Profile of a Researcher

Robert S. Langer, PhD

Institute Professor
Massachusetts Institute of Techonology
Cambridge, MA
[Research Group Site]

Robert S. Langer has, by just about every conceivable measure, had an outsized impact on the research and development of biomedical technologies. For two years in a row, he has been cited as the number 1 translational scientist in the world by *Nature Biotechnology* (36: 798, 2018; 335: 1126, 2017). Langer is one of thirteen Institute Professors (MIT's highest honors) at MIT, and one of four living individuals to receive the nation's two highest scientific honors – the United States National Medal of Science (2006) and the United States National Medal of Technology and Innovation (2011). He is the most cited engineer in history (Gura, *Science Careers,* November 14, 2014) and has an h-index of 260 according to Google Scholar.

Langer has made numerous contributions to cancer research and the development of cancer therapies. At a time when the scientific community did not believe angiogenesis inhibitors existed (*Science,* 195: 759, 1977), he (with his postdoctoral advisor, Judah Folkman) isolated the first such inhibitors, and developed bioassays (*Nature,* 263: 797, 1976) that would be used for the isolation of nearly all such inhibitors (*Science*, 193: 70, 1976) in the future. He also showed that such inhibitors were safe and effective when given systematically (*Proceedings of the National Academy of Sciences* 77: 4331, 1980).

When Langer first published his research on approaches for controlling the release of macromolecules including nucleic acids and peptides (*Nature,* 263: 797, 1976), the scientific community reacted with skepticism (Ball, Made to Measure: New Materials for the 21st Century, p. 240, Princeton University Press, Princeton, NJ, 1997; *Chemical and Engineering News*, 90: 20, 2012). Langer was repeatedly rejected on his grant applications, no chemical engineering department in the country would hire him for a faculty position and when he finally did get a faculty position (this was in a Nutrition and Food Science department), he nearly lost his job (*Chemical and Engineering News*, 90: 20, 2012; *Journal of Biomedical Materials Research*, 101A: 2449, 2013; xconomy 6-2014). However, today Langer's studies are widely recognized as largely creating the field of controlled drug delivery (*Nature*, 458: 22, 2009) and led to such widely used cancer treatments as Lupron Depot, Zoladex, Decapeptyl and (with Henry Brem) Gliadel.

The original controlled-release materials developed by Langer were generally in the form of microspheres. However, nanoparticles are critical for delivering significant payloads of any drug into cells, particularly potential newer drugs like siRNA and mRNA. Yet, when nanoparticles are injected into the body they are destroyed almost immediately by macrophages, and are unstable because they aggregate. Langer's lab solved these problems by synthesizing nanoparticles composed of polyethylene glycol (PEG) and any other material (e.g. poly lactic acid), and showed the nanoparticles could circulate for hours *in vivo*, be stable on the shelf for years, and not aggregate (*Science*, 263: 1600, 1994.). These principles are being widely used by many scientists and companies to practice “nanomedicine”. *Science* magazine has credited Langer’s seminal role in this area (*Science*, 314, 2010). He received both the Rusnano Prize for Nanotechnology and the Kabiller Prize for his work in this area.