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How Air Pollution Damages the Brain

The human brain is susceptible to grave harm from air pollution. Air pollutants can trigger strokes. They can also affect brain development and reduce human intelligence.

Air pollutants and Stroke

When armful air pollutants lead to inflammation and artery blockages in the arteries that nourish the brain, they can lead to stroke. Stroke is an important cause of incapacitation and of death.

- Particulate matter, especially fine particulates (PM2.5), increase the risk of strokes and of death from strokes, especially for women. Data from the Women's Health Initiative show that for each increase of 10μg/m3 in the PM2.5 concentration, women faced a 35% increase in the risk of a cerebrovascular event and an 83% increase in the risk of death from a cerebrovascular event.

- Although a relatively small portion of all strokes appear to be related to concentration of PM, the fact that nearly 800,000 people in the U.S. have a stroke each year means that even a small percentage results in a significant number of strokes.

- Studies have also found correlations between sulfur dioxide concentrations and ischemic stroke, carbon monoxide and stroke, and ozone peak concentrations and stroke.

Mercury and Developmental Damage

Mercury is a potent neurotoxin that can severely harm the brain and the developing nervous system. Human exposure to mercury occurs as a result of air pollution from natural sources, such as volcanoes, but also from man-made sources like coal-fired power plants, cement kilns and industrial boilers. These sources emit mercury into the atmosphere, where it remains until it is carried back to the earth by the rain. When mercury enters lakes and streams, bacteria convert it to methylmercury, a chemical form that accumulates in the tissues of fish and animals and moves up the food chain. Humans are exposed primarily through fish consumption, with large tuna, swordfish, king mackerel, and tilefish having the highest methylmercury concentrations.

When pregnant women eat foods contaminated with methylmercury, they expose their developing babies to this dangerous substance. Exposure to methylmercury in the womb can adversely affect a baby's growing brain and nervous system, resulting in eventual impacts on cognitive thinking, memory, attention, language, and fine motor and visual spatial skills. These may include impairment of speech, hearing, and walking, impairment of peripheral vision, lack of coordination of movements, and muscle weakness. Even mothers with no symptoms of nervous system damage may give birth to infants with severe disabilities. Children and infants who are exposed to methylmercury can likewise suffer impaired neurological development.

Minimizing or eliminating mercury emissions from man-made sources is an important action that can be taken to prevent additional amounts of mercury from entering the environment and affecting health.

Lead

Lead is a well-known toxic substance. Lead poisoning is particularly harmful during early childhood because children absorb lead from the gastrointestinal tract more readily than adults, and lead in the blood of children circulates into the brain more frequently.

Lead poisoning in infancy or childhood can have long-term mental and socio-emotional effects. Lead exposure in childhood can result in decreased cognitive functioning, including assessments of reaction time, scanning and executive functioning in adults, that is, cognitive flexibility and abstract reasoning. Lead exposure can also affect subsequent verbal memory and verbal fluency. Aggression, behavioral issues (such as depression and sleep complaints) and increased social/delinquent behavior have also been positively correlated with lead exposure.

For an individual, lead-induced loss of intelligence may hardly be noticed. However, when considered in a large population, substantial numbers of individuals are removed from the "superior intelligence" category and others are pushed down into the "retarded" category. The result is a smaller pool of individuals with outstanding intellects and a larger pool of individuals who require special resources to be able to function. These changes may be undetectable in an individual, but may have an enormous impact on the population as a whole.
