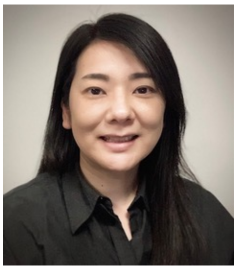
Laboratory of Organ Morphoregulation

Graduate School of Science



Professor Asako SHINDO shindo.asako.sci@osaka-u.ac.jp

Assistant Professor Soichiro KATO kato.soichiro.sci@osaka-u.ac.jp

““Form follows function” is a principle rooted in modernist architecture, suggesting that the design of an object should be primarily based on its intended function or purpose. This concept is epitomized in our bodies, where the elegant form of tissues and organs are tailored to specific functions. During animal development, cells intricately move and assemble to form tissue and organ architectures. How do cells know to form such beautiful shapes? We use *Xenopus laevis* embryos and larvae to observe individual cells during development, aiming to uncover the cellular and molecular regulation of morphogenesis.

Nutritional control of thyroid morphogenesis

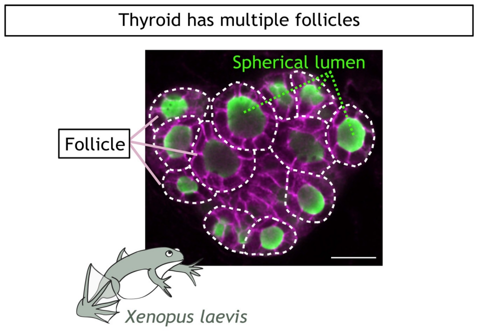
The thyroid, an endocrine organ, synthesizes thyroid hormone crucial for the development of other organs. Structurally, the thyroid consists of a number of follicles, each of which has a spherical shape. In our research on *Xenopus laevis* larvae, we identified that external nutrition is essential for initiating follicular development. In contrast, larvae without food temporarily halt their thyroid morphogenesis. How do nutritional factors drive thyroid morphogenesis, and how does nutrient deprivation temporary halt its development? We are exploring the impact of environmental nutrients on thyroid morphogenesis, emphasizing the interplay between the thyroid and the intestine.

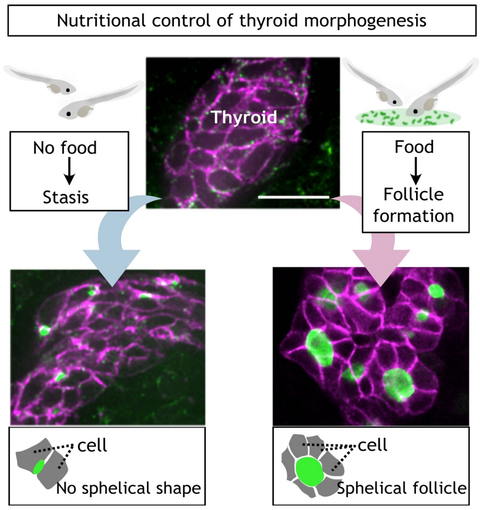
Mechano-management in epidermal development

The epidermis, a sheet-like structure, encapsulates the entire surface of embryos. Despite the dynamic morphological transitions during embryogenesis, this epidermal sheet remains undistorted, exhibiting neither tears nor slack. What mechanisms confer such morphological adaptability to the epidermis? Our findings suggest that a specific neurotransmitter and its receptor regulate cellular morphodynamics, either expanding or contracting, thereby ensuring the epidermal sheet’s deformability. We are investigating this previously unknown role of neurotransmitters in epidermal development, with a focus on their ability to manage mechanical tissue stresses.

Embryonic ability to receive and use external forces (Kato project)

Xenopus laevis embryos undergo morphogenesis within the confined space of the egg membrane, curling their bodies while simultaneously directing the development of their tissues and organs. Although bending causes varied forces to act on each side of the embryo, a symmetrical body structure is consistently achieved. Do these embryos counteract external forces through unknown mechanisms, or do they strategically use these forces for optimized body formation? We are devising advanced and specialized equipment to apply or measure physical forces on *Xenopus* embryos, aiming to decipher how these embryos regulate such forces during body shaping.





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Department of Biological Sciences
Graduate School of Science, Osaka University
1-1, Machikaneyama-cho, Toyonaka, Osaka
560-0043, Japan

TEL: +81-6-6850-5808

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