Scientists produce in vitro model of cell differentiation during early facial development

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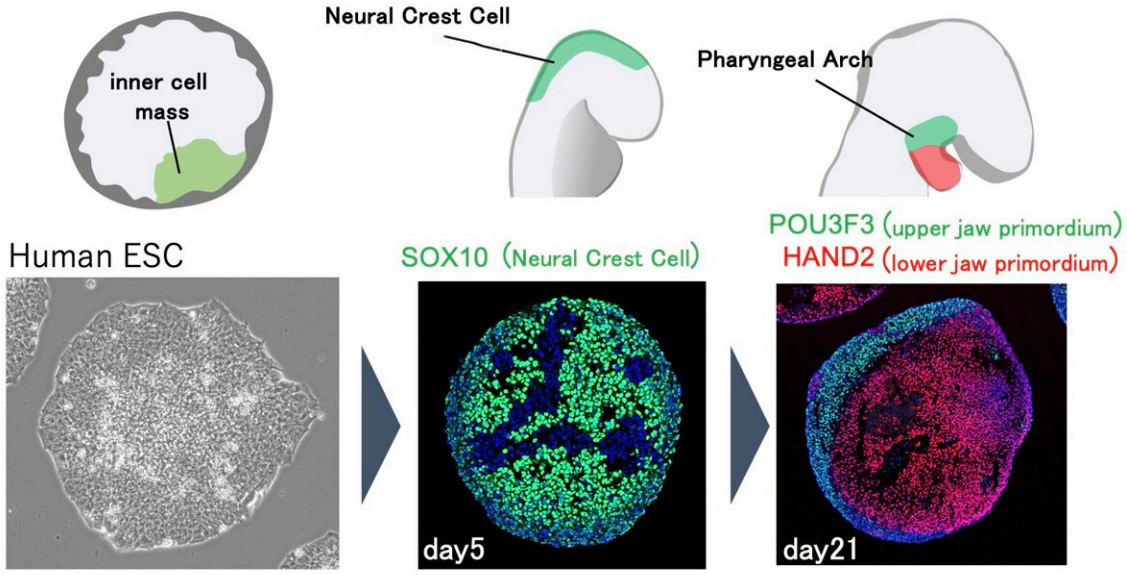

Human ES cells can now be used to induce structures with regionalized maxillary and mandibular primordia through the neural crest cell state, allowing for the recapitulation of jaw development in vitro. ($POU3F3^{+}$ for maxillary and $HAND2^{+}$ for mandibular). Credit: KyotoU/Mototsugu Eiraku and Yusuke Seto

Mother Nature is an artist, but her craft of creating animal faces requires more than a paintbrush and palette. Such highly complex shapes

originate from their respective transient neural crest cells.

These embryonic pluripotent cells within the facial primordium—the early development form—may be necessary for forming proper facial structures. However, analyzing the molecular mechanisms in such early stages of development poses many technical challenges.

Now, a group of Kyoto University researchers have produced neural crest cell-rich aggregates from human pluripotent stem cells and developed a method to differentiate them in cell populations with a branchial arch-like gene expression pattern. The work is published in the journal *Nature Communications*.

"After the cell populations differentiate into precursors of maxillary and mandibular cells in response to external signaling factors, these populations spontaneously form patterns of the facial primordium," explains Yusuke Seto of KyotoU's Institute for Medical and Biological Research.

This cartilage-like structure, reminiscent of Meckel's cartilage, is formed locally within the aggregates.

"We aim to establish a model for studying early facial development by using the properties of human pluripotent stem cells to generate in vitro tissue resembling the bronchial arch of the primordial face," adds Ryoma Ogihara, also of the Institute.

Researchers are examining the various developmental processes that cause interspecific and individual differences in facial structure to explain conditions such as craniofacial disorders.

"Using our in vitro model could help us better understand and control signal integration during the fate determination of the branchial arch and

cartilage formation in the face and elsewhere. We hope our technology can contribute to the development of cellular materials for new regenerative medicine," says Mototsugu Eiraku, also of the Institute.

More information: Yusuke Seto et al, In vitro induction of patterned branchial arch-like aggregate from human pluripotent stem cells, *Nature Communications* (2024). DOI: 10.1038/s41467-024-45285-0

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