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# Newly-Discovered Species of Bacteria Claimed to be Breaking Down Oil in Deepwater Plumes in the Gulf

## Good News for a Change, Or More Faulty Science?

By Washington's Blog
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A team of scientists published a paper today in the journal Science which provides some hopeful news.

Specifically, a team of scientists have discovered a new species of oil-eating microbes which thrive in the deepwater of the Gulf of Mexico:

> The biological effects and expected fate of the vast amount of oil in the Gulf of Mexico from the Deepwater Horizon blowout are unknown due to the depth and magnitude of this event. Here, we report that the dispersed hydrocarbon plume stimulated deep-sea indigenous -proteobacteria that are closely related to known petroleum-degraders. Hydrocarbon-degrading genes coincided with the concentration of various oil contaminants. Changes in hydrocarbon composition with distance from the source and incubation experiments with environmental isolates demonstrate faster-than-expected hydrocarbon biodegradation rates at 5°C.

Even better, the scientists believe that this new species (pronounced "gamma-proteo-bacteria") may not suck up as much oxygen as previously-discovered species:

> Based on these results, the potential exists for intrinsic bioremediation of the oil plume in the deep-water column without substantial oxygen drawdown.

This discovery is especially important given that a leading expert on oil-eating microbes – Dr. David Valentine – failed to find any of the leading known oil-eating bacteria in the deepwater plumes.

Many well-known bacteria – such as Salmonella, Yersinia (plague), Vibrio (cholera), Pseudomonas aeruginosa (lung infections in hospitalised or cystic fibrosis patients) and E. coli (food poisoning), as well as a number of geothermic ocean vent dwellers which eat methane or hydrogen sulfide – are members of the Gammaproteobacteria class of microbes. The scientists found a BP oil-eating species within that broader class of bacteria.

As Lawrence Berkeley Labs – a U.S Department of Energy lab – notes, the new species is closely related to Oceanospirillales, an order within the Gammaproteobacteria class of microbes:

> Results in the Science paper are based on the analysis of more than 200 samples collected from 17 deepwater sites between May 25 and June 2, 2010.
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> The dominant microbe in the oil plume is a new species, closely related to members of Oceanospirillales family, particularly Oleispirea antarctica and Oceaniserpentilla haliotis.
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> Frequent episodic oil leaks from natural seeps in the Gulf seabed may have led to adaptations over long periods of time by the deep-sea microbial community that speed up hydrocarbon degradation rates.
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> One of the concerns raised about microbial degradation of the oil in a deepwater plume is that the microbes would also be consuming large portions of oxygen in the plume, creating so-called "dead-zones" in the water column where life cannot be sustained. In their study, the Berkeley Lab researchers found that oxygen saturation outside the plume was 67-percent while within the plume it was 59-percent.

However, as Science News points out, not all experts agree with the new report:

> The team reports data from late May to early June showing that those deep-sea plumes enticed a hitherto unknown cold-water–adapted bacterium to rapidly chow down on the oil.
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> Indeed, [lead author Dr. Terry Hazen, co-director of the Earth Sciences Division of the Lawrence Berkeley National Laboratories] says, those bugs have been so voracious that for one plume of oil his team had been following, "within the last three weeks we no longer detect a deep plume. At all." It went away approximately two weeks after the well was capped on July 15, he observes. Its oil "is completely undetectable."
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> Also, the unusual population of oil-digesting bacteria that had inhabited that plume — and that would ordinarily be expected to stay with it as it moved — remained behind in a vestigial microbial cloud. "Doesn't that suggest biodegradation?" he asks.
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> Speaking of deep-sea plumes, "I've heard rumors they might have gone missing," notes David Valentine, a microbial geochemist at the University of California, Santa Barbara — but currents might simply have moved them into hiding. It would be nice to think the oil has been removed, he says. "But if it sounds too good to be true," he cautions, "it probably is." And yes, "This sounds too good to be true."
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> Hazen's interpretation has its skeptics. "Most of the science associated with this spill has been oversimplified," says John Kessler, a chemical oceanographer at Texas A&M University in College Station. In a good-faith effort to make sense of what's going on, many researchers look to offer interpretations based on too few data, he charges.
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> For instance, he says, "what Hazen was measuring was a component of the entire hydrocarbon matrix," which is a complex mix of literally thousands of different molecules. Although the few molecules described in the new paper in Science may well have degraded within weeks, Kessler says, "there are others

> that have much longer half-lives — on the order of years, sometimes even decades."
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> Moreover, he points out, many of the tools traditionally used to gauge biodegradation don't work well in the field. A few teams have lately begun transitioning to use of more sensitive probes, he says.
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> And data from those more sensitive tools are fueling his skepticism of Hazen's report that microbes have been erasing deep-sea plumes. As recently as August 22, Kessler says, "I spoke to some of those researchers out there [in the Gulf], and they told me they were still seeing plumes."

Similarly, as Reuters notes:

> According to WHOI oceanographer Richard Camilli, the plume could already be hundreds of miles from its previous location, and Hazen's team could simply have missed it. "The plume is not a stationary object," he told the Wall Street Journal.
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> University of South Florida microbial ecologist John Paul, part of a recent study that found oil in Florida fish spawning beds and contradicted federal claims of the oil's disappearance, wasn't convinced by the new results.
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> The differences in bacterial abundance, diversity and hydrocarbon degrading potential are "slight" between plume samples and regular Gulf seawater, said Paul. He also said that the gene-tagging technologies used by Hazen's team are used by few researchers "because they are often problematic in execution and interpretation of results."
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> According to University of Maryland aquatic toxicologist Carys Mitchelmore, Hazen's team only measured the breakdown of select compounds in the oil. "There's lots of other chemicals in the oil," she said.
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> She also stressed that it's essential to identify what happens when oil is degraded. That catch-all term implies that it just vanishes, but "sometimes things can be degraded into more toxic components," said Mitchelmore. The latest study did not make those measurements, nor did it test how microbes interacted with chemical oil dispersants used during the disaster.
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> "The big take-home is that we don't know much about many things related to this spill, the oil fate and its effects" said Mitchelmore. "There are huge data gaps and uncertainties, conflicting data from many aspects, and this will continue to happen based on the huge complexity of studying this."
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> "Above all," said Mitchelmore of the latest study, "note this is all based on 17 sample sites from the field.

As Lawrence Berkeley Labs notes, the research was funded by BP:

> Hazen … conducted this research under an existing grant he holds with the Energy Biosciences Institute (EBI) to study microbial enhanced hydrocarbon recovery. EBI is a partnership led by the University of California (UC) Berkeley and including Berkeley Lab and the University of Illinois that is funded by a $500 million, 10-year grant from BP.

Reuters also picks up on the potential conflict of interest:

> Funding for the study was provided by the Energy Biosciences Insitute, a joint project of the University of California, Berkeley, the Lawrence Berkeley National Laboratory, the University of Chicago at Illinois-Champaign and BP, who gave the EBI a $500 million, 10-year grant. Terry Hazen sits on the EBI's Executive Committee, as does BP executive Tom Campbell. Conflicts of interest are rarely as black-and-white or simple as they seem, but this ought to be mentioned.



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