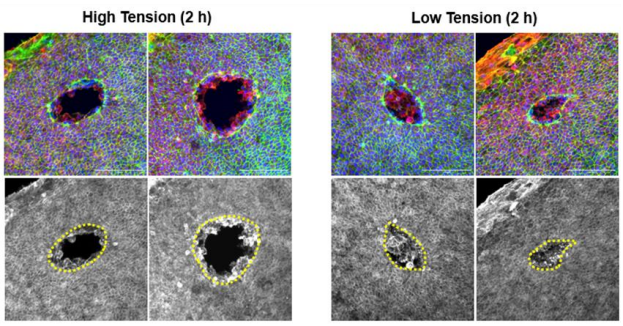

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https://sites.google.com/view/leehc/home


## REPRESENTATIVE RESEARCH FIGURES / SCHEMES

### Embryonic wound healing




### Seam resolution during closure

