

Re: Article: Bacterial Evolution Down in the Depths

Source: <http://sci.tech-archive.net/Archive/sci.bio.evolution/2005-08/msg00060.html>

- *From:* "IRR" <iotarhorho@xxxxxxxxxxxxxxxxxxxx>
 - *Date:* Thu, 4 Aug 2005 18:59:28 -0400 (EDT)
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"Perplexed in Peoria" <jimmenegay@xxxxxxxxxxxx> wrote in message
[news:dcn5lj\\$2k8v\\$1@xxxxxxxxxxxxxxxxxxxxxxxx](mailto:news:dcn5lj$2k8v$1@xxxxxxxxxxxxxxxxxxxxxxxx)

>

> "Robert Karl Stonjek" <rstonjek@xxxxxxxxxxxx> wrote in message
> [news:dcmakm\\$2bh4\\$1@xxxxxxxxxxxxxxxxxxxxxxxx](mailto:news:dcmakm$2bh4$1@xxxxxxxxxxxxxxxxxxxxxxxx)

>> Down in the depths

>> Sheilagh Molloy

>>

>> An obligate photosynthetic anaerobe found in deep-sea hydrothermal vents
>> might photosynthesize by harnessing geothermal light rather than solar
>> energy, according to recently published results.

>>

>> Scientists have been exploring the microbiology of deep-sea hydrothermal
>> vents – geysers that form along volcanic mid-ocean ridges – using
>> submersible vessels for almost 30 years. Until now, life in this
>> environment

>> was thought to depend on chemotrophic bacteria, although the
>> identification

>> of low-level illumination in the form of 'vent glow' gave a tantalizing
>> hint

>> that photosynthesis was a possibility.

>>

>> Beatty et al. investigated whether geothermal illumination could support
>> photosynthesis by analysing samples taken from the effluent plume of a
>> type

>> of vent known as a black smoker located at the East Pacific rise.

>> Enrichment

>> culturing yielded a non-motile bacterium that has been named GSB1.

>> Analysis

>> of the absorption and emission spectra of intact GSB1 cells isolated in
>> pure

>> culture – with major peaks at 750 nm and 775 nm, respectively – indicated
>> the presence of light-harvesting bacteriochlorophyll c.

>>

>> Further analysis by electron microscopy revealed the presence of
>> light-harvesting chlorosomes, structures that are commonly found in green
>> sulphur bacteria. Light energy is transferred to the chlorosome reaction
>> centre through the Fenna-Matthews-Olson (FMO) protein; PCR using

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- >> FMO-specific primers amplified a 970-bp FMO segment from GSB1, and
- >> sequence
- >> analysis led the authors to conclude that GSB1 is a green sulphur
- >> bacterium
- >> related to the Chlorobium and Prosthecochloris genera. For growth, GSB1
- >> requires anaerobic growth conditions, sulphur in the form of elemental
- >> sulphur or H₂S, CO₂ and light.
- >>
- >> This identification of a green sulphur bacterium in a sample taken from a
- >> deep-sea hydrothermal vent not only suggests that photosynthesis can take
- >> place in the absence of sunlight but also once again illustrates the
- >> maxim
- >> that bacteria are the ultimate survivors.
- >>
- >> Full Text at Nature
- >> http://www.nature.com/nrmicro/journal/v3/n8/full/nrmicro1220_fs.html
- >
- > It seems we still don't have a proof that these bacteria are actually
- > receiving and utilizing light. All we know is that they have some of the
- > machinery for doing so.

I think one of the key features that this article didn't key in on is that these types of organisms apparently are only known to be obligately photosynthetic, e.g. other types of metabolism (aerobic respiration, chemosynthesis) are not options here. Not to say that this bug could have just happened to float into this environment right as the samples were being collected...

- > A speculation: Isn't it possible that the chlorosomes are simply acting
- > as intermediate carriers in a non-photo-assisted electron transport chain?
- > ISTM that the environment in which these bacteria are found should be
- > rich enough in CO, CO₂, and H₂S to support reductive carbon fixation
- > even without a photo-assist. Building the chlorosomes when some simpler
- > electron carrier would do does seem wasteful, but then mother nature only
- > economizes when she is forced to.

IIRC, the chlorosomes are only able to effectively transfer the energy of absorbed photons to the photosynthetic reaction centers, primarily because this is by a radiative (e.g. light quanta) transferring mechanism called Forster energy transfer, rather than by transferring electrons through a chain of redox intermediates. Not to say that this odd bug might be doing something completely new... as you mention, this could be mother nature forced to economize.

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• *Follow-Ups:*

- ◆ *[Re: Article: Bacterial Evolution Down in the Depths](#)*

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◇ *From:* Perplexed in Peoria

• **References:**

◆ **Article: Bacterial Evolution Down in the Depths**

◇ *From:* Robert Karl Stonjek

◆ **Re: Article: Bacterial Evolution Down in the Depths**

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