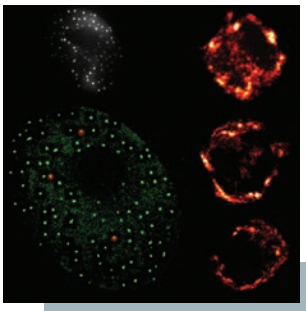

salk
Where cures begin.

Hu Cang

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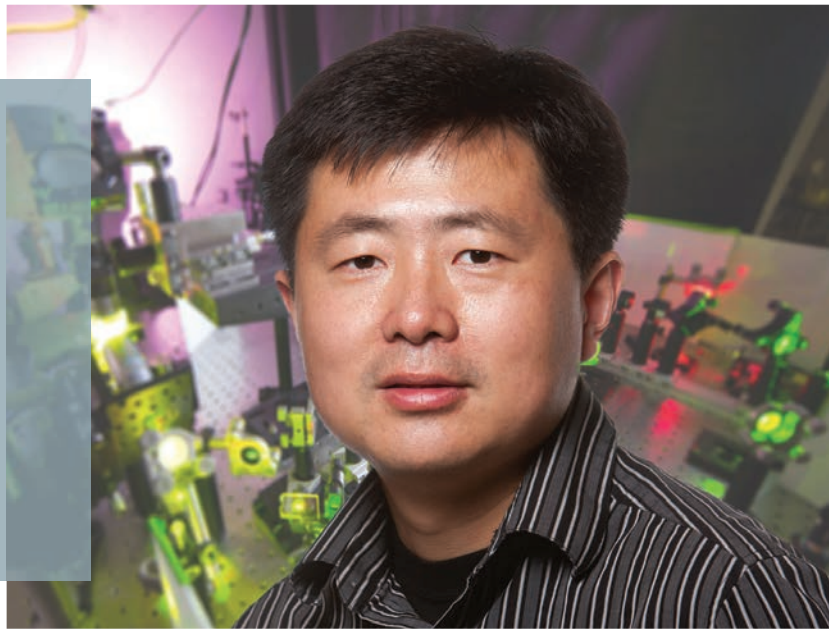

The Problem

Researchers in all realms of biology rely on microscopes to see the organisms, cells and even molecules that they study. But microscopes can only zoom in so far—the resolution of modern microscopes is about a quarter of a micrometer. This means that scientists can see cells and even some parts of cells but individual molecules—like the building blocks of proteins or DNA—are too small to distinguish from one another. Moreover, the dye molecules that can be attached to other molecules to light them up under the microscope wear out quickly, allowing only brief snapshots of their position. So, scientists face obstacles in seeing the tiniest details of molecules and in watching long-term processes inside cells.

The Approach

Hu Cang wants to improve the resolution of microscopes by designing lenses in a new way. Historically, lenses can only magnify objects that are at least as large as a wavelength of light—this is what has limited the resolution of microscopes. But Cang is developing a "super lens" that sees things smaller than a wavelength of light by assembling a lens from multiple parts. Cang's group has already made a microscope that can focus light down to a point smaller than ever before, enabling researchers to track individual proteins on the surface of a cell. Cang is also working on solving the second problem limiting today's microscopy: dyes that quickly fade when exposed to the bright light of a microscope. He is using chemical tricks to alter the structure and environment of these dyes to extend their lifespan.

With his expertise in cutting-edge microscopy, Cang collaborates with biologists who are trying to see the smallest moving parts of cells. He is particularly interested in using his new "super lens" approach to study the structure of genetic material, which is notoriously hard to visualize. Being able to see how strands of DNA fold and loop when they're packed within the nucleus of a cell might reveal more on how genes are turned on and off in both healthy and diseased cells.

The Innovations and Discoveries

- Cang showed how Amazon Cloud, an online data application, can be used to process the immense amount of data generated by super-resolution microscopes. The new approach could process an image that previously took 24 hours in only 72 minutes.
- He teamed up with Salk colleagues to study how proteins fold and bind to one another and develop new, stronger types of bonds. Cang's imaging approaches let scientists see details of these processes not previously visible.
- He also discovered a new way to stop dyes from fading under the microscope. By changing the environment of a dye, he enabled the dye to give off a thousand times more light before it wears out.

For more information, please visit:
www.salk.edu/scientist/hu-cang

Aging, Biophotonics, Cancer, Epigenetics