Fact or Fiction?

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Creation of Life through Electricity

Imagine you are running an experiment to determine if you can grow crystals by dripping a silicate solution onto a rock through which you are passing an electric current. After a number of weeks you start seeing small creatures grow out of your experiment and "move about with pleasure." What would you do? Probably call a press conference and bask in your "15 minutes of fame" which you would certainly deserve for showing "spontaneous generation" of life. After all, you produced living things from a lifeless compound!

Now let's go back to England in 1836 and a gentleman - amateur scientist named Andrew Crosse. A few months before Victoria ascended to the throne, living mites of the genus *Acarus* unexpectedly crawled out of an electrical experiment conducted in Crosse's private laboratory in Somerset. Here's what James Secord says about this experiment, "The sensitive nature of research into the origin of life gave the experiments a major role in controversies about miracles and materialism. With so wide a range of possible uses, the creation of life through electricity became the most famous experiments of the first half of the nineteenth century."[1] This was helped by publication of Mary Shelley's *Frankenstein* in 1818. In fact, Peter Haining hypothesizes that a young Mary Shelley, listening to a lecture on electricity by Crosse in 1814 (long before Crosse's spontaneous generation experiments) was an influential part in the construction of her novel.[2]

Andrew Crosse was interested in electricity and conceived the notion that crystalline mineral deposits were generated by electric discharges. So he set up an experiment where he passed a current from a voltaic cell through a solution of potassium silicate and hydrochloric acid that was set dripping over a porous stone of red iron oxide. The stone was kept electrified by platinum wires coupled to a small voltaic battery.[1]

This was a long term experiment - just think how long it takes for crystals to grow in caves. On the fourteenth day of the experiment, Crosse observed a few small whitish specks clustered around the middle of the electrified stone. Four days later, these specks had doubled in size and had struck out six or eight fine filaments around each speck. On the 26th day of the experiment, the objects had assumed the form of perfect insects, standing erect on the bristles which they were growing, and on the 28th day, the objects were moving their legs. After a few more days they detached themselves from the stone and moved about through the solution. Eventually, more than a hundred of them made their appearance on the oxide of iron. As Crosse reported, "Under a microscope I examined them and found that the smaller ones had six legs, the larger ones had eight. Others who have examined them pronounced them to be of the genus *acari*, but some say they are an entirely new species."[3]

All of this played out like an early version of what we experienced with "cold fusion" a few years ago. The timing was auspicious for Crosse. The first stage in his creation of electrical life depended on the voltaic cell, a new experimental technology of the "second scientific revolution." And as James Secord notes, "The second stage depended on new printing methods, an innovative technology of the Industrial Revolution. The steam press, developed in the first decade of the nineteenth century, transformed the production of newspapers and periodicals, making possible runs in the tens and even hundreds of thousands. The first newspaper to take advantage of these new capabilities was *The Times*, which was to play a key role in the *acari* controversies. Other related technologies revolutionized the printing of books, so that prices fell to the point where they could be bought in large numbers by members of the middle classes and even by educated artisans. The significance of this new genre of "people's literature" was nowhere more evident than in science. Without the voltaic cell, Crosse's experimental program would have been impossible. Without the steam press, his work could never have entered the public domain as a popular sensation."[1]

Secord adds, "Publication (without Crosse's permission) on the last day of 1836 in a local newspaper under the headline 'extraordinary experiment' led to an international sensation. The power of the press was released in full tide. Crosse was accused of being a Frankenstein, a 'disturber of the peace of families' and 'a reviler of our holy religion.' By others he was hailed as an enthusiastic genius who had broken the ancient boundary between life and matter. Debate about the issue continued for decades."[1] More recently, *The Times* (July 29, 1938) even devoted a column to him on the one hundredth anniversary of his initial experiments.[4]

To add a sense of legitimacy to Crosse's work, towards the end of February 1837, Michael Faraday was widely reported in the press to have successfully repeated Crosse's experiment. Secord notes, "Faraday had not even tried to replicate Crosse's experiment, but the reports that he had done so successfully had a major impact on the debate. Blanket coverage of the story in periodicals and newspapers meant that this 'result' joined the original report of Crosse's work as an established scientific fact; the leading experimental

natural philosopher in England now stood behind the electrical origin of insect life." Here's what Faraday said to a friend: "With regard to Mr. Crosse's insects etc., I do not think anybody believes in them here except perhaps himself and the mass of wonder-lovers. I was said in the English papers to have proved the truth of his statement, but I immediately contradicted the matter publicly and should have thought that nobody who could judge in the matter would have suspected me of giving evidence to the thing for a moment. Contradict it in my name as fully as you please."[1] Yet the power of the press prevails. Faraday was claimed to have duplicated Crosse's results as recently as 1966.[5]

At least six experimentalists attempted to duplicate Crosse's work. One of them, the Kentish surgeon William Henry Weekes claimed success. No one else repeated the work successfully and so insects did not appear in other laboratories. Bringing this event to our present time, Secord reports, "In the twentieth century the only experimenters hoping to try the work of Crosse and Weekes have been American school children, led by books like Frank Edwards' *Stranger than Science* (1959) to believe that Faraday had repeated the experiments successfully. The Royal Institution was deluged with their inquiries during the early 1960s. After all, the creation of insect life through electricity would make a superb project for a student science fair."[1]

Walter Gratzer observes, "Gradually truth prevailed, a closer inspection of siliceous rocks revealed no insects, and no more was heard of the spontaneous generation debate, although it was by no means the end of the spontaneous generation debate. This was settled for practical purposes by Pasteur in 1864, much applauded by Faraday. A few diehards held out, prominent among them a biology professor at London University, E. W. MacBride, who was silenced only by death in 1943."[3]

In discussing the electrical hypothesis and spontaneous generation, Milton Millhauser concludes, "The electrical hypothesis was no more than provisional. As for the *Acarus*, it had never really convinced the scientists, and was promptly enough exposed as a blunder—an affair of slipshod methods and contaminated apparatus. The creature itself turned out to be merely the perdurable *Acarus horridus,* which flourishes in the rubbish of chemists' shops, survives immersion in undiluted ammonia, and would presumably relish a bath in copper nitrate and a prolonged electric shock."[6] Crosse, incidentally, also produced *acari* in concentrated solutions of copper nitrate, copper sulfate and zinc sulfate.[7]

Perhaps you've even had a few of these creatures in some of your plating solutions. It's not unheard of. A strain of mold has been reported that grows in a 270 g/L copper sulfate solution containing some sulfuric acid, as long as a little sugar was present.[8] Others have reported on fungus growing and rich, blue bacteria have been found in potassium ferricyanide solution.[10]

On the topic of electricity and generation of life, one has to mention the famous Stanley Miller- Harold Urey experiment conducted in 1953 at the University of Chicago, This experiment attempted to recreate the chemical conditions of the primitive Earth in the laboratory using water, methane, ammonia, hydrogen and electricity (to simulate lightning). At the end of one week of continuous operation Miller and Urey found traces of organic compounds, including organic acids and amino acids, formerly regarded as exclusive products of living things.[11,12] Subsequent experiments, adding traces of hydrogen cyanide, hydrogen sulfide and phosphates revealed all sorts of organic chemicals created in these conditions, many of them being particularly characteristic of living things. As John Postgate reports, "This experiment has been abundantly confirmed in other laboratories."[13] **P&SF**

References

1. J.A. Secord, "Extraordinary Experiment: Electricity and the Creation of Life in Victorian England," in *The Uses Of Experiment*, David Gooding, Trevor Pinch & Simon Schaffer, Eds., Cambridge University Press, Cambridge, UK, 1989; p. 337.
2. P. Haining, *The Man Who Was Frankenstein*, Frederick Muller Ltd., London, UK, 1979; p. 70.
3. W. Gratzer, *The Undergrowth of Science*, Oxford University Press, Oxford, UK, 2000; p. 100.
4. P. Haining, *The Man Who Was Frankenstein*, Frederick Muller Ltd., London, UK, 1979; p. 5.
5. R.T. Gould, *Oddities*, University Books, New York, NY, 1965.
6. M. Millhauser, *Just Before Darwin*, Wesleyan University Press, Middletown, CT, 1959; p. 94.
7. R.T. Gould, *Oddities*, University Books, New York, NY, 1965; p. 120.
8. J. Postgate, *Microbes & Man*, 3rd Ed., Cambridge University Press, Cambridge, UK, 1992; p. 42.
9. 0. Sletten & C.E. Skinner, *Journal of Bacteriology*, **56** (5), 679, 1948.
10. R.L. Folk, private communication, January 11, 2001.
11. S.L. Miller, "A Production of Amino Acids Under Possible Primitive Earth Conditions," *Science*, **117**, 528 (May 15, 1953).
12. S.L. Miller & H.C. Urey, "Organic Compounds Synthesis on the Primitive Earth," *Science*, **130**, 245 (July 31, 1959).
13. J. Postgate, *Microbes & Man*, 3rd Ed., Cambridge University Press, Cambridge, UK, 1992; p. 243.

Answers to I.Q. Quiz #448

From page 9.

1. (a) Reduce the cost of water and sewer taxes, (b) reduce treatment equipment costs (capacity), (c) increase treatment efficiency, (d) reduce chemical usage and (e) enhance process integrity.
2. Rinsing between processes protects the following process from contamination by the chemicals in the prior process tank Rinsing at the end of the process line prevents the formation of undesirable residues on parts and also helps to dry them.
3. Soils accumulated in the tank and the rinse water can stratify. Agitation is essential to combat the problem.
4. The drag-out rinse must be filtered to avoid returning solids to the tank, which can harm the finish,
5. Water quality is measured in terms of electrical conductivity, expressed as "mhos" (reciprocal of resistance, ohms) or Siemens.