

point being to diagnose tuberculosis and other lung diseases), and some physicians worried that this could have epidemic cancer consequences.³⁰

The overly precise dates of discovery I have mentioned for this or that radiation/cancer link conceal the fact that people suffering from a radiogenic cancer might linger over a period of decades, as the disease spread from one part of the body to another. A laboratory assistant who began X-ray work in 1897 in a surgical clinic in Breslau, for example, developed chronic X-ray eczema on his hands in 1899, and in 1908 developed two small cancers on his left index finger. These were removed, but tumors continued to appear: in 1911 on the little finger of his right hand, and nine years later on the ring finger of his other hand. In 1923 he had tumors removed from his left hand, along with the lymph glands from below his shoulder. The cancer continued to spread, and in 1927 he lost his entire left arm to the disease. His shoulder was removed in 1930, and he probably lost his life to the disease, though the published account stops at this point.³¹ Many other professionals suffered a similar fate—the noted roentgenologist Guido Holzknacht, for example, and countless patients and technicians whose names we will never know.

Reports that X-rays could cause genetic damage began to be taken seriously in the 1920s. Fears were especially strong among German eugenicists, terrified that radiation might harm the German germ plasm.³² Experimental evidence that X-rays could cause sterility had been around since 1903, when Heinrich Albers-Schönberg in Hamburg showed that X-rays could induce impotence in male rabbits,³³ but human evidence was not long in coming. In 1908, another young German radiologist found severe chromosomal damage in the fetus of a woman X-rayed thirty-three times to induce abortion.³⁴ By the early 1920s, German human geneticists were aware that an unusually large number of X-ray workers—including therapists and technicians—were sterile, and that X-ray mutagenesis was the most likely cause.³⁵ Scientists in other countries were encountering similar horrors: French scientists in 1923 published their first case of an *enfant des rayons X* (born with a deformed head after fetal irradiation),³⁶ and an American textbook

shortly thereafter cautioned that “fetal monsters” could result from the X-raying of pregnant women.³⁷

The response by several of Germany’s leading racial theorists was to caution that excessive exposure to ionizing radiation could jeopardize Germany’s biological future. Fritz Lenz, Germany’s first professor of racial hygiene (and a Nazi party member as of 1937), warned in his widely read 1921 textbook on human heredity that X-rays and radioactive sources might cause genetic damage.³⁸ Eugen Fischer, founding director of Berlin’s Kaiser Wilhelm Institute for Anthropology, Human Genetics, and Eugenics, in 1929 and 1930 cautioned that while many substances were suspected of being genotoxic (alcohol, nicotine, mercury, lead, and arsenic, for example), only X-rays had been shown conclusively to have this power. Fischer cited H. J. Muller’s well-known demonstration that X-rays could mutate the sperm cells of the fruit fly, *Drosophila* (in 1927); he also noted that Emmy Stein working with Erwin Baur had earlier shown that radium could cause heritable defects in snapdragons (in 1922, published in 1926).³⁹ By the end of the decade there were dozens of reports testifying to the power of the rays to cause congenital injuries.⁴⁰

Continuing evidence of congenital deformities from X-rays led physicians to argue for stronger radiation safeguards and for limits on the marriageability of exposed persons—to prevent them from breeding. A 1927 report in Germany’s leading pediatric journal reviewed twenty cases of birth defects caused by X-rays, including severe deformities such as fetal microcephaly. One year later, Germany’s leading journal of X-ray therapeutics described a child born with limb deformities similar to those observed in the embryos of irradiated mice; the child had been X-rayed in utero, prompting the deduction that the rays were to blame for the handicap.⁴¹ Concerns such as these led the Bavarian Society for Pediatrics and Gynecology in 1927 to adopt a resolution recommending that women receiving extensive X-ray treatments while pregnant should have their fetuses aborted.⁴² Professional eugenicists responded with equally imaginative proposals. Eugen Fischer in 1930 warned that women exposed to X-rays should be permanently barred from bearing children.⁴³ X-raying a woman’s ovaries