VILIFICATION IN SCIENTIFIC REVOLUTIONS

ABSTRACT: Vilification, involving defaming or speaking evil of a person, is not unknown in the process of scientific revolution. Pierre-Charles-Alexandre Louis (1787–1872), George Waldbott (1898–1982), and Herbert Needleman (1927–2017) have all set us an excellent example of pursuing academic knowledge and scientific revolution despite experiencing personal vilification.

Keywords: Bloodletting, Fluoride neurotoxicity; Lead neurotoxicity; Louis PCA; Needleman HL; Scientific revolutions; Vilification; Waldbott GL.

Vilification, involving defaming or speaking evil of a person, is not unknown in the process of scientific revolution. French physician Pierre-Charles-Alexandre Louis (1787–1872) was vilified when he disagreed in 1828 and 1834 with the theory that fevers were the result of inflammation of the organs and that bloodletting was an effective treatment for any fever.[1,2] His approach was strongly resisted by doctors at the time who were unwilling to wait for tests to determine if current treatments were effective, or to discard treatments if they were found to be ineffective.[3] Although Louis's view that bloodletting should be limited to severe cases of disease is no longer accepted, Louis's position that bloodletting was not an generally effective approach for treating fever is now universally accepted.[4] Bloodletting has been abandoned in modern medicine apart from the use of therapeutic phlebotomy for a few specific indications such as for reducing the number of red blood cells in haemochromatosis, polycythemia vera, and porphyria cutanea tarda.[5]

Pierre-Charles-Alexandre Louis
14 April 1787–22 August 1872

Devo et al. noted that it should not be a surprise that scientists are sometimes challenged by special interest groups and that the huge financial implications of many research studies invites vigorous attack.[2] They noted Angell's reference to litigation, fear, bias, and greed interfering with scientific efforts to answer questions of importance to public health and that an anti-scientific social attitude encouraged premature or ill-informed political and legal solutions to medical questions.[2,6] Devo et al. gave as an example the hobbling by the lead industry of the work of Needleman et al. on the health risks of low-level lead exposure and how others were intimidated through coordinated attacks at scientific meetings and skilful manipulation of the procedures for investigating scientific misconduct.[2]

Herbert Needleman died in Pittsburgh, USA, at the age 89 on 18 July 2017 and it is appropriate to pay tribute to his persistence in persevering with his pioneering work on the neurotoxicity of lead despite personal attacks on his integrity.[7,8] Needleman's interest in lead neurotoxicity developed while he was working as a resident at the Children's Hospital of Philadelphia where he treated a severely ill child with acute lead poisoning who gradually recovered from a stuporous state with EDTA chelation therapy.[9] He realized that, because of financial constraints, the mother could not act on his advice that she move her accommodation to a healthier environment with less lead pollution in order for her daughter to avoid a further episode of poisoning, with the associated risk of mental retardation.[9] Later,

while working as a resident in a community psychiatry programme in North Philadelphia, he gave a talk at a black church one night to a group of adolescents and at the end of the talk, a boy came up to him and started talking about his ambitions.[9] Needleman noticed the boy was obviously brain-damaged and having trouble with his words, propositions, and ideas.[9] Needleman wondered how many of the children he was seeing at his clinic had undiagnosed lead poisoning.[9] The window in his clinic office overlooked a school playground, in an older urban neighbourhood polluted with lead from paint and industrial contamination, and he watched the children every morning line up to go to school.[9] He decided that he would go into the school, identify the children who had elevated lead levels, and see what their IQs were.[9]

The area was difficult to study because of the limitations with the available tests for lead exposure with hair, blood, and fingernails.[9] Hair and fingernails could be contaminated with dirt containing lead from the environment and not reflect the levels in the body while blood lead levels might be normal at the age of six and not reflect exposure before the age of 2 years.[9] He knew lead accumulated in bone and hit on the idea of measuring lead in deciduous teeth after they had fallen out or had been extracted.[9] He worked with dental colleagues and collected deciduous teeth from suburban and inner-city children.[9] Two papers on the lead levels in teeth were published in 1972[10,11] and it was suggested that a tooth might be a useful marker to estimate the body lead burden after the exposure had ended.[10] In a major 1979 paper, Needleman et al. reported that 58 children with high dentine lead levels scored significantly less well on the Wechsler Intelligence Scale for Children (Revised) than those with low lead levels.[12] This difference was also apparent on verbal subtests, on three other measures of auditory or speech processing, and on a measure of attention. Analysis of variance showed that none of these differences could be explained by any of the 39 other variables studied. The classroom behaviour, of all the 2146 children whose teeth were studied, was also evaluated by a teachers' questionnaire and the frequency of non-adaptive classroom behaviour was found to increase in a dose-related fashion with increases in the dentine lead level.[12] Thus, lead exposures, at doses below those producing symptoms severe enough to be diagnosed clinically, appeared to be associated with neuropsychological deficits that might interfere with classroom performance.[12]

In a subsequent letter to the editor, Needleman, Levison, and Bellinger examined the additional variable of pica which was not one of the original 39 covariates studied.[13] They found the actual relative risk due to lead was 3.89 and concluded that pica was not a confounding variable, and that a small IQ difference between the median or mean scores in the distribution of the subjects with high lead levels and those with the with low lead levels resulted in important differences in the tails of the distributions.[13] Children with elevated lead levels were three times more likely to have a verbal IQ below 80 and although 5% of those with low lead levels had IQ scores in the superior range (>125), no child with an elevated lead level scored in this range.[13]

In 1996, Needleman et al. reported on a study of 301 children aged 7 and 11 years and concluded that lead exposure was associated with an increased risk for antisocial and delinquent behaviour, and that the effect followed a developmental course.[14]

Photo courtesy of David Bellinger

Dr Alan Leviton (left), Dr Herbert Needleman (13 December 1927–18 July 2017), and Dr David Bellinger at the Charles A. Dana Foundation Award ceremony in 1989. Needleman won an award for his research on lead poisoning.

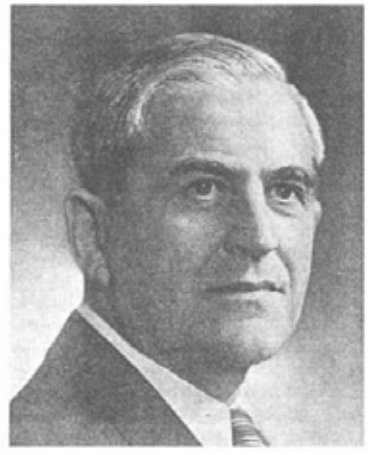
Needleman was attacked for not adjusting his results for all the factors that might possibly affect brain development.[15] He responded by noting, "I pointed out that complete covariate control is impossible to achieve, but that many studies controlling for differing factors found a lead effect. This consistency among the studies published at that time was strong evidence that the lead effect was real and not produced by confounders, and this was strongly buttressed by animal studies, which showed similar changes and effectively destroyed the reverse causality hypothesis."[15] However, this response did not satisfy his opponents and he was accused of fraud.[15] Two scientists took it upon themselves to scrutinize his work for possible flaws.[15] In 1991, Needleman received a brief that accused him of scientific misconduct.[9] It was submitted by David Geneson, an attorney with Hunton and Williams, a firm that was linked, through its board of trustees, to the Ethyl Corporation of America, a company involved in the manufacture and marketing of the anti-knock agent tetraethyllead.[9] The charges were sent to the Office of Scientific Integrity, National Institutes of Health, who referred them to the University of Pittsburgh.[9,15] Needleman's files were locked, and he could only look at his data in the presence of a representative of the Office of Scientific Integrity of the University.[9] An inquiry committee, composed of three people from the University, two epidemiologists and a statistician, looked at his data tapes and regressions and got the same results.[9] They reported that they found no evidence of scientific misconduct but they could not rule out scientific misconduct.[9] The University said that there was enough reason to go ahead with an investigation, which is the second phase of a scientific misconduct inquiry.[9] Needleman said that it was like a grand jury deciding whether or not there was a reason to go forward,[9] The University found that there was no misconduct but that they should go forward anyway.[9]

Needleman said that this was an absolutely horrible time for him.[9] He said that he was mostly furious because he thought that they were not going to find anything because there was not anything to find.[9] He said that he learnt who his friends were

and they were not people in the medical school, but in the faculty in the University at large, such as those in the liberal arts and the sciences.[9] A medical school friend said later that he did not visit during this period because he was afraid.[9] After a hearing lasting one and a half days, an investigating committee found that there had been no misconduct.[9] Although the faculty handbook stated that if someone is found not guilty of scientific misconduct the University should make a public statement, they never did.[9] However, he subsequently won the Chancellor's Award for Community Service and received $2,000 together with a handshake.[9] The unreasonably protracted investigation eventually exonerated him but cost him more than ten years of frustration and an enormous waste of his time.[15]

The work by Needleman and his colleagues played a critical role in the elimination of lead in petrol and the lowering of the Centers for Disease Control's blood lead standard for children.[9]

The vilification accorded to Louis and Needleman has also been seen in the reporting of fluoride-induced toxicity. George Waldbott reported that Dr Hornung wrote a derogatory letter about his scientific reasoning on fluoridation which distorted the facts and was widely distributed in the news media and at public hearings to undermine his stature as an expert on the health effects of the fluoride ion.[16]



Photograph courtesy of Fabian Bachrach

George L Waldbott
14 January 1898–17 July 1982

Both lead and the fluoride ion are neurotoxic at very low levels, may interact,[17] and may share a common mechanism for inducing neurotoxicity.[18] Needleman considered that there was no threshold for the neurotoxic effect of lead, that it had no biological function, and that any amount was going to be deleterious.[9] The safe level of fluoride intake for children has been estimated to be less than 0.05 mg/day.[19] While the neurotoxicity of lead is now universally accepted, the neurotoxicity of fluoride at low levels, such as with the use of water with 0.7 mg F/L (0.7 ppm), is still being disputed.

The German philosopher Arthur Schopenhauer submitted that "All truth passes through three stages: first it is ridiculed, second it is violently opposed, third it is accepted as being self-evident." The acceptance of the neurotoxicity of lead places the knowledge about lead at the third stage in Schopenhauer's classification while a general understanding of the toxicity of fluoride has yet to achieve that status. Max Plank did not reveal himself as being a naïve optimist when he commented, "A new scientific truth does not triumph by convincing its opponents and making them see the light, but rather because its opponents eventually die, and a new generation grows up that is familiar with it." It has been said that, "Science advances funeral by funeral." In commenting on the influence of Pierre-Charles-Alexandre Louis, Best and Neuhauser expressed a similar sentiment with, "As long as one is willing to wait a generation, teaching students is the way to change the world."[20]

Thomas Kuhn concluded that techniques of persuasion were more important in changing paradigms than the documentation of proof and the demonstration of

error.[21] He considered that if a paradigm was ever to triumph it must gain some first supporters—people who would develop it to the point where hardheaded arguments could be produced and multiplied.[21] Then as more scientists were converted, the exploration of the new paradigm could continue until, at last, only a few elderly hold-outs remained, and a new scientific community reformed as a single group.[21] However, embracing a new paradigm at an early stage often needed to be done with faith that the new paradigm would succeed with the many large problems that confronted it, knowing only that the older paradigm had failed with a few.[21] Kuhn viewed the transfer of allegiance, from a widely-held paradigm to one that contradicted it, as a conversion experience that could not be forced.[21]

The pioneers in scientific revolutions often build on the work of those who have preceded them but doing so in the face of personal criticism requires courage and determination. Pierre-Charles-Alexandre Louis (1787–1872), George Waldbott (1898–1982), and Herbert Needleman (1927–2017) have all set us an excellent example of pursuing academic knowledge and scientific revolution despite experiencing personal vilification.

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