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Why is chemical brain injury ignored? Pondering causes and risks - Editorial

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NEARLY A DECADE AGO, I was persuaded that the brain was more sensitive to chemicals than were other organs. (1) Evidence originated from studies conducted by myself and others; we investigated the possible association between human brain damage and exposure to various chemicals contained in gases, organic solvents, and pesticides. My earlier resistance to this possibility originated from a lingering personal doubt and a sincere hope that it was not true. Growing support from the study of individuals--alone and in groups (i.e., clinical epidemiology)--has challenged the belief that epidemiology cannot prove causation. (2,3) Repeated strong associations that establish cause and effect in clinical medicine are considered only suggestive, but this is not sufficient in epidemiology.

During the past 50 yr, the hesitancy of researchers to distinguish causes from risk factors has been an unfortunate legacy of this paradigm of chronic-disease epidemiology; it derives, in part, from the difficulty in the extension of Koch's postulates beyond infectious disease. (3) Forgotten is the observation made 150 yr ago that halting exposure to fecal and insect-borne agents stopped epidemics. This observation was made prior to the postulates introduced by Robert Koch, (4) and the concept of "infection" had not yet been introduced. A classic example is Snow's mapping of London's cholera cases; this approach allowed for the evolution of the association with water from the Broad Street pump, which was contaminated with human excrement. (4)

I presume that the numerous factors that currently slow both individuals' and society's acceptance of chemicals as major causes of diseases are the same as those that created opposition so many years ago to the demonstration that fecal contamination of water caused cholera. I think it imperative to identify 13 such factors.

1. Concealed damage. This factor is familiar to shippers; often, an individual must open a package before discovering damage not visible on the surface. By analogy, subtle tests may be needed for the identification of chemical brain injury. The wide gulf between abnormal findings detected by subtle testing and an individual appearing maimed encourages skeptics to cry for strong proof that impairments truly exist. When such findings were evident on sensitive tests, they portended important defects or deficiencies that needed follow-up studies to show progression. After 10 yr of follow-up, brain injury had worsened. (6)
2. Psychic resistance to vulnerability. The reluctance of individuals to consider that the brain could be vulnerable is an emotional defense to fear or terror--like the outcry upon learning of the unexpected death of a loved one. Inasmuch as we know that the human brain is protected by a bony skull, and that a barrier between blood and brain filters out bacteria, we hope it also deflects harmful chemicals. But, in another compartment of our logical brain, we know that the barrier does not filter out anesthetic gases (ether), alcohol contained in drinks, or injected (street) drugs.
3. "It's all in your head." Sometimes physicians dismiss unfamiliar problems of patients with this rejoinder, implying that the perceived problem stems from a mind disorder or a psychiatric problem. Seldom is the broader, literal interpretation made--that "in your head" means a brain problem. While "mind" may be a nebulous concept, brain dysfunction is susceptible to orderly, objective investigation. It is strange that few psychiatrists, when evaluating chemically exposed patients, consider that the depression, mania, and other disorders they treat with drugs (chemicals) could be caused by other chemicals. Instead, the tendency is to prescribe more chemicals (drugs), thus further poisoning the brains of such patients.
4. Acceptance of mind-altering drugs. The average citizen is well aware of the effects on the mind-brain of illicit chemicals, such as heroin and cocaine, marijuana, and lysergic acid diethylamide (LSD), as well as legal chemicals like alcohol and caffeine, and prescribed (and street) amphetamines. Many physicians have prescribed Paxil and Prozac "reflexively" to improve mood--especially for the treatment of depression. Such obvious connections should not be ignored. Thorazine, the first widely prescribed psychic or mind-altering drug, has been prescribed for 50 yr, and iproniazid (a monoamine oxidase inhibitor related to isoniazid, which is used to treat tuberculosis) has been available for a similar time period.
5. Not an imminent threat. Chemical brain damage is not generally considered an imminent or personal threat, like, for example, anthrax or terrorist.

piloted airliners. Exposure to Sarin in the Tokyo subway, however, demonstrated that chemical warfare is effective on large numbers of people. The methyl isocyanate disaster at Bhopal, India, in 1984 had a worse outcome than that experienced in Tokyo. Possible personal harm from chemical exposure has not been inferred. Individuals with chemical brain injury are frequently labeled as "emotionally disordered," but they should be viewed as a vanguard of individuals who are knowledgeable about chemicals by virtue of experience. There is no evidence that the aforementioned individuals "were differently susceptible." Rather, they just happened to be present when the exposure event occurred—for example, like the victims on September 11, 2001.

6. Competition from other threats. This factor has been suggested to be an explanation for indifference. Critical review evidences little substance in these "competing" threats. Recognition that a bacterial infection (*Helicobacter pylori*) caused peptic ulcer was only a minor newsmaker. Enormous concern has been generated regarding acquired immune deficiency syndrome (AIDS) and associated problems, which are sexually transmitted diseases and threaten to depopulate Africa. (7) AIDS is a serious brain infection and intoxication. The emerging resistance of bacteria to antibiotics was hyped in *The Coming Plagues* (7) and *Secret Agents: The Menace of Emerging Infections*. (8) Antibiotic resistance is a well-known result of short-sighted practices, abetted by treating colds and sore throats with antibiotics and adding antibiotics to animal feed for the increase of productivity (meaning: profits). Clearly, anthrax, smallpox, and similar agents resemble the aforementioned chemicals--Sarin and methyl isocyanate--in being extremely difficult to guard against.

7. Delay in acknowledging health risks. This factor was a 20th century theme. Cigarette smoke was associated with lung cancer in the 1950s. Inasmuch as many physicians quit smoking, their rates of lung and other cancers dropped quickly; myocardial infarction and stroke decreased greatly by 1975. Twenty-five years following 1975, nonsmokers' rights were recognized, and indoor smoking was curtailed--despite lobbying by powerful and rich tobacco interests under the pretense of guarding the rights of smokers, but whose underlying impetus was the protection of their immense profits. The proscription of asbestos exposure was, by far, more difficult than was the proscription of spitting on the sidewalk or the quarantining of tuberculosis patients. The banning of asbestos required 75 yr--a time period that exceeded that required for the banning of indoor cigarette smoke. The asbestos lobby protected profits until companies filed for bankruptcy in the early 1990s. American corporations' general rule appears to be that the health of workers takes a back seat to profits.

8. Economic interests. Economic interests may discourage prevention--even of cancer. The avoidance of exposure to toxins halted scrotal cancer in chimney sweeps, bladder cancers in Rehm's aniline dye workers, and radon lung cancers in miners in the late 19th century. Enormous, expensive institutions do "research on cancer," and dedicated public organizations pursue the biologically implausible myth of cancer cures. The fact is that big reductions in lung cancer mortality occurred when cigarette smokers quit smoking. Another success was achieved when exposure to ionizing radiation was curtailed following the bombing of Hiroshima and Nagasaki, and after the Nevada/Utah atomic testings. It is safe for us to assume that other cancers can be prevented by the cessation of exposure to cancer-causing chemicals (e.g., polyaromatic hydrocarbons from petroleum, polychlorinated biphenyls).

9. The promise of human genome mapping. Genome mapping is viewed as the key to human disease, and it threatens to replace cancer as a rallying cry for "believers." Attention is consistently deflected from the reality that only 5% of human diseases has a genetic basis, with, perhaps, an additional 10% showing genetic influence. Worst are the hollow claims that we must know the site at which chemicals affect the genome to stop their inhalation or withdraw them from use--thus ignoring the lessons since cholera.

10. Splintering of medical and surgical practice. This ongoing aforementioned process is creating experienced technicians (still licensed as physicians and surgeons) who cannot see and understand the interplay of factors in their patients. These individuals have been trained to perform triple-bypass surgery; to transplant kidneys, livers, and hearts; to perform angioplasties and stent blood vessels; to cannulate intrahepatic bile ducts; and to conduct bronchoscopic, gastroscopic, and colonoscopic examinations. Therapeutic oncologists and hematologists wield powerful chemicals to cure the 1st cancer and cause the 2nd. Technical engineering characterizes doctors who can barely perceive the edges of their subspecialties--they might be sued if they venture beyond set boundaries. Few academic departments train internists or surgeons who consider problems in whole patients or inquire beyond reflex responses when unusual problems strike.

11. Neurology has been slow to consider causes. Perhaps this slowness occurs because neurology focuses on the structure of the brain, not its function. Pathophysiological thinking began prior to 1950 in the field of hematology, and shortly thereafter in the pulmonary disease and cardiology specialties. In contrast, neurology adopted the electroencephalogram mainly to confirm seizures, and the computerized axial tomography scanner and magnetic resonance imaging to find localized lesions, but otherwise, with the assistance of 19th century methods, it estimates muscle strength, body balance,

visual function, memory, and problem-solving. Psychological testing, such as that developed by Wechsler in 1940 and Halstead (to Reitan) in 1950, is also ancient and largely obsolete. (6)

12. Resistance to the idea that chemicals damage brains and may cause chronic brain diseases. This "bridge concept" has few disciples in neurology. Examples of damage from specific organic solvents include n-hexane and acrylamide, both of which destroy nerves (9); clioquinol (hydroxyquinoline), which produces optic atrophy and permanent vision loss; and ethambutol (for the treatment of tuberculosis), which causes optic neuritis and the loss of red and green discrimination. Regarding these as special cases--not to be generalized to anticipate similar problems from other chemicals--impairs progress. Recall that John Parkinson's disease, described in 1817, was epidemic in manganese refiners in 1837; and that new but strong associations have been found between dying cells in the brain's striatonigral system and herbicides and the street drug MPTP (1-methyl-4-phenyl-1,7,3,6-tetrahydropyridine).

13. Failure to recognize potential harm from low chemical concentrations. Despite awareness that the brain has enormous amplifier capacity, most neurologists ignore--and some deplore--the concept of sensitivity to low concentrations of chemicals. The case in point is Multiple Chemical Sensitivity Syndrome, which is labeled as "fringe" or "kooky," as if the battlements of medical thought must be defended from such an idea. Some held to these biases while they treated Gulf War veterans who died of premature amyotrophic lateral sclerosis. In contrast, occupational neurotoxicity has a rich history, including the disturbance of brain function by mercury in mirror silverers in 1700, and palsy and psychosis caused by lead, as described in 1737 by Ben Franklin in fellow printers who handled lead type. These 13 explanations for delayed acceptance of the reality of chemical brain injury illustrate a cultural lag in medical thinking and in society as a whole. Acceptance of a new idea can take a generation--or 2 or 3. Recall the classic hazards of cigarette smoking recognized in the 1950s, of asbestos in the 1960s, and of nuclear (ionizing) radiation (also in the 1960s). Half a generation has ensued, so perhaps the existence of chemically induced brain injury will be accepted by 2010. Ironically, acceptance will be slower if many decision makers' brains have been damaged, and it will be accelerated if damage has been limited to a few.

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