

19 Ocean Ooze Teems With Life

THE OCEAN BOTTOM IS ONE OF THE world's most important yet enigmatic ecosystems, covered in a thick sludge rich with bacteria that consume and recycle dead algae and animal feces. Somehow those bacteria get the essential oxygen they need to digest, even though very little of it should be able to penetrate the muck.

Last February, Danish biologist Lars Peter Nielsen stumbled on a possible explanation after his team at the University of Aarhus noticed activity in beakers of sludge set up for an experiment that had ended weeks earlier. The researchers measured falling oxygen levels at the surface of the sediment coupled with a disappearance of hydrogen sulfide (a food source to bacteria) a few centimeters below. "The oxygen and hydrogen sulfide were apparently interacting very closely and rapidly," Nielsen says—even though microbial chemical interactions should not be able to traverse such a distance.

Nielsen believes the secret is a bacterial pulley system of sorts: Oxygen-processing bacteria at the top connect to digestive microbes below via long protein threads that transport electrons. "A bacterium may not rely only on its microenvironment and neighboring cells," he says. "It may engage in a network with other bacteria living far away to share resources." BO ZHANG



Even in a beaker, bacteria in ocean-bottom sludge survive by sharing.

20 AIDS Virus Has an Ancient History

HIV IS A NEWCOMER AMONG HUMAN pathogens, having caused the first known cases of AIDS within the past few decades. So scientists suspected that SIV, the primate virus that spawned HIV, was just a few hundred years older. Tulane University virologist Preston Marx published research in September that suggests otherwise: SIV seems to be at least 32,000 years old, meaning it coexisted with people nearly all that time before HIV emerged.

Marx's team did SIV tests on monkeys from Bioko Island, which was cut off from the African continent 10,000 years ago. The Bioko SIV strains all shared ancestry with strains from the African mainland, indicating the virus is at least that old and probably much older. "Events in the 20th century launched the virus from a benign monkey virus into a human epidemic," Marx says. The growing use of blood transfusions and the rise of crowded cities may have helped pass SIV around and let it evolve into HIV.

If we do not figure out what triggered the HIV epidemic, it will be hard to prepare for what might come next. "We could be making new strains without knowing how to stop or control them," Marx says. MONICA HEGER



SIV, the yellow circles seen in this bone marrow culture, is the precursor to HIV.



21 Scans Can Track Brain Development

IN JUST SIX MINUTES, AN MRI scanner can reveal whether a child's brain is developing normally. That newfound capability was announced in September by a team at Washington University in St. Louis. Led by neurologist Bradley Schlaggar, the group studied 238

healthy volunteers, 7 to 30 years old, using functional MRI, a technique that identifies active neural circuits based on blood flow and blood oxygen levels. The scientists then used powerful computers to crunch the imaging data, seeking out common patterns of neural activity at different ages.

The Washington University team was able to home in on 200 patterns of neural activity that change as a brain matures. "Just as pediatricians chart height and weight to track developmental milestones, we can use patterns of neural activity to see where individuals fall within the typical range of variability for their age," Schlaggar says. Beatriz Luna, a developmental neuroscientist at the University of Pittsburgh, was staggered by the news. "As recently as a year ago, people thought this would be impossible," she says. "We assumed there would be too much individual variation to track brain maturation."

Reference maps of the maturing brain could improve our understanding of autism, schizophrenia, and other disturbances associated with abnormal brain development. "This promises to make functional MRI much more relevant as a diagnostic tool," Schlaggar says. KATHLEEN MCAULIFFE