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Safety of electronic cigarettes and the Loch Ness Monster

4. JUNE 2014 BY [BERND MAYER](#) — 13 COMMENTS

This is the famous “Surgeon’s Photograph,” showing a monster that allegedly lives in the lake Loch Ness in Scotland and is often cheerfully called by its nickname, Nessie. Despite this picture and several pretended sightings, there is no genuine evidence for the existence of Nessie. The scientific community considers the monster as a modern-day myth and explains sightings as misidentifications of more mundane objects, hoaxes, or wishful thinking (for more information see the comprehensive [Wikipedia article](#)).



However, absence of evidence is not necessarily evidence of absence. Nessie could be shy and immediately duck out of sight whenever someone comes close. You may argue it would have had no chance to hide from sonar scanning of the whole lake (what has indeed been done several times in the past). But possibly it resides in hidden caves in deep water. So we extend our search to sufficiently large underwater caves but still don't find the monster. But without knowledge about its biology, we cannot exclude that Nessie is highly flexible and able to squeeze its way through extremely tight, hardly detectable corridors. The monster even might be getting

transparent under certain circumstances, further compromising its detection. In other words, we cannot prove that the Loch Ness Monster does not exist. We can only state that

(i) there is no evidence for its existence, and that

(ii) its existence would be scientifically implausible (for several obvious reasons I don't discuss here).

This example illustrates an important point: there is no "proof" in the empirical sciences. Mathematicians can prove a theorem, but dealing with the real world will never provide unshakeable truth. There are extremely well established laws of nature, such as the law of gravity or the laws of thermodynamics, but the transition from Newtonian physics to relativity and quantum mechanics shows that sometimes even established principles are replaced by better theories.

What has this blabber got to do with with electronic cigarettes? Authorities concerned about our health often request marketing of electronic cigarettes be banned until their safety is proven. To prove safety, one has to prove the absence of harm. So we encounter similar difficulties as described above for proofing the absence of Nessie.

What evidence is required for declaring electronic cigarettes as "safe"?

Electronic cigarettes may be regarded as safe if users don't experience toxic effects. Since millions of users haven't suffered any damage so far, this criterion appears to be met. However, there could be subtle chronic effects that become apparent only after a while. To account for this possibility, health advocates ask for long-term studies. But what is "long" (1, 5, 10 or even 20 years?) and for what kind of effects should we look for?

Similarly to the search for the monster at plausible locations, we will likely study the occurrence of biologically plausible incidents, such as impaired function of the lungs, blood vessels, or the heart. But what about the hidden caves the monster may reside in? Long-term use of electronic cigarettes could affect physiological functions we had not considered. Through some unexpected, not well understood mechanisms vaping could cause an increased risk to develop a certain type of cancer, or enhance the severity of migraine attacks, or promote the appearance of pimples on the butt, any adverse effect you can think of.

Even if a long-term cohort study should reveal, let's say a 2-fold increased risk for

colon cancer after 20 years of vaping, a subsequent study may find an association between colon cancer and long-term banana consumption. Unfortunately, the study on electronic cigarettes was not controlled for this unexpected confounder (as epidemiologists call this type of annoying disrupting factors). So we have to start over again. In fact, anything we consume could have subtle harmful effects verifiable only in extensive studies. In case of bananas, we just don't care.

Vaping could provoke a virtually infinite number of effects, which "cannot be excluded" as often said, theoretically requiring an infinite number of disproving studies. However, if I claim that something happens, I have a responsibility to provide supporting evidence. Reversing the burden of proof by requesting others to refute my claim is a variant of the **argument from ignorance**, a popular anti-scientific tactic to distract from lacking evidence. Therefore, electronic cigarettes have to be considered as being safe in the absence of data suggesting harm, not the other way round.

Summary

I have deliberately chosen far-fetched examples to show that the approval of electronic cigarettes could be postponed forever by asking to wait until their safety is proven. There is no evidence for harmful effects of inhaling the vapor of liquids, consisting of propylene glycol, glycerol, nicotine and flavoring, going beyond the effects of other consumables, such as coffee, drinks or some foodstuff. In addition, based on current knowledge in physiology, pharmacology and toxicology there are no grounds for supposing that vaping could be particularly harmful. The monster was not found, and its existence would be implausible.

There are conditions in which nicotine consumption should be kept to a minimum, e.g. serious cardiovascular diseases and, possibly, pregnancy. But individuals suffering from gout, high blood pressure or liver disease are recommended to reduce their consumption of meat, strongly salted food, or alcohol, respectively. Only very tough hardliners would call for a ban of these products, I suppose.

Flickr Creative Commons Image via [Biodiversity Heritage Library](#)



About Bernd Mayer

Dedicated to science, critical thinking, and scientific education of young people. Fighting pseudoscience and all kind of esoteric junk.

Comments



Hans Schmidt says

5. June 2014 at 21:55

Congrats! I like your way of presenting science. Vape on!

Reply



Spazmelda says

6. June 2014 at 14:49

Very nice explanation of the impossibility of proof of absolute safety!

Reply



matt says

6. June 2014 at 15:19

Still think NASA need to rule out the mission to Mars due to the risk of attack from little green men

Reply



James Hayton says

6. June 2014 at 17:50

a minor detail, that in no way detracts from the article; That picture of 'Nessie' has, by the surgeon's own admission be declared a fake . . .

Logically, one cannot prove a global negative; at best one can say, ' at this time, in this place, no evidence has been found',

Reply



Bernd Mayer says

6. June 2014 at 18:50

Thank's for mentioning! You are right, the photograph is a fake. I hope I haven't left the impression to expect finding Nessie somewhere in the lake.



Reply



Anja M ERF vaper (@anjaffm) says

10. June 2014 at 21:00

Excellent! Thank you very much!

Reply



Jim Ranes says

28. June 2014 at 18:29

Dr Mayer,

Thank you for your excellent writings on the subject. I am one of the directors of a

grass roots boots on the ground organization fighting for our rights to freely vape and for smart educated local legislation. We will continue to posts your writings and link your blog on our FB page (almost 4100 members<https://www.facebook.com/groups/thevapingmilitia/>) and on our website (<http://vapingmilitia.org/>). Thanks you sir again for your work.

Jim Raney

Executive Director

The Vaping Militia LLC

Reply



Sloppy Joe says

15. August 2014 at 18:28

I enjoyed reading this, thank you.

I must say, though, that I don't completely agree with "...electronic cigarettes have to be considered as being safe in the absence of data suggesting harm, not the other way round."

'They' are saying that ecigs are not safe because there is an absence of data. We're saying they are safer, therefore the burden of proof is on us. Example: the prosecuting side has the burden of proof that X murdered Y. X says he didn't do it. Prosecution says he did and is required to prove it.

The absence of data should not lead one to conclude that electronic cigarettes have to be considered anything, let alone safe. That's like saying, 'god exists because there is an absence of data suggesting his existence'.

It's a bit of a dramatic reference to express my (somewhat fine) point.

Reply

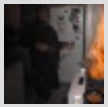


Michael Peake says

18. April 2015 at 0:01

In a constitutional state or democracy the legislature, in the first level of jurisdiction, has to prove that you are “guilty”. It’s not that the people have to prove that they are “innocent”. And that applies also to us vapers from a scientific point of view. Everything else falls under “applied “religious sentiments” of our “opponANTZ”.

Reply



castello2 says

7. March 2015 at 21:56

Nicely written Bernd!

Reply

Trackbacks

Respiratory Societies on Electronic Cigarettes: Farewell to Science, Reason, and the Hippocratic Oath says:

2. October 2014 at 9:49

[...] Correct, but meaningless. Absence of evidence is not evidence of absence. Therefore, adverse health effects of the emissions of a fart can neither be excluded. In fact, it is not possible to exclude adverse health effects of anything. For further details, I refer to my post on the “Safety of electronic cigarettes and the Loch Ness Monster”. [...]

Reply

Pseudowissenschaft in der E-Zigaretten Politik - LIQUID-NEWS says:

7. May 2015 at 2:28

[...] die auf absolut alles angewendet werden kann und daher absolut sinnfrei ist. Wie im Artikel "Electronic cigarettes and the Loch Ness Monster" bereits erläutert, kann eine garantierte Gefahrenlosigkeit ("absence of harm") [...]

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7. May 2015 at 17:24

[...] die auf absolut alles angewendet werden kann und daher absolut sinnfrei ist. Wie im Artikel "Electronic cigarettes and the Loch Ness Monster" bereits erläutert, kann eine garantierte Gefahrenlosigkeit ("absence of harm") niemals [...]

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Scientific essays about nicotine, tobacco and electronic cigarettes.

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Dedicated to science, critical thinking, and scientific education of young people



- Bernd Mayer

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