

1장. 발명과 혁신의 역사

American Society of Mechanical Engineers. 2022 "Owens AR Bottle Machine." Engineering History Landmarks no. 86. New York: ASME.

Librado, P., et al. 2021. "The Origins and Spread of Domestic Horses from the Western Eurasian Steppes." *Nature* 598:634– 640.

Shea, J. J. 2016. *Stone Tools in Human Evolution: Behavioral Differences among Technological Primates*. Cambridge: Cambridge University Press.

Smil, V. 2018. *Energy and Civilization: A History*. Cambridge, MA: MIT Press.

Smil, V. 2014. *Making the Modern World: Materials and Dematerialization*. Chichester: Wiley.

Akana, J., et al. 2012. Portable display device. US Patent USD670,286S1, filed November 23, 2010, and issued November 6, 2012.

Brooks, D. E. 2013. Diane's manna. US Patent US8,609,158B2, filed June 20, 2012, and issued December 17, 2013.

Brown, A. E., and H. A. Jeffcott. 1932. *Beware of Imitations*. New York: Viking Press.

Carayannis, E. G. 2013. *Encyclopedia of Creativity, Invention, Innovation and Entrepreneurship*. Berlin: Springer.

Chan, C. L. 2015. "Fallen Behind: Science, Technology, and Soviet Statism." *Intersect: The Stanford Journal of Science, Technology, and Society* 8, no. 3.

Electronic Frontier Foundation. 2022. "Stupid Patent of the Month." Electronic Frontier Foundation. <https://www.eff.org>.

Hannas, W. C., and D. K. Tatlow., eds. 2021. *China's Quest for Foreign Technology: Beyond Espionage*. London: Routledge.

Perry, R. 1973. *Comparison of Soviet and US Technology*. Santa Monica, CA: Rand Corporation.

- Sykes, A. O. 2021. "The Law and Economics of 'Forced' Technology Transfer and Its Implications for Trade and Investment Policy (and the U.S.- China Trade War)." *Journal of Legal Analysis* 13:127– 171. <https://doi.org/10.1093/jla/laaa007>.
- Tenner, E. 1997. *Why Things Bite Back: Technology and the Revenge of Unintended Consequences*. New York: Vintage.
- Cannon, K. M., and D. T. Britt. 2019. "Feeding One Million People on Mars." *New Space* 7, no. 4 (December): 245– 254.
- Kurzweil, R. 2006. *The Singularity Is Near*. New York: Penguin.
- Mokyr, J. 2014. "The Next Age of Invention: Technology's Future Is Brighter Than Pessimists Allow." *City Journal* 24 (Winter): 12– 21. <https://www.city-journal.org/html/next-age-invention-13618.html>.
- SpaceX. 2022. "Mars & Beyond: The Road to Making Humanity Multiplanetary." SpaceX.com. <https://www.spacex.com/human-spaceflight/mars/>.
- US Patent and Trademark Office. 2021. U.S. Patent Activity Calendar Years 1790 to the Present (database). https://www.uspto.gov/web/offices/ac/ido/oeip/taf/h_counts.htm.
- Cooper, G., and B. Sinclair. 1990. "Failed Innovations— ICOHTEC Symposium, Hamburg, August 1989." *Technology and Culture* 31:496– 499.
- Herring, S. D. 1989. *From the Titanic to the Challenger: An Annotated Bibliography on Technological Failures of the Twentieth Century*. New York: Garland Press.
- Petroski, H. 1985. *To Engineer Is Human: The Role of Failure in Successful Design*. New York: St. Martin's Press.
- Petroski, H. 2001. "The Success of Failure." *Technology and Culture* 42:321– 328.
- Schiffer, M. B. 2019. *Spectacular Flops: Game- Changing Technologies That Failed*. Clinton Corners, NY: Eliot Werner Publications.
- Tracy, P. 2022. "Apple's 12 Most Embarrassing Product Failures." <https://gizmodo.com/apple-failures-newton-pippin-butterfly-keyboard-macinto-1849106570>.
- Centers for Disease Control and Prevention. 2020. "Road Traffic Injuries and Deaths— A

Global Problem." CDC, National Center for Injury Prevention and Control (last reviewed December 14).

McNish, J., and S. Silcoff. 2015. *Losing the Signal: The Untold Story behind the Extraordinary Rise and Spectacular Fall of BlackBerry*. New York: Flatiron Books.

Newall, P. 2018. *Ocean Liners: An Illustrated History*. Barnsley: Seaforth Publishing.

Smil, V. 2016. *Still the Iron Age: Iron and Steel in the Modern World*. Oxford: Elsevier.

2장. 현대사회에서 퇴출당한 발명

Lounici, M. S., et al. 2017. "Knock Characterization and Development of a New Knock Indicator for Dual- Fuel Engines." *Energy* 141, 2351e2361.

Zhen, X., et al. 2012. "The Engine Knock Analysis— An Overview." *Applied Energy* 92:628– 636.

Anderson, J. E., et al. 2012. "Octane Numbers of Ethanol- Gasoline Blends: Measurements and Novel Estimation Method from Molar Composition." *SAE Technical Paper* 2012- 01- 1274. doi: 10.4271/2012- 01- 1274.

Stolark, J. 2016. "Fact Sheet: A Brief History of Octane in Gasoline: From Lead to Ethanol." *White Paper*. Washington, DC: Environmental and Energy Study Institute.

Boyd, T. A. 2002. *Charles F. Kettering: A Biography*. Fairless Hills, PA: Beard Books.

Hagner, C. 1999. *Historical Review of European Gasoline Lead Content Regulations and Their Impact on German Industrial Markets*. Geesthacht: GKSS- Forschungszentrum Geesthacht GmbH.

Landrigan, P. J. 2002. "The Worldwide Problem of Lead in Petrol." *Bulletin of the World Health Organization* 80:768.

Midgley, T. IV. 2001. *From the Periodic Table to Production: The Life of Thomas Midgley, Jr., the Inventor of Ethyl Gasoline and Freon Refrigerants*. Corona, CA: Stargazer Publishing.

- Nriagu, J. O. 1990. "Rise and Fall of Leaded Gasoline." *The Science of the Total Environment* 92:13–28.
- Robert, J. C. 1983. *Ethyl— A History of the Corporation and the People Who Made It*. Charlottesville: University of Virginia Press.
- Denworth, L. 2009. *Toxic Truth: A Scientist, a Doctor, and the Battle over Lead*. Boston: Beacon Press.
- Kovarik, W. 2003. "Ethyl: The 1920s Conflict over Leaded Gasoline and Alternative Fuels." Personal website of Prof. Kovarik. billkovarik.com.
- Kovarik, W. 2005. "Milestones: Leaded Gasoline." *International Journal of Occupational and Environmental Health* 11:384–397.
- Rosner, D., and G. Markowitz. 1985. "A 'Gift of God'? The Public Health Controversy over Leaded Gasoline during the 1920s." *American Journal of Public Health* 75:344–352.
- Sicherman, B. 1984. *Alice Hamilton: A Life in Letters*. Cambridge, MA: Harvard University Press.
- Newell, R. G., and K. Rogers. 2003. "The U.S. Experience with the Phasedown of Lead in Gasoline." Discussion Paper. Washington, DC: Resources for the Future. <https://web.mit.edu/ckolstad/www/Newell.pdf>.
- Nielsen, C. 2021. *Unleaded: How Changing Our Gasoline Changed Everything*. New Brunswick, NJ: Rutgers University Press.
- US EPA (Environmental Protection Agency). 1985. *Costs and Benefits of Reducing Lead in Gasoline: Final Regulatory Impact Analysis*. Washington, DC: Office of Policy Analysis.
- Lewis, J. 1985. "Lead Poisoning: A Historical Perspective." *EPA Journal* 11, no. 4 (May): 15–18.
- Needleman, H. L. 1999. "History of Lead Poisoning in the World." Tucson, AZ: Center for Biological Diversity.
- Riva, M. A., et al. 2012. "Lead Poisoning." *Safety and Health at Work* 3:11–16.
- Aizer, A., et al. 2016. "Do Low Levels of Blood Lead Reduce Children's Future Test Scores?" NBER Working Paper 2258. Cambridge, MA: National Bureau of Economic Research.

- Bellinger, D. C., 2011. "The Protean Toxicities of Lead: New Chapters in a Familiar Story." *International Journal of Environmental Research and Public Health* 8:2593– 2628.
- Canfield, R. L., et al. 2004. "Impaired Neuropsychological Functioning in Lead-Exposed Children." *Developmental Neuropsychology* 26:513– 540.
- Markowitz, G., and D. Rosner. 2014. *Lead Wars: The Politics of Science and the Fate of America's Children*. Berkeley: University of California Press.
- Mason, L. H., et al. 2014. "Pb Neurotoxicity: Neuropsychological Effects of Lead Toxicity." *Biomedical Research International*, article ID 840547.
- Nwobi, N. L., et al. 2019. "Positive and Inverse Correlation of Blood Lead Level with Erythrocyte Acetylcholinesterase and Intelligence Quotient in Children: Implications for Neurotoxicity." *Interdisciplinary Toxicology* 12:136– 142.
- IPCS INCHEM. 1999. DDT. Poisons Information Monograph 127. <https://incchem.org/documents/pims/chemical/pim127.htm>.
- Müller, P. H. 1948. "Dichloro- Diphenyl- Trichloroethane and Newer Insecticides." Nobel Lecture, December 11, 1948. <https://www.nobelprize.org/uploads/2018/06/muller-lecture.pdf>.
- Müller, P. H. 1961. "Zwanzig Jahre wissenschaftliche- synthetische Bearbeitung des Gebietes der synthetischen Insektizide." *Naturwissenschaftliche Rundschau* 14:209–219.
- National Academy of Sciences, Committee on Research in the Life Sciences. 1970. *The Life Sciences*. Washington, DC: National Academy of Sciences.
- Carson, R. 1962. *Silent Spring*. Boston: Houghton and Mifflin.
- Culver, L., et al., eds. 2012. *Rachel Carson's Silent Spring Encounters and Legacies*. Munich: Rachel Carson Center.
- Dunlap, T. R., ed. 2008. *DDT, Silent Spring, and the Rise of Environmentalism*. Seattle: University of Washington Press.
- Jameson, C. M. 2013. *Silent Spring Revisited*. London: A&C Black.
- Kroll, G. 2001. "The 'Silent Springs' of Rachel Carson: Mass Media and the Origins of Modern Environmentalism." *Public Understanding of Science* 10:403– 420.

- Ruckelshaus, W. 1972. "Consolidated DDT Hearing: Opinion and Order of the Administrator." *Federal Register* 37:13369– 13376.
- Secretary of State. 2016. "Bill Ruckelshaus: The Conscience of 'Mr. Clean.'" Legacy Washington.
- Sweeney, E. M. 1972. "Hearing Examiner's Recommended Findings, Conclusions, and Orders." *Federal Register*, April 25, 40 CFR 164.32.
- Whitney, C. 2012. "The Silent Decade: Why It Took Ten Years to Ban DDT in the United States." *Virginia Tech Undergraduate Historical Review* 1. <http://doi.org/10.21061/vtuhr.v1i05>.
- Barker, R. J. 1958. "Notes on Some Ecological Effects of DDT Sprayed on Elms." *Journal of Wildlife Management* 22:269– 274.
- Falk, K., et al. 2018. "Raptors Are Still Affected by Environmental Pollutants: Greenlandic Peregrines Will Not Have Normal Eggshell Thickness until 2034." *Ornis Hungarica* 26:171– 176.
- Peakall, D. B. 1993. "DDE- Induced Eggshell Thinning: An Environmental Detective Story." *Environmental Review* 1:13– 20.
- Ratcliffe, D. A. 1958. "Broken Eggs in Peregrine Eyries." *British Birds* 51:23– 26.
- Ratcliffe, D. A. 1967. "Decrease in Eggshell Weight in Certain Birds of Prey." *Nature* 215:208– 210.
- Bouwman, H., et al. 2011. "DDT and Malaria Prevention: Addressing the Paradox." *Environmental Health Perspectives* 119:744– 747.
- Buxton, P. A. 1945. "The Use of the New Insecticide DDT in Relation to the Problems of Tropical Medicine." *Transactions of the Royal Society of Tropical Medicine and Hygiene* 38:367– 400. [https://doi.org/10.1016/0035-9203\(45\)90039-3](https://doi.org/10.1016/0035-9203(45)90039-3).
- Dagen, M. 2020. "History of Malaria and Its Treatment." In G. L. Patrick, ed., *Antimalarial Agents*, Amsterdam: Elsevier, 1– 48.
- Palmer, M. 2016. "The Ban of DDT Did Not Cause Millions to Die from Malaria." <https://www.semanticscholar.org/paper/The-ban-of-DDT-did-not-cause-millions-to-die-from-Palmer/0e6812f87d27be92effac4fe8bfd414bc8f82476>.

- Pruett, B. D. 2013. "Dichlorophenyltrichloroethane (DDT): A Weapon Missing from the U.S. Department of Defense's Vector Control Arsenal." *Military Medicine* 178:243– 245.
- UN Environment Program. 2001. *Stockholm Convention on Persistent Organic Pollutants*. New York: UNEP.
- UN Environment Program. 2010. *Ridding the World of POPs: A Guide to the Stockholm Convention on Persistent Organic Pollutants*. Geneva: Stockholm Convention Secretariat, UNEP. <http://chm.pops.int/Portals/0/Repository/CHM-general/UNEP-POPS-CHM-GUID-RIDDING.English.PDF>.
- World Health Organization. 2011. *The Use of DDT in Malaria Vector Control*. Geneva: WHO.
- World Health Organization. 2020. *World Malaria Report 2020: 20 Years of Global Progress and Challenges*. Geneva: WHO.
- Eskenazi, B., et al. 2009. "The Pine River Statement: Human Health Consequences of DDT Use." *Environmental Health Perspectives* 117:1359– 1367.
- Larsen, N. 2021. "Thomas Midgley, the Most Harmful Inventor in History." Podcast. <https://www.bbvaopenmind.com/en/science/research/thomas-midgley-harmful-inventor-history>.
- Rogan, W. J. and A. Chen. 2005. "Health Risks and Benefits of Bi(4- Chlorophenyl)-1,1,1-Trichloroethane (DDT)." *Lancet* 366:763– 773.
- US Department of Health and Human Services. 2019. "Toxicological Profile for DDT, DDE, and DDD." Washington, DC: USDHHS.
- Calm, J. M. 2008. "The Next Generation of Refrigerants: Historical Review, Considerations, and Outlook." *International Journal of Refrigeration* 31:1123– 1133.
- Giunta, C. J. 2006. "Thomas Midgley, Jr., and the Invention of Chlorofluorocarbon Refrigerants: It Ain't Necessarily So." *Bulletin for the History of Chemistry* 31:66– 74.
- McLinden, M. O., and M. L. Huber. 2020. "(R)Evolution of Refrigerants." *Journal of Chemical & Engineering Data* 65:4176– 4193.
- Midgley, T. Jr. 1937. "From the Periodic Table to Production." *Industrial and Engineering Chemistry* 29:241– 244.

- Midgley, T. Jr., and A. L. Henne. 1930. "Organic Fluorides as Refrigerants." *Industrial and Engineering Chemistry* 22:542– 545.
- Midgley, T. Jr., A. L. Henne, and R. R. McNary. 1931. Heat transfer. US Patent 1,833,847, issued November 24, 1931.
- Midgley, T. IV. 2001. *From the Periodic Table to Production: The Life of Thomas Midgley, Jr., the Inventor of Ethyl Gasoline and Freon Refrigerants*. Corona, CA: Stargazer Publishing.
- Rigby, M., et al. 2013. "Re- evaluation of the Lifetimes of the Major CFCs and CH₃CCl₃ Using Atmospheric Trends." *Atmospheric Chemistry and Physics* 13:2691– 2702.
- Sicard, A. J., and R. T. Baker. 2020. "Fluorocarbon Refrigerants and Their Syntheses: Past to Present." *Chemical Reviews* 120:9164– 9303.
- Cagin, S., and P. Dray. 1993. *Between Earth and Sky: How CFCs Changed Our World and Endangered the Ozone Layer*. New York: Pantheon.
- Dotto, L., and H. Schiff. 1978. *The Ozone War*. Garden City, NY: Doubleday & Co.
- Douglass, A. R., et al. 2014. "The Antarctic Ozone Hole: An Update." *Physics Today* 67, no. 7 (July): 42. doi: 10.1063/PT.3.2449.
- Farman, J. C., et al. 1985. "Large losses of Total Ozone in Antarctica Reveal Seasonal ClO_x/ NO_x Interaction." *Nature* 315:207– 210.
- Lovelock, J. E. 1971. "Atmospheric Fluorine Compounds as Indicators of Air Movements." *Nature* 230:379.
- Molina, M. J. 1995. "Polar Ozone Depletion." Nobel Lecture, December 8, 1995. <https://www.nobelprize.org/uploads/2018/06/molina-lecture.pdf>.
- Molina, M. J., and F. S. Rowland. 1974. "Stratospheric Sink for Chlorofluoromethanes: Chlorine Atom Catalyzed Destruction of Ozone." *Nature* 249:810– 812.
- NASA. 2019. "Ozone Hole Is the Smallest on Record Since Its Discovery." NASA, October 21. <https://www.nasa.gov/feature/goddard/2019/2019-ozone-hole-is-the-smallest-on-record-since-its-discovery>.

NASA. 2020. "Large, Deep Antarctic Ozone Hole in 2020." NASA Earth Observatory, September 20. <https://earthobservatory.nasa.gov/images/147465/large-deep-antarctic-ozone-hole-in-2020>.

Newman, P.A., et al. 2009. "What Would Have Happened to the Ozone Layer If Chlorofluorocarbons (CFCs) Had Not Been Regulated?" *Atmospheric Chemistry and Physics* 9:2113– 2128.

Roan, S. 1989. *Ozone Crisis: The 15- year Evolution of a Sudden Global Emergency*. New York: John Wiley & Sons.

Rowland, F. S. 1995. Nobel Lecture in Chemistry. December 8. <https://www.nobelprize.org/uploads/2018/06/rowland-lecture.pdf>.

Solomon, S. 1999. "Stratospheric Ozone Depletion: Review of Concepts and History" *Review of Geophysics* 37:375– 316.

Stolarski, R. S., and R. J. Cicerone. 1974. "Stratospheric Chlorine: A Possible Sink for Ozone." *Canadian Journal of Chemistry* 52:1610– 1615.

Tevini, M., ed. 1993. *UV- B Radiation and Ozone Depletion: Effects on Humans, Animals, Plants, Microorganisms, and Materials*. Boca Raton, FL: Lewis Publishers.

Maxwell, J., and F. Briscoe. 1997. "There's Money in the Air: The CGC Ban and DuPont's Regulatory Strategy." *Business Strategy and the Environment* 6:276– 286.

Reimann, C. R. 2018. "Observing the Atmospheric Evolution of Ozone- Depleting Substances." *Geoscience* 350:384– 392.

United Nations Environment Program. 2020. *Montreal Protocol on Substances That Deplete the Ozone Layer*. Nairobi: UNEP.

3장. 세계를 지배할 뻔한 발명

Dwiggins, D. 1980. *The Complete Book of Airships— Dirigibles, Blimps and Hot Air Balloons*. Shrewsbury: Airlife.

- Folkes, J. 2008. "Balloons, Airships and Kites— Lighter Than Air: Past, Present and Future." *Aeronautical Journal* 112:421– 429.
- Liao, L., and I. Pasternak. 2009. "A Review of Airship Structural Research and Development." *Progress in Aerospace* 45:83– 96.
- MacMechen, T. R., and C. Dienstbach. 1912. "The Greyhounds of the Air." *Everybody's Magazine* 27:290– 304.
- Robinson, D. H. 1973. *Giants in the Sky: History of the Rigid Airship*. Henley- on-Thames: Foulis.
- Swinfield, J. 2012. *Airship: Design, Development and Disaster*. London: Conway.
- Toland, J. 1972. *The Great Dirigibles: Their Triumphs and Disasters*. Mineola, NY: Dover Publishers, 1972.
- Dienstbach, C., and T. R. MacMechen. 1909. "The Aerial Battleship." *McClure's Magazine* 33:422– 434.
- Jamison, L., et al. 2005. *High- Altitude Airships for the Future Force Army*. Santa Monica, CA: Rand Corporation.
- Robinson, D. W. 1976. *USAF History of Manned Balloons and Airships*. Maxwell Air Force Base, AL: USAF.
- Robinson, D. W. 1997. *The Zeppelin in Combat: A History of the German Naval Airship Division, 1912– 1918*. Seattle: University of Washington Press.
- Archbold, R., and K. Marschall. 1994. *Hindenburg: An Illustrated History*. New York: Warner Books.
- Botting, D. 2001 *Dr. Eckener's Dream Machine: The Great Zeppelin and the Dawn of Air Travel*. New York: Henry Holt and Co.
- Brooks, P. 2004. *Zeppelin: Rigid Airships 1893– 1940*. London: Putnam Aeronautical Books.
- Clausberg, K. 1979. *Zeppelin: Die Geschichte eines unwahrscheinlichen Erfolges*. München: Schirmer/Mosel.

- de Syon, G. 2001. *Zeppelin! Germany and the Airship, 1900– 1939*. Baltimore, MD: Johns Hopkins University Press.
- Dick, H. G., and D. H. Robinson. 1985 *The Golden Age of the Great Passenger Airships Graf Zeppelin & Hindenburg*. Washington, DC: Smithsonian Institution Press.
- DiLisi, G. A. 2017. "The Hindenburg Disaster: Combining Physics and History in the Laboratory." *Physics Teacher* 55:268.
- Eckener, H. 1929. Rigid airship with separate gas cells. US Patent 1,724,009, issued August 13, 1929.
- Eckener, H. 1958. *My Zeppelins*. London: Putnam and Co.
- Lehmann, E. 1937. *Zeppelin: The Story of Lighter- Than- Air Craft*. London: Longmans, Green and Co.
- Majoor, M. 2000. *Inside the Hindenburg*. Boston: Little, Brown and Co.
- Sattelmacher, A. 2021. "Shuffled Zeppelin Clips: The Flight and Crash of LZ 129 Hindenburg in the Archives." *Isis* 112:352– 360.
- Zeppelin, F. 1899. Navigable balloon. US Patent 1,621,195, filed December 29, 1897, and issued March 14, 1899.
- Ling, J. 2020. "The Age of the Airship May Be Dawning Again." *Foreign Policy*, February 29.
- Miller, S., et al. 2014. *Airships: A New Horizon for Science*. Pasadena, CA: Keck Institute for Space Studies. www.kiss.caltech.edu/study/airship/.
- Prentice, B. E., et al. 2021. "Transport Airships for Scheduled Supply and Emergency Response in the Arctic." *Sustainability* 13:5301.
- Windischbauer, F., and J. Richardson. 2005. "Is There Another Chance for Lighter-Than-Air Vehicles?" *Foresight* 7:54– 65.
- Villamizar, H. 2022. "Air Nostrum Orders a Fleet of Airlander Airships." *Airways Magazine*, June 17, 2022. <https://airwaysmag.com/air-nostrum-airlander-airships>.
- Hahn, O., and F. Strassman. 1939. "Über den Nachweis und das Verhalten der bei der Bestrahlung des Urans mittles Neutronen entstehenden Erdalkalimetalle." *Naturwissenschaften* 27:11– 15.

- Lanouette, W. 1992. *Genius in Shadows: A Biography of Leo Szilard*. New York: Charles Scribner's Sons.
- Meitner, L., and O. R. Frisch. 1939. "Disintegration of Uranium by Neutrons: A New Type of Nuclear Reaction." *Nature* 143:239– 240.
- Eisenhower, D. D. 1953. *Atoms for Peace Speech to the 470th Plenary Meeting of the United Nations General Assembly*. <https://www.iaea.org/about/history/atoms-for-peace-speech>.
- Beck, P. W. 1999. "Nuclear Energy in the Twenty- First Century: Examination of a Contentious Subject." *Annual Review of Energy* 24:113– 138.
- Lovering, J. R., et al. 2016. "Historical Construction Costs of Global Nuclear Power Reactors." *Energy Policy* 91:371– 382.
- Marcus, G. 2010. *Nuclear Firsts: Milestone on the Road to Nuclear Power Development*. La Grange Park, IL: American Nuclear Society.
- Murray, R. L. 2009. *Nuclear Energy*. Oxford: Elsevier.
- Cantelon, P. L. 1984. *The American Atom: A Documentary History of Nuclear Policies from the Discovery of Fission to the Present, 1939– 1984*. Philadelphia: University of Philadelphia Press.
- Cowan, R. 1990. "Nuclear Power Reactors: A Study in Technological Lock- in." *Journal of Economic History* 50:541– 567.
- Forsberg, C. W., and A. M. Weinberg. 1990. "Advanced Reactors, Passive Safety, and Acceptance of Nuclear Energy." *Annual Review of Energy* 15:133– 152.
- Holl, J. M., et al. 1985. *United States Civilian Nuclear Power Policy, 1954– 1984: A History*. Washington, DC: US Department of Energy.
- Kaplan, S. 2008. *Power Plants: Characteristics and Costs*. Washington, DC: Congressional Research Service.
- Lowen, R. S. 1987. "Entering the Atomic Power Race: Science, Industry, and Government." *Political Science Quarterly* 102:459– 479.

- Nuclear Regulatory Commission. 2011. Reactor Designs, Safety, Emergency Preparedness, Security, Renewals, New Designs, Licensing, American Plants, Decommissioning. Washington, DC: NRC.
- Parker, L., and M. Holt. 2007. Nuclear Power: Outlook for New U.S. Reactors. Washington, DC: Congressional Research Service.
- Pope, D. 1991. "Seduced and Abandoned? Utilities and WPPSS Nuclear Plants 4 and 5." Columbia Magazine, Fall 1991.
- Rockwell, T. 1992. The Rickover Effect: How One Man Made a Difference. Annapolis, MD: Naval Institute Press.
- Chapin, D. M., et al. 2002. "Nuclear Power Plants and Their Fuel as Terrorist Target." Science 297:1997–1999.
- Mahaffey, J. 2019. Atomic Accidents: A History of Nuclear Meltdowns and Disasters: From the Ozark Mountains to Fukushima. Oakland, CA: Pegasus Books.
- Nuclear Energy Agency. 2002. Chernobyl: Assessment of Radiological and Health Impacts. Paris: NEA.
- Weinberg, Alvin M. 1972. "Social Institutions and Nuclear Energy." Science 177: 27–34.
- Cochran, T. B., et al. 2010. Fast Breeder Reactor Programs: History and Status. Princeton, NJ: International Panel on Fissile Materials.
- International Atomic Energy Agency. 2012. Status of Fast Reactor Research and Technology Development. Vienna: IAEA. https://www-pub.iaea.org/MTCD/Publications/PDF/te_1691_web.pdf.
- Judd, A. M. 1981. Fast Breeder Reactors: An Engineering Introduction. Oxford: Pergamon.
- Sokolski, H. 2019. "The Rise and Demise of the Clinch River Breeder Reactor." Bulletin of the Atomic Scientists, February 6. <https://thebulletin.org/2019/02/the-rise-and-demise-of-the-clinch-river-breeder-reactor/>.
- IAEA. 2021. Small nuclear power reactors.
- Oklo. 2021. "What Could You Do with a MW- Decade of Emission- Free Power?," <https://oklo.com>.

- Rolls Royce. 2021. "Small Modular Reactors— Rolls- Royce." <https://www.rolls-royce.com/innovation/small-modular-reactors.aspx>.
- TerraPower. 2021. The Sodium Reactor: From Research to Reality. <https://www.terrapower.com/sodium-reactor-reality-2021>.
- World Nuclear Association. "Small Nuclear Power Reactors." <http://world-nuclear.org>.
- Bisplinghoff, R. L. 1964. "The Supersonic Transport." *Scientific American* 210, no. 6: 25– 35.
- Culick, F. E. C. 1979. "The Origins of the First Powered, Man- Carrying Airplane." *Scientific American* 241, no. 1: 86– 100.
- International Civil Aviation Organization. 1960. Annual Report of the Council to the Assembly for 1959. Montreal: ICAO. <https://www.icao.int/assembly-archive/Session13E/A.13.REP.1.PEN.pdf>.
- Carioscia, S. A., et al. 2019. Challenges to Supersonic Flight. Alexandria, VA: Institute for Defense Analyses.
- Edwards, G. 1974. "The Technical Aspects of Supersonic Civil Transport Aircraft." *Philosophical Transactions of the Royal Society of London. Series A, Mathematical and Physical Sciences* 275:529– 565.
- Nowlan, F. S., and K. W. Comstock. 1965. "The Assessment of Supersonic Transport Operating Costs." *SAE Transactions* 73:685– 697.
- Tang, R. Y., et al. 2018. Supersonic Passenger Flights. Washington, DC: Congressional Research Service.
- Bureau d'Enquêtes et d'Analyses pour le Sécurité de l'Aviation Civil. 2002. Accident on 25 July 2000 at La Patte d'Oie in Gonesse (95) to the Concorde Registered F- BTSC Operated by Air France. Paris: BEA.
- Butcher, L. 2010. *Aviation: Concorde*. London: Library House of Commons.
- Buttler, T., and J. Carbonel. 2018. *Building Concorde: From Drawing Board to Mach 2*. Forest Lake, MN: Specialty Press.
- Glancy, J. 2016. *Concorde: The Rise and Fall of the Supersonic Airliner*. Boston: Atlantic Books.

- Johnman, L., and F. M. B. Lynch. 2002. "The Road to Concorde: Franco- British Relations and the Supersonic Project." *Contemporary European History* 11:229– 252.
- Smith, R. K. 2019. "The Supersonic Airliner Fiasco: Frenzied International Aeronautical Saga of Communicable Obsessions, 1956– 1976." *Air Power History*, Fall, 5– 20.
- Trubshaw, B. 2019. *Concorde: The Complete Inside Story*. Cheltenham: History Press.
- Bedwell, D. 2012. "Supersonic Gamble." *Aviation History Magazine*, May. <https://www.historynet.com/supersonic-gamble.htm>.
- Office of Technology Assessment. 1980. *Impact of Advanced Air Transport Technology*. Washington, DC: OTA.
- Boom Supersonic. 2022. "Boom— Supersonic Passenger Airplanes." <https://boomsupersonic.com/>.
- Lockheed Martin. 2022. "X- 59." <https://www.lockheedmartin.com/en-us/products/quesst.html>.
- Schneider, D. 2021. "The Recent Supersonic Boom." *Spectrum IEEE*, August.
- Spike Aerospace. 2022. "The Spike S- 512 Supersonic Jet: Fly Supersonic. Do More." <https://www.spikeaerospace.com/>.

4장. 인류에게 꼭 필요한 발명

- London Mechanics' Register 1825. London and Edinburgh Vacuum Tunnel Company. 1825. *London Mechanics' Register* 1:205- 207.
- Medhurst, G. 1812. *Calculations and Remarks, Tending to Prove the Practicality, Effects and Advantages of a Plan for the Rapid Conveyance of Goods and Passengers Upon an Iron Road Through a Tube of 30 Feet in Area, by the Power and Velocity of Air*. London: D. N. Shury.
- Medhurst, G. 1827. *A New System of Inland Conveyance, for Goods and Passengers, Capable of Being Applied and Extended Throughout the Country; and of Conveying All Kinds of Goods, Cattle, and Passengers, with the Velocity of Sixty Miles in an Hour, at an Expense That Will Not Exceed the One- Fourth Part of the Present Mode of Travelling, Without the Aid of Horses or Any Animal Power*. London: T. Brettell.

- Buchanan, R. A. 1992. "The Atmospheric Railway of I. K. Brunel." *Social Studies of Science* 22:231– 243.
- Goddard, R. H. 1914. "Bachelet's Frictionless Railway at Basis a Tech Idea." *Worcester Polytechnic Institute Journal* 1914:12– 21.
- Goddard, R. H. 1950. Vacuum tube transportation system. US Patent 2,511,979A, filed May 21, 1945, issued June 30, 1950.
- Scientific American. 1909. "The Limit of Rapid Transit." *Scientific American* 101, no. 1: 366.
- Bachelet, É. 1912. Levitating transmitting apparatus. US Patent 1,020,942, issued March 19, 1912.
- Weinberg, B. 1917. "Traveling at 500 Miles Per Hour in the Future Electric Railway." *Electrical Experimenter* 1917:794.
- Weinberg, B. 1919. "Traveling at 500 Miles an Hour." *Popular Science Monthly* 1919:705.
- Davy, R. B. 1920. Vacuum- railway. US Patent 1,336,782, issued April 13, 2020.
- Salter, R. M. 1972. *The Very High Speed Transit System*. Santa Monica, CA: Rand Corporation.
- Salter, R. M. 1978. *Trans- Planetary Subway Systems— A Burgeoning Capability*. Santa Monica, CA: Rand Corporation.
- Armagana, K. 2020. "The Fifth Mode of Transportation: Hyperloop." *Journal of Innovative Transportation* 1, no. 1: 1105.
- Hyperloop TT. 2022. "The Future Is Now Boarding." *Hyperloop Transportation Technologies*. <https://www.hyperlooptt.com>.
- Klühspies, J. et al. 2022. *Hyperloop? Ergebnisse einer internationalen Umfrage im Verkehrswesen*. Munich: The International Maglev Board.
- Musk, E. 2013. "Hyperloop Alpha." https://www.tesla.com/sites/default/files/blog_images/hyperloop-alpha.pdf.
- Nøland, K. 2021. "Prospects and Challenges of the Hyperloop Transportation System: A Systematic Technology Review." *IEEE Access* 9:28439– 28458. <https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=9350309>.

- Virgin Hyperloop. 2021. "Virgin Hyperloop." <https://virginhyperloop.com>.
- Beijerinck, M. W. 1888. Die Bakterien der Papilionaceen- Knöllchen. *Botanische Zeitschrift* 46:725– 804.
- Boddey, R. M., and J. Döbereiner. 1995. "Nitrogen Fixation Associated with Grasses and Cereals: Recent Progress and Perspectives for the Future." *Fertilizer Research* 42:241– 250.
- Borlaug, N. 1970. "Nobel Prize Acceptance Speech." December 10. <https://www.nobelprize.org/prizes/peace/1970/borlaug/acceptance-speech/>.
- Burrill, T. J., and R. Hansen. 1917. "Is Symbiosis Possible between Legume Bacteria and Non- Legume Plants?" *Agricultural Experimental Station Bulletin* 202:115– 181.
- Döbereiner, J. 1988. "Isolation and Identification of Root Associated Diazotrophs." *Plant and Soil* 110:207– 212.
- Hellriegel, H., and H. Wilfarth. 1888. "Untersuchungen über die Stickstoffernährung der Gramineen und Leguminosen." Beilage der Zeitschrift des Vereins für die Rübenzuckerindustrie. Berlin: Kayssler.
- Löhnis, F. 1921. "Nodule Bacteria of Leguminous Plants." *Journal of Agricultural Research* 20:543– 556.
- Smil, V. 2001. *Enriching the Earth: Fritz Haber, Carl Bosch and the Transformation of World Food Production*. Cambridge, MA: MIT Press.
- Beatty, P. H., and A. G. Good. 2011. "Future Prospects for Cereals That Fix Nitrogen." *Science* 333:416– 417.
- Bloch, S. E. et al. 2020. "Harnessing Atmospheric Nitrogen for Cereal Crop Production." *Current Opinion in Biotechnology* 62:181– 188.
- Crookes, W. 1898. "Address of the President before the British Association for the Advancement of Science, Bristol, 1898." *Science* 8:561– 575.
- Huisman, R., and R. Geurts. 2020. "A Roadmap toward Engineered Nitrogen Fixing Nodule Symbiosis." *Plant Communications*. <https://doi.org/10.1016/j.xplc.2019.100019>

Pankiewicz, V. C. S., et al. 2019. "Are We There Yet? The Long Walk towards the Development of Efficient Symbiotic Associations between Nitrogen- Fixing Bacteria and Non- Leguminous Crops." *BMC Biology* 17:99.

Rosenblueth, M., et al. 2018. "Nitrogen Fixation in Cereals." *Frontiers in Microbiology* 9:1794. doi: 10.3389/fmicb.2018.0179.

Sharma, P., et al. 2016. "Biological Nitrogen Fixation in Cereals: An Overview." *Journal of Wheat Research* 8, no. 2: 1– 11.

Yang, J., et al. 2018. "Polyprotein Strategy for Stoichiometric Assembly of Nitrogen Fixation Components for Synthetic Biology." *Proceedings of the National Academy of Sciences* 115, no. 36: E8509- E8517.

Azotic Technologies. 2018. "Azotic's Natural Nitrogen Fixing Technology Is Now Commercially Available in the USA." <https://www.azotictechnologies.com/news-and-insight/latest-news/heading-5/#:~:text=After%20positive%20field%20trial%20results,results%20and%20feedback%20from%20growers>.

Azotic Technologies. 2021. "Envita Technologies." <https://www.azotic-na.com/science-behind-envita>.

Schwartz, J., et al. 2020. *Practical Farm Research 2020*. <https://www.beckshybrids.com/portals/0/sitecontent/literature/2020-2021-literature/Becks-2020-PFRBook.pdf>.

Schwartz, J., et al. 2021, *Practical Farm Research 2021*. <https://www.beckshybrids.com/portals/0/sitecontent/literature/2021-2022-literature/PFR-Book-2021-web.pdf>.

US Food and Drug Administration. 2021. *GMO Crops, Animal Food, and Beyond*. Washington, DC: US FDA.

Witt, M., et al. 2020. *On- Farm Corn Nitrogen Enhancer Foliar Treatment Demonstration Trials*. Ames: Iowa State University.

Bethe, H. A. 1967. "Energy Production in Stars." Nobel Lecture, December 11. <https://www.nobelprize.org/uploads/2018/06/bethe-lecture.pdf>.

Glasstone, S. 1974. *Controlled Nuclear Fusion*. Washington, DC: US Atomic Energy Commission.

- Kikuchi, M., et al., eds. 2012. *Fusion Physics*. Vienna: International Atomic Energy Agency.
- Chou, C. B., et al. 2016. *Fusion Energy via Magnetic Confinement: An Energy Technology Distillate*. Princeton, NJ: Andlinger Center for Energy and the Environment.
- Coppi, B. 2016. "Relevance of Advanced Nuclear Fusion Research: Breakthroughs and Obstructions." *American Institute of Physics Conference Proceedings* 1721, no. 1, 020003. <https://doi.org/10.1063/1.4944012>.
- Dean, S. O. 2013. *Search for the Ultimate Energy Source: A History of the U.S. Fusion Energy Program*. New York: Springer.
- El- Guebaly, L. 2010. "Fifty Years of Magnetic Fusion Research (1958– 2008): Brief Historical Overview and Discussion of Future Trends." *Energies* 3:1067– 1086.
- Lopes Cardozo, N. J., et al. 2016. "Fusion: Expensive and Taking Forever?" *Journal of Fusion Energy* 35:94– 101
- Shafranov, V. D. 2001. "On the History of the Research into Controlled Thermonuclear Fusion." *Uspekhi Fizicheskikh Nauk* 44:835– 865.
- Zohm, H. 2019. "On the Size of Tokamak Fusion Power Plants." *Philosophical Transactions of the Royal Society A* 377: 20170437. <http://dx.doi.org/10.1098/rsta.2017.043>.
- ITER. 2021. "What Is ITER?" <https://www.iter.org/proj/inafewlines>.
- Nuckolls, J., et al. 1972. "Laser Compression of Matter to Super- High Densities: Thermonuclear (CTR) Applications." *Nature* 239:139– 142.
- Zylstra, A. B., et al. 2022. "Burning Plasma Achieved in Inertial Fusion." *Nature* 601:542– 548.
- Ball, P. 2019. "Lessons from Cold Fusion: 30 Years On." *Nature* 569:601.
- Berlinguette, C. P., et al. 2019. "Revisiting the Cold Case of Cold Fusion." *Nature* 570:45– 51.
- Nagel, D. J. 2021. "Experimental Status of LENR." PowerPoint presentation. Washington, DC: US Department of Energy.
- Ball, P. 2021. "The Race to Fusion Energy." *Nature* 599:562– 566.

Dabbar, P. 2021. "Fusion Breakthrough Dawns a New Era for US Energy and Industry." The Hill, September 10. <https://thehill.com/opinion/technology/571722-fusion-breakthrough-dawns-a-new-era-for-us-energy-and-industry/>.

Enter, S., et al. 2018. "Approximation of the Economy of Fusion Energy." *Energy* 152:489–497.

European Fusion Development Agreement. 2012. *Fusion Electricity: A Roadmap to the Realisation of Fusion Energy*. Culham: EFDA.

Galchen, R. "Green Dream." *New Yorker*, October 11, 22–28.

Hirsch, R. L. 2015. "Fusion Research: Time to Set a New Path." *Issues in Science and Technology* Summer 2015:35–42.

International Atomic Energy Agency. 2021. "Fusion Energy." *IAEA Bulletin*, May.

Jassby, D. 2017. "Fusion Reactors: Not What They're Cracked Up to Be." *Bulletin of the Atomic Scientists*, April 19.

Young, C. 2021. "We Are Now One Step Closer to Limitless Energy from Nuclear Fusion." *Interesting Engineering* September 9, 2021.

5장. 발명과 혁신의 현실적 전망

Gandy, S. 2021. "6 Ways the FDA's Approval of Aduhelm Does More Harm Than Good." *STAT*, June 15. <https://www.statnews.com/2021/06/15/6-ways-fda-approval-aduhelm-does-more-harm-than-good/>.

Hall, B. H. 2020. "Patents, Innovation, and Development." NBER Working Paper 27203. Cambridge, MA: National Bureau of Economic Research.

McDonald, L. 2017. "What Is Tony Seba Smoking? EVAdoption News, May 20. <https://evadoption.com/what-is-tony-seba-smoking-evadoption-news-may-20-2017/>.

Norris, M. 2020. "Brain- Computer Interfaces Are Coming. Will We Be Ready?" *The RAND blog*. Santa Monica, CA: Rand Corporation, August 27.

Pham, C., and F. Gilbert. 2021. "Predicting the Future of Brain- Computer Interface

- Technologies: The Risky Business of Irresponsible Speculation in News Media." *Bioethics Forum* 12:15– 28.
- RethinkX. 2017. Transportation Report. <https://www.rethinkx.com/transportation>.
- Rosario, C. 2019. "4 Problems with Electronic Health Records." *Advanced Data Systems Corporation*, October 16. <https://www.adsc.com/blog/problems-with-electronic-health-records>.
- SpaceX. 2017. "Mars & Beyond." <https://www.spacex.com/human-spaceflight/mars/>.
- Sumner, P., et al. 2014. "The Association between Exaggeration in Health- Related Science News and Academic Press Releases: Retrospective Observational Study." *British Medical Journal* 2014:349. doi: 10.1136/bmj.g7015.
- Azhar, A. 2021. *The Exponential Age: How Accelerating Technology Is Transforming Business, Politics, and Society*. New York: Diversion Books.
- Berlinski, D. 2018. "Godzooks." *Inference* 3, no. 4. <https://inference-review.com/article/godzooks>.
- Harari, Y. 2017. *Homo Deus: A Brief History of Tomorrow*. New York: Harper.
- Kurzweil, R. 2005. *The Singularity Is Near*. New York: Penguin.
- Kurzweil, R. 2021. "Kurzweil: Tracking the Acceleration of Intelligence." <http://www.kurzweilai.net/>.
- Mokyr, J. 2014. "The Next Age of Invention: Technology's Future Is Brighter Than Pessimists Allow." *City Journal* 24 (Winter): 12– 21. <https://www.city-journal.org/html/next-age-invention-13618.html>.
- Mokyr, J. 2017. *A Culture of Growth: The Origins of the Modern Economy*. Princeton, NJ: Princeton University Press.
- Kinch, M. S. 2015. "An Overview of FDA- Approved Biologics Medicines." *Drug Discovery Today* 20:393– 398.
- Kinch, M. S., et al. 2013. "An Overview of FDA- Approved New Molecular Entities: 1827– 2013." *Drug Discovery Today* 19:1033– 1039.

- Ricciarelli, R., and E. Fedele. 2017. "The Amyloid Cascade Hypothesis in Alzheimer's Disease: It's Time to Change Our Mind." *Current Neuropharmacology* 15:926–935.
- US Food and Drug Administration. 2022. Drug Approvals and Databases.
- Ahlgren, L. 2021. "Embraer Launches a Fleet of 4 New Sustainable Aircraft Designs." Simple Flying, November 8. <https://simpleflying.com/embraer-sustainable-aircraft-designs/>.
- Bailey, J. 2019. "Who Is Alice? An Introduction to the Bizarre Eviation Electric Aircraft." Simple Flying, June 26. <https://simpleflying.com/eviation-alice-electric-aircraft>.
- Eviation. 2022. "Sustainable, Economical Aviation." <http://eviation.com>.
- Universal Hydrogen. 2021. "Fueling Carbon- Free Flight." <https://hydrogen.aero/>.
- Zunum Aero. 2019. "Bringing You Electric Air Travel Out to a Thousand Miles." <https://zunum.aero/>.
- Anderson, J., et al. 2018. *Artificial Intelligence and the Future of Humans*. Washington, DC: Pew Research Center.
- Choi, C. Q. 2021. "7 Revealing Ways AIs Fail." *IEEE Spectrum* September 2021:42–47.
- Jordan, M. I. 2021. "Stop Calling Everything 'Artificial Intelligence.'" *Mind Matters: News*, April 7, 2021. [https://mindmatters.ai/2021/04/ai-researcher-stop-calling-every-thing-artificial-intelligence/#:~:text=Jordan%20\(pictured\)%20adds%2C,talking%20as%20if%20we%20do.%E2%80%9D](https://mindmatters.ai/2021/04/ai-researcher-stop-calling-every-thing-artificial-intelligence/#:~:text=Jordan%20(pictured)%20adds%2C,talking%20as%20if%20we%20do.%E2%80%9D).
- Kissinger, H., et al. 2021. *The Age of AI*. Boston: Little, Brown and Co.
- Pretz, K. 2021. "Stop Calling Everything AI, Machine- Learning Pioneer Says." *IEEE Spectrum*, September, 58–59.
- Roitblat, H. L. 2020. *Algorithms Are Not Enough: Creating General Artificial Intelligence*. Cambridge, MA: MIT Press.
- Strickland, E. 2021. "The Turbulent Past and Uncertain Future of AI." *IEEE Spectrum*, October, 27–31.
- Thompson, N. C., et al. 2021. "Deep Learning's Diminishing Returns." *IEEE Spectrum*, October, 51–55.

- Hall, E. C. 1996. *Journey to the Moon: The History of the Apollo Guidance Computer*. Washington, DC: American Institute of Aeronautics and Astronautics.
- Hennessy, J. 2019. *The End of Moore's Law & Faster General Purpose Computing, and a Road Forward*. Faculty paper, Stanford University, March. https://opennetworking.org/wp-content/uploads/2020/12/9_2.05pm_John_Hennessey.pdf.
- Moore, G. E. 1965. "Cramming More Components onto Integrated Circuits." *Electronics* 38, no. 8: 114– 117.
- Moore, G. E. 1975. "Progress in Digital Integrated Electronics." *Technical Digest, IEEE International Electron Devices Meeting*, 11– 13.
- Moore, G. E. 2003. "No Exponential Is Forever: But 'Forever' Can Be Delayed!" Paper presented at IEEE International Solid- State Circuits Conference, San Francisco. <http://ieeexplore.ieee.org/document/1234194/>.
- Rupp, K., and S. Selberherr. 2011. "The Economic Limit to Moore's Law." *IEEE Transactions on Semiconductor Manufacturing* 24, no. 1: 1– 4.
- Smil, V. 2015. "Moore's Curse." *IEEE Spectrum*, April, 26.
- Cunningham, C. 2020. "TV Screen Sizes over Time." *VAVA*, February 10. <http://blog.vava.com/the-evolution-of-tv-screen-sizes-past-and-future-the-largest-4k-tv/>.
- European Commission. 2021. "Electricity Price Statistics." Eurostat. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Electricity_price_statistics#:~:text=The%20EU%20average%20price%20in,was%20%E2%82%AC0.2369%20per%20kWh.
- Feldman, D., et al. 2021. *U.S. Solar Photovoltaic System and Energy Storage Cost Benchmark: Q1 2020*. Technical Report NREL/TP- 6A20- 77324. US Department of Energy, National Renewable Energy Laboratory, January.
- Kelly, B., et al. 2020. "Measuring Technological Innovation over the Long Run." NBER Working Paper 25266. Cambridge, MA: National Bureau of Economic Research.
- Smil, V. 2005. *Creating the 20th Century: Technical Innovations of 1867– 1914 and Their Lasting Impact*. New York: Oxford University Press.

- Smil, V. 2006. *Transforming the 20th Century: Technical Innovations and Their Consequences*. New York: Oxford University Press.
- Smil, V. 2016. *Still the Iron Age: Iron and Steel in the Modern World*. Amsterdam: Elsevier.
- Smil, V. 2019. *Growth: From Microorganisms to Megacities*. Cambridge, MA: MIT Press.
- UN Food and Agricultural Organization. 2021. *The State of Food Security and Nutrition in the World 2021*. Rome: FAO.
- UN Food and Agriculture Organization. 2022. *Crops and Livestock Products (database)*. Food and Agriculture Statistics, FAOSTAT.
- World Bank. 2022. *GDP Per Capita (Constant 2015 US\$) (database)*. <https://data.worldbank.org/indicator/NY.GDP.PCAP.KD>.
- Zu, C., and H. Li. 2011. "Thermodynamic Analysis on Energy Densities of Batteries." *Energy and Environmental Science* 4:2614–2625.
- American Cancer Society. 2021. *Cancer Treatment and Survivorship: Facts & Figures 2019–2021*. Atlanta: American Cancer Society, 2019. <https://www.cancer.org/content/dam/cancer-org/research/cancer-facts-and-statistics/cancer-treatment-and-survivorship-facts-and-figures/cancer-treatment-and-survivorship-facts-and-figures-2019-2021.pdf>.
- Farrelly, C. 2021. "50 Years of the 'War on Cancer': Lessons for Public Health and Geroscience." *Geroscience* 43:1229–1235.
- Memorial Sloan Kettering Cancer Center. 2021. "Mission Possible? Revisiting the 'War on Cancer' 50 Years Later." *MSK News*, Winter. <https://www.mskcc.org/msk-news/winter-2020/mission-possible-revisiting-war-cancer-50-years-later>.
- National Cancer Institute. 2020. "Milestones in Cancer Research and Discovery." Washington, DC: National Institutes of Health.
- National Cancer Institute. 2021. "National Cancer Act of 1971." Washington, DC: National Institutes of Health, February (last update). <https://www.cancer.gov/about-nci/overview/history/national-cancer-act-1971>.

- Obama, B. 2009. Address to Joint Session of Congress. Remarks of President Barack Obama—Address to Joint Session of Congress. <https://obamawhitehouse.archives.gov/the-press-office/remarks-president-barack-obama-address-joint-session-congress>.
- Rehemtulla, A. 2009. "The War on Cancer Rages On." *Neoplasia* 11:1252– 1263.
- Sporn, M. B. 1996. "The War on Cancer." *Lancet* 347:1377– 1382.
- von Eschenbach, A. C. 2003. "NCI Sets Goal of Eliminating Suffering and Death due to Cancer by 2015." *Journal of the National Medical Association* 95:637–639.
- Weir, H. K., et al. 2015. "The Past, Present, and Future of Cancer Incidence in the United States: 1975 through 2020." *Cancer* 121:1827– 1837.
- White House. 2022. "Fact Sheet: President Biden Reignites Cancer Moonshot to End Cancer as We Know It." Press release, February 2.
- Breakthrough Energy. 2021. "Breakthrough Energy Catalyst and Major Corporations Announce Partnership to Accelerate the Clean Energy Transition." <https://www.breakthroughenergy.org/catalyst-announcement>.
- International Energy Agency. 2020. *Global EV Outlook 2020*. IEA, June. <https://www.iea.org/reports/global-ev-outlook-2020>.
- International Energy Agency. 2021. "CO2 Emissions: Global Energy Review 2021." IEA. <https://www.iea.org/reports/global-energy-review-2021/co2-emissions>.
- Smil, V. 2017. *Energy Transitions: Global and National Perspectives*. Santa Barbara, CA: Praeger.
- Smil, V. 2021. "SUVs Ascendant." *IEEE Spectrum*, September, 22– 23.
- Smil, V. 2021. "Electric Flight." *IEEE Spectrum*, November, 22– 23.
- UN Framework Convention on Climate Change, Glasgow Climate Pact. 2021. "Draft text on 1/CMA.3." November 13. https://unfccc.int/sites/default/files/resource/Overarching_decision_1-CMA-3_1.pdf.

1장. 발명과 혁신의 역사

[그림 1.1] US Patent 766,768, 1903년 4월 13일 접수, 1904년 8월 2일 발행.
<https://patents.google.com/patent>

[그림 1.2] US Patent D670,286S1, 2010년 11월 23일 접수, 2012년 11월 6일 발행.
<https://patents.google.com/patent/USD670286>

[그림 1.3] 셔터스톡 이미지(754279576)

[그림 1.4] Pittsburgh: Harbison- Walker Refractories, 1909

2장. 현대사회에서 퇴출당한 발명

[그림 2.1] Williams Haynes Portrait Collection (Philadelphia, Science History Institute), box 10. <https://digital.sciencehistory.org/works/9s161624t>

[그림 2.2] https://commons.wikimedia.org/wiki/File:Charles_F._Kettering.jpg

[그림 2.3] US Patent 1,573,846, 1922년 4월 15일 접수, 1926년 2월 23일 출원,
<https://patents.google.com/patent/US1573846>

[그림 2.4] <https://www.nobelprize.org/prizes/medicine/1948/summary>

[그림 2.5] 미국 어류·야생동물국(US Fish and Wildlife Service)

[그림 2.6] US Patent 1,568,102, 1923년 7월 28일 접수, 1926년 1월 5일 출원. <https://patents.google.com/patent/US1568102A>

[그림 2.7] NOAA Climate.gov

3장. 세계를 지배할 뻔한 발명

[그림 3.1] https://en.wikipedia.org/wiki/Ferdinand_von_Zeppelin

[그림 3.2] Bundesarchiv photo 102- 06617.

[그림 3.3] Parkhannah, https://commons.wikimedia.org/wiki/File:Dragon_Dream.jpg.

[그림 3.4] US Navy Arctic Submarine Laboratory

[그림 3.5] 미국회도서관(Library of Congress photo)

[그림 3.6] 샌디에고 항공우주 박물관 아카이브(Miles Blaine Collection, San Diego Air and Space Museum Archive)

[그림 3.7] https://commons.wikimedia.org/wiki/File:Boeing_2707-300_3-view.svg

4장. 인류에게 꼭 필요한 발명

[그림 4.1] 하이퍼루프 알파, <http://tesla.com>

[그림 4.2] Wellcome Library no. 37252i, <https://wellcomecollection.org/works/re2aprgu>. Reprinted under Creative Commons Attribution International 4.0 license.

[그림 4.3] 에밀 베첼레 컬렉션, 미국역사박물관 기록보관소(Émile Bachelet Collection, Archives Center, National Museum of American History)

[그림 4.4] <https://www.nobelprize.org/prizes/chemistry/1918/haber/facts/>
<https://www.nobelprize.org/prizes/chemistry/1931/bosch/biographical/>

[그림 4.5] Matthew Crook.

[그림 4.6] 브라질 농업부(Embrapa, Brazilian Ministry of Agriculture)

[그림 4.7] 로스 알라모스 국립 연구소(Los Alamos National Laboratory)

[그림 4.8] 로렌스 리버모어 국립 연구소(Lawrence Livermore National Laboratory)

[그림 4.9] ITER 협회, <http://www.iter.org>.

5장. 발명과 혁신의 현실적 전망

[그림 5.1] Vaclav Smil, “Decarbonization Algebra,” Spectrum February 2022; data from International Energy Agency and UN Framework Convention on Climate Change.