

Do you believe astrology is a science?...

... well, a lot of Swedes certainly do. According to a new opinion study from the Swedish organisation Vetenskap & Allmänhet 23% of them think that astrology is scientific. The study's authors subsequently conclude, "The results show that people do not have enough knowledge about what science is."

Yes, yes, we hear your response, "C'mon, we're scientists. *Of course*, we know what is and what isn't science! Astrology is most definitely pseudo-science and there are even more examples - homeopathy, anthroposophy, intelligent design, vibrational medicine to name but a few." But are you sure? Do you think you *definitely* know *exactly* how science and pseudo-science differ from one another?

The mere fact that somebody works in science does not necessarily mean that they know the difference between science and pseudo-science. That's what we have just experienced in connection with an article we published at the end of last year in our German sister journal *Laborjournal* (English version on our [Lab Times](http://www.labtimes.org/editorial_e_22.html) website at http://www.labtimes.org/editorial_e_22.html).

The story centred around two professorships in the Faculty of Organic Agricultural Sciences at the German University of Kassel. These had originally been created by a consortium of donors whose origins lie mainly in organic farming and/or anthroposophy. No wonder, therefore, that the chairs were decided in favour of two relatively open followers of anthroposophy. Furthermore, one of the applicants had published several articles and supervised a couple of theses; all claiming that nature's spirits such as elves or goblins truly exist!

Yet another story of how pseudo-scientific elements manage to masquerade under the cloak of true science. And the university, as hard-pressed for money as any these days, succumbed.

Our author presented the facts in his article and concluded by effectively stating that anthroposophy cannot be proven to be scientific and that, consequently, anthroposophical antics should not be tolerated in the "houses of science", i.e. the universities. Beyond that, everyone is free to believe and follow whatever his or her preference.

Shortly after the article appeared, we were flooded by furious e-mails sharply protesting against the article and defending anthroposophy. We have to admit, we somewhat expected and were prepared for this reaction. What *did*, however, surprise us was that most of the complaints were received from scientists working in scientific institutes. For example, a female scientist from a medical research institute wrote, "Your report about the anthroposophists [...] constitutes the maximum of intolerance and polemics. We cannot imagine that a magazine that employs people who apparently cannot tolerate different views and directions of thought actually follows a truly scientific approach." Pardon? We really had to rub our eyes hard!

After many more similar responses we could not help concluding that working as a scientist in a scientific institute doesn't



Zebra has stripes
– fact or theory?

necessarily mean one always knows what constitutes science – albeit the usual formal scientific education. So it seems befitting to spend the last few paragraphs of this editorial questioning what actually separates science from pseudo-science.

Most notably Karl Popper wrote about the demarcation line in order to compare science to "non-science-that-tries-to-look-like-science". In particular, he wanted to work out what exactly is missing from pseudo-science to make it true science.

Here come Popper's conclusions in a nutshell (with the invaluable help of an essay entitled "Has the demarcation problem been solved?" by US philosopher Janet Stemwedel). Science starts by building up theories. Theories, however, are always tentative. They can be rather speculative or extremely well tested – either way, they are still theories. For example, proclaiming that zebras have stripes is not a fact but a theory since we might one day spot a zebra without stripes.

From this follows that scientific claims are generally testable – and are, therefore, falsifiable (as mentioned, you only have to look for zebras without stripes). Thus, science is set up to challenge its theories and search for evidence that might prove a theory to be false. Supporting this statement is the evidence that can be found to establish with certainty that a conclusion is wrong; however, we never find evidence to conclusively verify a theory. If then a scientific picture of the world is wrong, that hard-headed scientific attitude at least provides us with the chance of finding out it is wrong, so we can switch to a different picture.

Pseudo-science, in contrast, seeks confirmation; it is set up to look for evidence that supports its claims. And these claims, in turn, usually fit with any sort of discernible outcome imagined. The logical conclusion is that no conceivable test could show a pseudo-scientific claim to be false – meaning that it is not testable at all. Thus, pseudo-science may make you *feel* like you've got a good picture of how the world works but you could well be completely wrong! However, you'll never find out...

Of course few scientists spend every waking minute thinking about how to challenge their own theories. What's important, however, is the general difference in attitude between science and pseudo-science. In an ideal world a scientist is disposed to kiss even his favourite theory goodbye if the evidence stacks up against it, whereas, a proponent of pseudo-science won't ever...

Has this been of some help to you? For comments and discussion: editors@lab-times.org

The Editors

