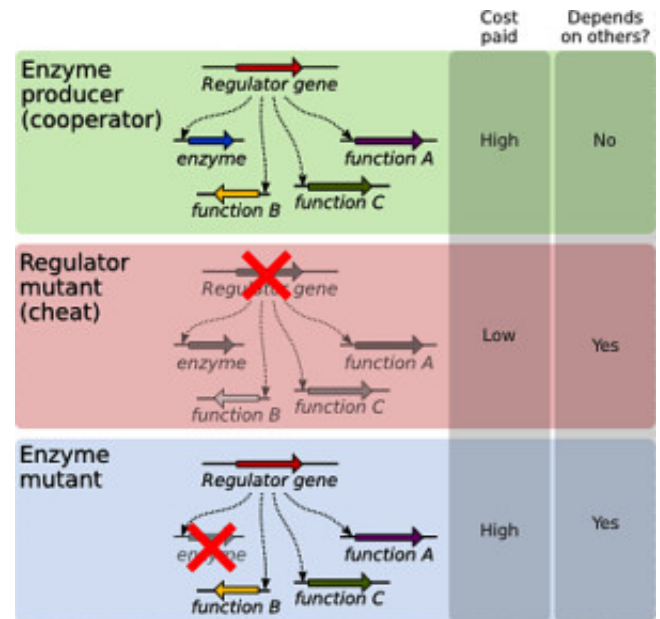


Gene wiring keeps bacteria cooperating

A bacterial cell can cooperate with its neighbours by producing molecules that allow them to grow better. These molecules may for example be enzymes that break down complex nutrients into digestible components. Because making these enzymes is costly, cells that make them quickly get outcompeted by others that only benefit but do not produce anything. These "cheating" cells arise easily through mutations that make them stop producing the enzyme.



There is a catch though: previous research has shown that where the mutation occurs makes cheating detrimental. Rather than occurring in the gene making the enzyme, mutations are typically found in a so-called "regulator gene", which controls not only the enzyme-making gene but a whole suite of other genes. Cheats that have this mutation then lose lots of other functions and can no longer grow well in some conditions. But this still leaves one question open: why does the mutation occur there rather than in the enzyme-making gene? In our study we show that losing only the enzyme-making gene - compared to the regulator gene - hardly gives any advantage to the cell. Instead, it loses its independence and must rely on other enzyme-producers without even saving itself any cost. Our understanding of how cooperation can be protected by gene wiring is becoming clearer: the organization of genes that are regulated together and the low cost of individual cooperator genes makes cheating less advantageous.

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