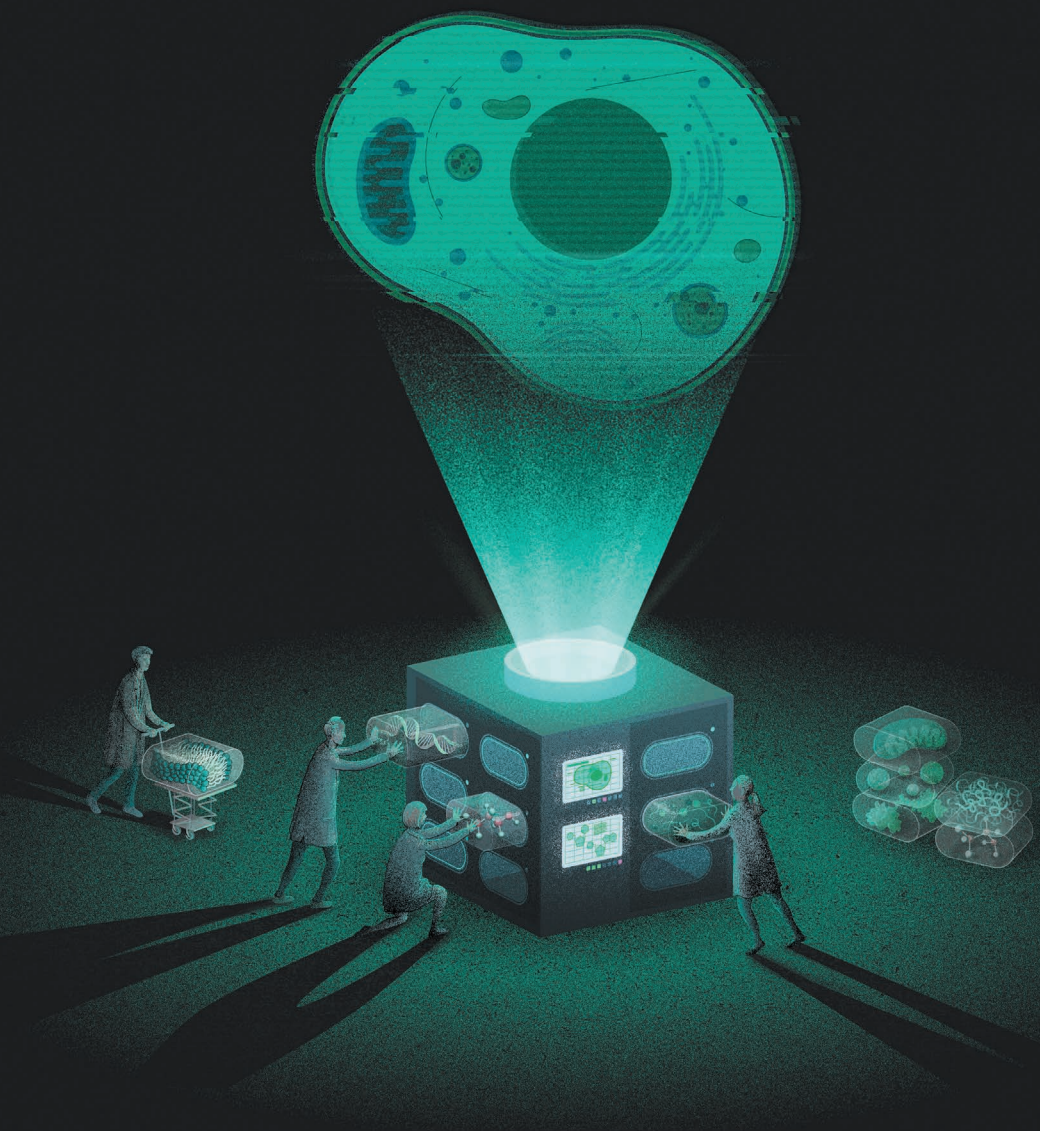


ILLUSTRATION BY NIK SPENCER/*NATURE*

BOTTOM-UP BIOLOGY

Researchers are tearing up the biology rule books by trying to construct cells from scratch. A special issue explores the lessons being learnt about life.

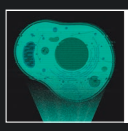
Cells are often called the building blocks of life — but that metaphor fails to capture their complexity. How do the multitudes of different molecules within a lipid envelope come together to carry out the functions required to sustain organisms? The standard approach in biology has been to work from the top down to study how cell components interact in their natural environment. But technical advances now allow researchers to take a different tack: using engineering principles to reconstruct biological processes from the bottom up. This special issue explores the potential and possible limits of bottom-up cell biology.

The ultimate goal for many is to construct an artificial cell from scratch. But there are vigorous debates about how to build it and what functions would be required to constitute life. A News Feature on page 172 explores how researchers are working to develop components such as membranes and metabolic pathways and to piece them together into a whole. And an Editorial on page 155 reminds us to consider the responsibility that comes with creating artificial life.

Before they succeed in creating an artificial cell, researchers might be able to develop cell-like systems engineered for biomedical applications. On page 177, Dan Fletcher, a bioengineer at the University of California, Berkeley, offers a wish list for such ventures that address pressing medical needs, including artificial blood cells and smart delivery vehicles for drugs.

Some groups are extending the bottom-up approach beyond cell construction. On page 203, Xavier Trepat at Spain's Barcelona Institute for Science and Technology and his colleagues report that they have developed a system in which cells stretch and deform themselves *in vitro* in ways that have been seen only in metal alloys. Now we can investigate whether this property helps to shape tissues during development, say Manuel Théry and Atef Asnacios from Paris Diderot University in an accompanying News & Views article, on page 192.

Like all scientific approaches, there are limits to what can be learnt from engineering biology. As a News & Views forum on page 188 highlights, researchers disagree about how useful the approach is for studying biological phenomena that are governed by physical variables. The complexity of cells is precisely what makes it appealing to build one, piece by piece. ■



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