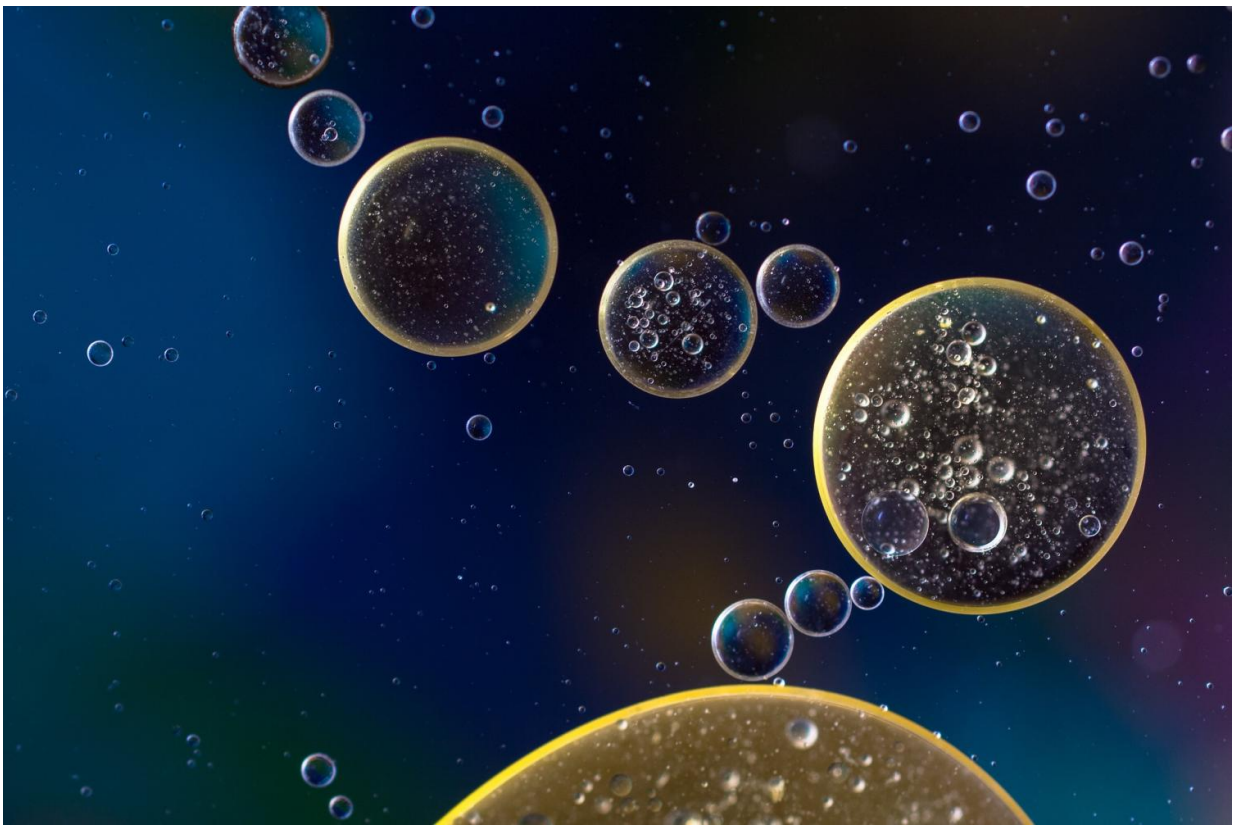
New cell movement process key to understanding and repairing facial malformations

October 18 2018



Credit: CC0 Public Domain

The embryonic stem cells that form facial features, called neural crest cells, use an unexpected mechanism of moving from the back of the

head to the front to populate the face, finds a new UCL-led study.

The researchers say their findings could help understand how facial defects form, bringing scientists one step closer to repairing craniofacial malformations in the embryo.

The new study, published in *Science*, reports a new and surprising mechanism that is likely to be important for other processes involving cell movement, such as cancer invasion during metastasis or wound healing, which may pave the way to develop new forms of therapies for each.

"Our findings solve a long-standing question in the scientific community about how cells move. The traditional explanation likens the process to how a train moves: there is an engine at the front of the train that generates the force, pulling the rest of the train forward. Our surprising discovery shows that the engine moving the cells is at the back and not at the front," said the study's lead author, Professor Roberto Mayor (UCL Cell & Developmental Biology).

This has important consequences as any new therapies based on modifying cell movement to repair facial malformation, improve wound healing or inhibit cancer metastasis should target the back cells, and not the front cells as traditionally done.

"In the womb, neural crest cells need to migrate from the back to the front of the head in order to form the face. For the first time, we've identified how that migration happens, and it appears to be similar to how you would squeeze toothpaste from the back of a tube to move the contents at the front," said Professor Mayor.

The discovery has important implications for understanding the causes of facial defects, such as cleft palate and facial palsy, which account for

a third of all birth defects globally (3.2 million each year) and are the primary cause of infant mortality.

For the study, the researchers investigated embryos of both frogs and fish, because their neural crest cells behave in a similar way to those of humans and their movement is often used to study the spread of cancer. In addition, the embryo development of frogs and fish can be studied without inflicting harm.

The team used light to control the behaviour of the neural crest cell cluster using a technique called optogenetics. After identifying a protein cable surrounding the cluster that contracts to move the cluster, they found that when neural crest cells at the back of the embryo were illuminated with a laser beam, they contracted and led to movement towards the face.

"By clarifying how faces develop, we can begin to investigate how that process can occur incompletely or differently to cause facial defects, and hopefully identify ways to prevent such harmful defects," said Ph.D. researcher Adam Shellard (UCL Cell & Developmental Biology), a co-author of the paper.

More information: "Supracellular contraction at the rear of neural crest cell groups drives collective chemotaxis," *Science* (2018). DOI: 10.1126/science.aau3301

Provided by University College London