

Squirrel In Hell

2016-11-20

On Risk of Viral Infections from Chlorella

第一

In November 2014, a certain study caused a great deal of panic. The study reported detecting traces of a Chlorella virus (ATCV-1) in samples from human throats, and finding a decrease of cognitive capacity in those infected with it. The authors of the study report that they had further verified their result by infecting mice with the same virus, and finding that they had lower performance on solving some puzzles versus mice in the control group.

The original [study](#) was titled:

Chlorovirus ATCV-1 is part of the human oropharyngeal virome and is associated with changes in cognitive functions in humans and mice

However when picked up by other sources, it quickly [became](#):

Algal virus found slowing down the brains of humans

And then in [popular media](#):

Found: The viral infection that makes nearly HALF of us more stupid (and it lasts for YEARS)

Soon, the virus was dubbed the "Stupidity Virus" and it went downhill from there. You can easily imagine how it happened that the Internet is now flooded with those articles, and that they (still, after 2 years) drown out anything else about the issue.

第二

Let's pause and figure out what to make of this, imagining we are back in November 2014. Which is similar to what I knew after a quick search on the topic (the "shouty" articles obscure anything else, so that's what I saw) and checking the original study.

On the first page, we read:

We unexpectedly found sequences homologous to the chlorovirus Acanthocystis turfacea chlorella virus 1 (ATCV-1) in a metagenomic analysis of DNA extracted from human oropharyngeal samples. These samples were obtained by throat swabs of adults without a psychiatric disorder or serious physical illness who were participating in a study that included measures of cognitive functioning. The presence of ATCV-1 DNA was confirmed by quantitative PCR with ATCV-1 DNA being documented in oropharyngeal samples obtained from 40 (43.5%) of 92 individuals.

and

The presence of ATCV-1 DNA was not associated with demographic variables but was associated with a modest but statistically significant decrease in the performance on cognitive assessments of visual processing and visual motor speed.

So the virus was found in 40 of 92 people (suspicious! extremely suspicious!), and was correlated with a "modest but statistically significant" decline in cognitive capacity (suspicious! small sample? are we overinterpreting noise?).

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If you take a look at the rest of the paper, the authors used 9 tests, from which 4 had definitely not significant results ($p > 0.1$), 3 had p value around 0.01, and one had $p < 0.002$. This is NOT at all strong evidence, considering that the situation is maximally selected to get any apparently significant result.

After adding the additional outside-view monition "**Beware the man of one study**", my credence-o-meter says "very low" overall.

However, if someone was very worried about cognitive decline, they could still understandably be uneasy.

第三

So what has happened after the original study? Checking Google Scholar and "Related Content" on the PNAS website turns up several papers:

- March 2015 - an independent group from Denmark published a **letter**, in which they argue that the detection of the ATCV-1 virus was likely a mistake due to contamination of samples. They detected similarly short fragments of matching DNA in various other samples, as well as in negative controls. The second sequencing experiment from the original study, based on the PCR method, suffers from similar problems. The authors also point to some laboratory reagents that correlated with spurious detections, and overall claim to have rebutted the original findings.
- March 2015 - published immediately in the same issue of the PNAS journal, a **reply** to the letter listed above, signed by all of the 18 authors of the original study. They argue that it is unlikely that both of the sequencing experiments generated spurious results, and that the PCR reactions they did had negative results in controls. They also say that the suspicious laboratory reagents have not been used.
- December 2015 - a **paper** in the Journal of Virology, by four of the authors of the original study and two new people, in which they detect inflammatory responses in macrophages for a short time after exposure to the ATCV-1 virus. This confirms my earlier suspicion that this kind of effect (i.e. a standard slight inflammatory response) could wholly account for any observed changes in infected organisms (including a temporary slight cognitive decline).
- August 2016 - another **paper** about reactions of mice to being infected with ATCV-1, by Irina V. Agarkova (listed in all the previous studies), Thomas M. Petro (the study from December), and Marilyn S. Petro. The access to this one is restricted, though it appears to claim similar results as before.

Except for the above, there seems to not have been much interest in the topic from other researchers.

I don't have any particular qualifications to read biology papers, but the more carefully I looked at the evidence supporting the case in the original study, the weaker it seemed. Also, the reply from Denmark gives references that support having very low priors for this kind of result. At some point you just have to admit that there is nothing here.

The third virtue is lightness. Let the winds of evidence blow you about as though you are a leaf, with no direction of your own. Beware lest you fight a rearguard retreat against the evidence, grudgingly conceding each foot of ground only when forced, feeling cheated. Surrender to the truth as quickly as you can.

- E. Yudkowsky

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