Case Study for Health:
Plastics and the Human Body

Without plastics, modern medicine simply would not exist as we know it. Plastic is a vital part of almost everything that happens today in hospitals, operating rooms, and doctor's offices. However, even as plastics help make us healthier, there is increasingly widespread concern that the abundance of plastic in our lives is also making us sicker. The plastics that provide us with medical marvels may also be slowly and almost imperceptibly poisoning us.

People have been wary of plastics since their earliest invention. After John Wesley Hyatt invented celluloid, the first synthetic polymer, in 1869, consumers purchased brushes, combs, shirt collars, billiard balls, and toothbrushes made from this new substance. As celluloid grew in popularity, so did concerns about its flammability. Dramatic stories, spurred perhaps by a natural human distrust of new, unfamiliar things, fanned celluloid's reputation as a dangerous explosive, making it difficult to tell truth from fiction.

Though stories of danger were often exaggerated, some plastics did prove genuinely harmful. In 1959 dry cleaners began wrapping clothes in thin, clingy plastic bags. A storm of terrible news reports soon followed: in just a few months 80 young children suffocated while playing with the bags. Cries to ban the bags led the plastics manufacturing industry to launch a national education campaign about how to dispose of the bags properly and to change the manufacturing specifications to make the bags less dangerous.

Bu plastic quickly proved its value to human health. In the 1940s Harvard Medical School professor Carl Walter used plastic to revolutionize blood collection. Traditional glass and rubber systems for blood collection and storage were heavy, fragile, and difficult to sterilize between uses. Walter experimented with a replacement—plasticized polyvinyl chloride (PVC), a polymer that is made flexible by the addition of DEHP, a phthalate. Plasticized PVC was durable, inexpensive, lightweight, and disposable, and its use greatly enhanced the sterility and security of blood collection and storage. It also allowed doctors to separate blood into red blood cells, plasma, and platelets, and thereby use a single unit of blood to treat three people. This system rapidly became a success. After being tried and proven by military doctors in the Korean War, PVC blood storage became the norm in American hospitals by the 1960s. Plastic also quickly replaced glass and metal in other medical equipment where its versatility solved numerous problems caused by other materials.

While PVC provided lifesaving medical advances, it also sparked serious health concerns. In 1974, at the B.F. Goodrich Company's PVC plant, four workers died of the same rare liver cancer. An investigation implicated exposure to the chlorine gas that is added to PVC to give the plastic its strength, flexibility, and fire resistance. The federal government acted to resolve the problem, enforcing strict regulations on worker safety conditions to prevent future exposure.

The crisis at the Goodrich plant raised public concern about the safety of plastics and the additives used to produce them. Research suggested that what went into plastics during the

manufacturing process didn't always stay there. In 1969 Johns Hopkins University toxicologists Robert Rubin and Rudolph Jaeger found that DEHP was leaching from plastic and into human tissues. A 1972 *Washington Post* article reported that phthalates like DEHP had been found in blood samples from people who had been exposed only through everyday contact with plastic, noting that "humans are just a little plastic now."[1]

The foundational principle of toxicology is that virtually any chemical can be poisonous if too much is consumed. Even water, necessary for all life, can be fatal if you drink too much. Paracelsus, the 16th-century founder of toxicology put it succinctly: "The poison is in the dose." But the chemicals leaching from plastics into human bodies and the environment may be a different kind of toxin. A prominent toxicology researcher, Theo Colburn, argues that when it comes to phthalates and other plastic additives, it might not be the amount of the dose but the *timing* that matters most. Colburn and other researchers say that plastic additives can disrupt human endocrine, or hormonal, systems and that for children and babies exposure, even in small doses, can have an outsized effect on development.

The plastics industry responds aggressively to the reports of researchers like Colburn, arguing that no study has conclusively proven plastics unsafe. The industry criticizes research reports that connect plastics with endocrine disruption, questioning research methods and results and noting that endocrine disruption that occurs in the presence of plastic does not prove that plastics cause endocrine disruption. But because endocrine disruptors do not work like traditional toxins, it is difficult for researchers to prove their effects in the way the industry demands.

Some public-health advocates argue that it's best to *prove* any potentially toxic substance safe rather than to *assume* it's safe until proven otherwise. Such activists point to the European Union's adoption of REACH (Registration, Evaluation, Authorisation and Restriction of Chemicals), which requires that safety information on all chemicals be provided to consumers. Unlike Europe, the United States has no overarching or effective laws to regulate the safety of chemicals, so consumers have no way of knowing what's in a certain plastic. John Wargo of Yale University has proposed a Plastics Control Act that would mandate safety testing, require the labeling of contents, and prohibit dangerous chemicals. However, lawmakers in the United States have not shown any movement toward advancing such a measure into law.

A new experimental procedure to grow human tissue and organs on a framework of microplastic threads is just one of the amazing medical advances in the works today made possible by plastic. But unanswered questions about the safety of plastic create an uncertain future for human and environmental health. Plastics are now a part of our bodies and our environment, and the long-term consequences are still unknown.

[1] Quoted in Susan Freinkel, *Plastic: A Toxic Love Story* (New York: Henry Holt, 2011), p. 89.