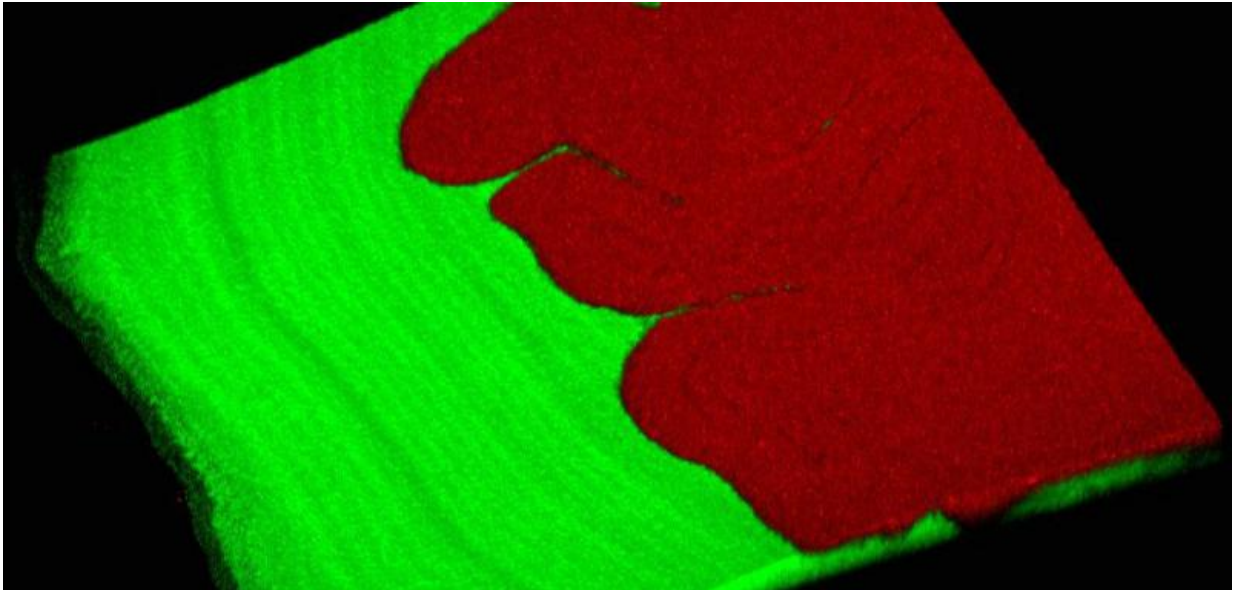


Divide the labour and rule the Petri dish

February 9 2016, by Stuart Gillespie, Oxford Science Blog



As a philosophical and practical concept, the idea of the division of labour – the separation of a work process into a number of tasks – can be traced back through figures as eminent as the economist Adam Smith and the engineer Charles Babbage (and even to a passage in Plato's Republic).

But while the division of [labour](#) is most commonly associated with mass production assembly lines, a new paper from researchers in Oxford University's Department of Zoology shows how bacteria can evolve a

similar process in a matter of days.

Dr Wook Kim, first author of the study, published in *Nature Communications*, told Science Blog: "Many sophisticated societies have the division of labour – not least our own, where it is central to much of our success both ecologically and industrially. Indeed, the term was used by the Scottish economist Adam Smith, who was a major player in the industrial revolution. Smith originally applied it to the idea of factory production lines, where different people specialise on individual tasks to manufacture something more complex. Smith wrote about manufacturing pins, but it is in car manufacturing that this process is perhaps best known and used."

In biology, the division of labour is observed in a number of insect societies – including bees, ants, wasps and termites – in which workers specialise in tasks such as foraging for particular foods, nursing the young, or guarding the colony. This allows the colony to achieve things collectively that a lone individual could never do.

Dr Kim added: "As well as insects, the division of labour is also known from a few species of bacteria that divide up their cells into specialised cells that do different things. There are a number of tasks divided up in this way, including toxin production, DNA uptake, and spore formation. However, in all cases, these systems have taken a long time – presumably millions of years – to evolve. By contrast, we have found that bacteria can evolve a division of labour in a matter of days. This opens up the possibility that the division of labour is much more widespread than we realised and is a way that many bacteria can deal with new challenges they face in the environment."

Based on the knowledge that bacteria can evolve rapidly in response to environmental challenges, Dr Kim and colleagues, including senior author Professor Kevin Foster, turned their attention to the division of

labour.

Dr Kim said: "We observed that colonies of *Pseudomonas fluorescens* repeatedly evolved to spread out rapidly and gain new territory much more successfully than their ancestors. Moreover, we found that this territory-grabbing is done by the combination of two genotypes working together – a division of labour. One strain pushes from behind, and the other makes a wetting polymer that lubricates and allows them both to move outwards. So it's a really nice mechanical division of labour, where together they can do something that neither can do on their own. We also show that this all occurs with just a single mutation that makes the "pushy" strain more sticky and adhesive. This allows it to form a rigid mat behind the other strain and push it along.

"Given the propensity of bacteria to rapidly radiate – or evolve – in every environment, this process should effectively create many combinations and permutations of distinct genotypes that may lead to a division of labour. Our work is also testament of the power of evolution, through natural selection, to find elegant solutions to a problem. By simply putting the cells on agar, we inadvertently gave the [bacteria](#) the challenge of finding a better way to colonise the surface of the nutrient-rich agar. In the face of this challenge, they rapidly responded to generate this simple but elegant solution that relies on both teamwork and the division of labour."

More information: Wook Kim et al. Rapid radiation in bacteria leads to a division of labour, *Nature Communications* (2016). [DOI: 10.1038/ncomms10508](https://doi.org/10.1038/ncomms10508)

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