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BIOMATERIALS

Sticky Bacterium

Chemistry behind biological adhesives super strength remains unknown

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COURTESY OF YVES BRUN

STUCK ON YOU
Flagellum-bearing swarmer cells of the bacterium species *Caulobacter crescentus* are poised to pinch off from their parent cells, stalk cells whose stalks are capped with

holdfasts, which have adhesive powers surpassing any other known in biology.

New measurements of the adhesive power of a common aquatic bacterium indicate that the glue it makes to stick to surfaces is, in the words of the scientists who did the work, "the strongest ever measured for biological adhesives" (*Proc. Natl. Acad. Sci USA* **2006,** *103,* 7764).

"It's three to four times stronger than superglue," says Indiana University bacteriologist Yves Brun. Its strong enough, he adds, that a quarter-size patch could conceivably suspend a 5-ton elephant. In quantitative terms, the sticking power of the bacteriums adhesive approaches 70 Newton/mm^2, report Brun, Brown University biophysicist Jay X. Tang, and their coworkers.

The *Caulobacter crescentus* cells of the study are everywhere in aquatic settings. In one of their two forms, they grow stalks capped with a footlike structure known as a holdfast. There, an adhesive concoction, based in part on polysaccharides of *N*-acetylglucosamine, enables the cell to stick to surfaces. Once in place, the "stalk" cells bud off a series of mobile "swarmer cells" that seek out their own little dots of real estate, to which they stick by growing their own stalks and holdfasts.

To measure the bioadhesives strength, the researchers allowed stalk cells to attach to a thin, flexible pipette. Then they drew the cells corn-dog-shaped body into another pipette until the cell detached. The degree of bending of the first pipette, along with measurements of the holdfasts tiny area made with an atomic force microscope, provided a basis for the scientists to calculate the adhesives strength.

"The challenge now is to understand the chemical and biological basis for the impressive force," the researchers note. That wont be easy, says *Caulobacter* researcher John Smit of the University of British Columbia. "The adhesive sticks to everything, and so it is hard to analyze."

The researchers speculate that biotechnologically produced glues inspired by the *Caulobacter*s own could prove useful for repairing ships at sea and as alternatives to sutures and staples in surgical procedures.

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