**Study Links Origin of Sexual Reproduction with High Mutation Rates**

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PASADENA, California—Biologists have long known the advantages of sexual reproduction to the evolution and survival of species. Sex helps a creature pass on its good mutations and respond better to environmental stresses that would leave its asexual neighbors floundering in the shallow end of the gene pool.

But a puzzling question is, how did sex begin in the first place?

Researchers from the California Institute of Technology (Caltech) and the Jet Propulsion Laboratory (JPL) propose an answer, based on studies of RNA material and computer-simulated activity of bacteria.

Claus Wilke of Caltech and Chris Adami, of both Caltech and JPL, have concluded that asexual bacteria can be nudged to evolve into sexual reproduction if they are subject to high levels of mutation induced by environmental stress—from, say, radiation exposure or a catastrophic meteor.

**Computer-Based Research**

The work was based in part on studies of "digital organisms," or self-replicating computer programs designed to closely resemble the life cycles of living bacteria. Such an approach is necessary because it's hard to obtain accurate data on how living organisms respond over time to multiple mutations and gradually lose their fitness.

"It is difficult to construct constantly changing environments in a petri dish," Adami said. Computer-based simulations, on the other hand, make it possible to study many generations in a short period of time.

Although the study did not involve living organisms, the researchers say their findings have significant implications for understanding the origin of sexual reproduction in the early world.

Many primitive single-celled organisms do just fine with asexual reproduction. But mathematical models have demonstrated that a sexual mutant in an asexual population isn't likely to compete successfully and pass on its genes. The researchers say their work shows that higher rates of mutations enable an asexual population to adapt sufficiently to give mutant individuals a greater advantage if those mutants reproduce sexually.

"The reason the origin of sexual reproduction has been such a big mystery is that we look at the world as it is now. But the early world was a much more stressful place, sometimes changing very rapidly," said Adami, who is co-publishing a report on the work in the July 22 issue of *Proceedings: Biological Sciences B,* a scientific journal of the Royal Society.

"We can't say how or when sexual reproduction came to take a hold in nature," he added, "but we can now say that high mutation rates can, under the right conditions, force an asexual organism to become sexual."