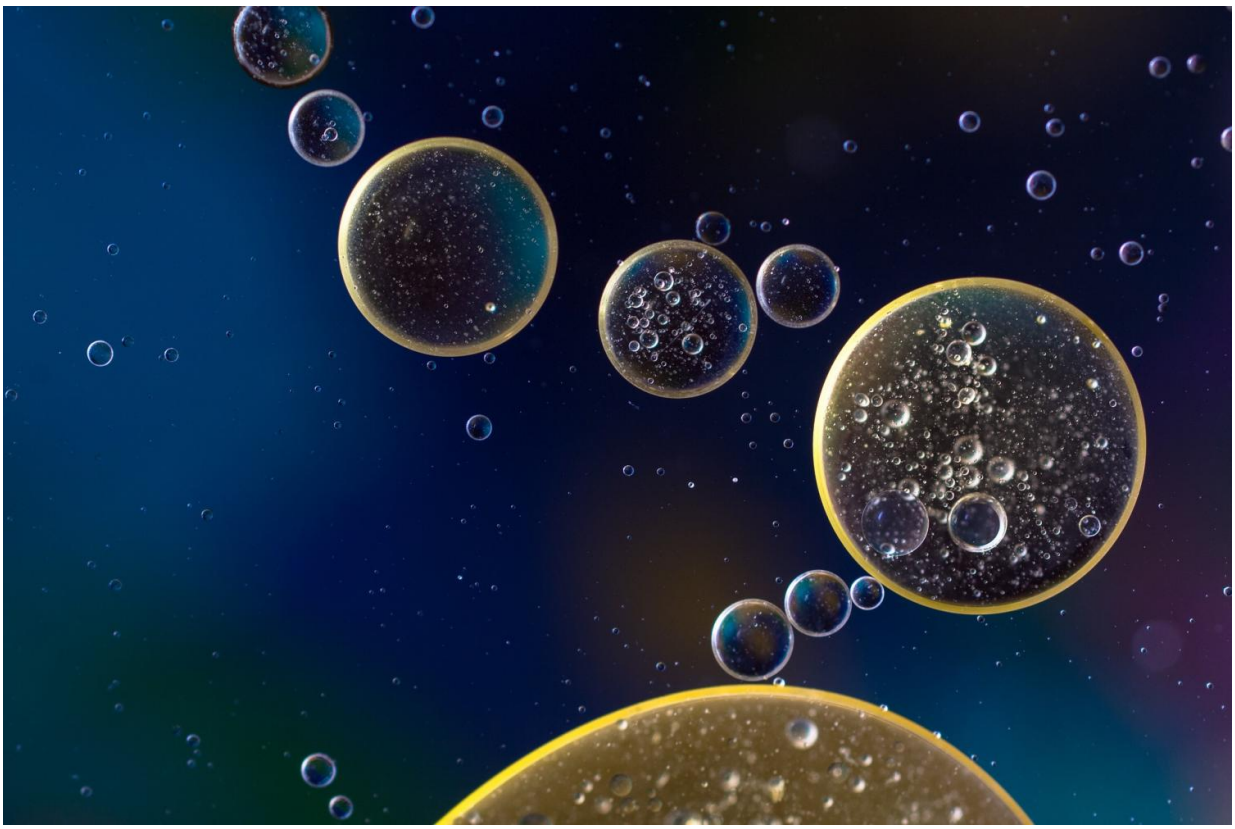
Noise helps cells make decisions: Team reveals the importance of genetic noise in development

August 1 2017



Credit: CC0 Public Domain

Random differences between cells early in development could be the key to making different cells in the body, according to new research from a

team co-led by Professor Wolf Reik. Different cell types - brain, blood, skin, gut etc. - all have unique and vital roles, yet they all start out the same. Cells become different as a result of a long sequence of biochemical choices made before we're born. For us to be healthy, these choices need to ensure we get the right number of each cell type.

Scientists at the Babraham Institute, EMBL-EBI and the Wellcome Trust-Medical Research Council Stem Cell Institute examined the genetics of stem cells from embryos at the earliest stages of development. Typically, cells of the same type have matching patterns of gene activity - many of the same genes are turned off or on in all cells. This latest research, published in the journal *Cell Reports* reveals that when cells start specialising into different cell types their gene activity becomes more 'noisy' - each cell starts to turn different groups of genes on or off.

The results, which focus on two choices near the start of embryo formation, show that, when cells are making decisions about what to become, there is greater variation in the activity of the genes in different cells - the same genes may be turned on in some cells and off in others. By chance this noise will make some cells more likely to become one type of cell, whilst others will start to favour an alternative.

The paper's co-first authors were Hisham Mohammed, Irene Hernando-Herraez and Aurora Savino. Dr Mohammed at the Babraham Institute, said: "Our analyses suggest that elevated transcriptional noise at two key points in early development coincides with cell fate decisions. By contrast, after these decisions cells become highly synchronised and grow rapidly. Our study systematically charts transcriptional noise and uncovers new processes associated with early lineage decisions."

This process of making similar cells become different is called symmetry breaking. This study marks the first time that a technique called single-cell sequencing has been used to examine individual cells

from mouse embryos in the early stages of development. Previous research has only examined groups of cells, so it has been impossible to investigate the differences between cells during symmetry breaking.

Co-senior author Professor Jennifer Nichols at the Wellcome Trust-Medical Research Council Stem Cell Institute, said: "Our data allow us to study gene activity in individual cells to an unprecedented level of precision. This detail has allowed us to observe substantial differences between cells. Regulating noisy gene activity during development may be a key part of how cells make decisions about their future. In the future we hope to discover how this process is controlled to better understand how noise shapes early development."

As the lead computational scientist on the paper, Dr John Marioni at EMBL-EBI, said: "Making sense of the data generated in studies like this is only possible thanks to ongoing advances in computational biology. With more than 10,000 pieces of data being collected about each individual cell, modern computers are essential in achieving the level of sensitivity needed for this type of research."

More information: *Cell Reports* (2017). DOI: 10.1016/j.celrep.2017.07.009

Provided by Babraham Institute

Citation: Noise helps cells make decisions: Team reveals the importance of genetic noise in development (2017, August 1) retrieved 2 May 2024 from https://phys.org/news/2017-08-noise-cells-decisions-team-reveals.html

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.