Links accurate as of January 2022.

Slide 5:

Dorrier, Jason. "If the Body Is a Machine, Can It Be Maintained Indefinitely?" *Singularity Hub*, Singularity Education Group, 3 Aug. 2014, <u>https://singularityhub.com/2014/08/03/on-the-road-to-the-fountain-of-youth/</u>.

Wapcaplet. "File:Diagram of the Human Heart (Cropped).Svg." *Wikimedia Commons*, 2 June 2006, <u>https://commons.wikimedia.org/wiki/File:Diagram of the human heart (cropped).svg</u>

Slide 6:

InovaNewsroom. "Wound Healing Center at Inova Loudoun Treats Complex Wound and Ostomy Cases." *Inova Newsroom*, Inova Health System, 19 May 2017,

https://www.inovanewsroom.org/ilh/2017/05/wound-healing-center-at-inova-loudoun-treats-complex-wound-and-ostomy-cases/.

Slide 7:

Metcalfe, Tom. "This Is Your Brain, in Glorious Color." *NBCNews.com*, NBCUniversal News Group, 15 June 2021, <u>https://www.nbcnews.com/science/science-news/brain-glorious-color-rcna1192</u>.

Slide 8:

Inspiring. "Good and Bad Food. Thumbs Silhouette with Healthy and Junk Food." *Shutterstock*, Shutterstock, Inc., <u>https://www.shutterstock.com/image-vector/good-bad-food-thumbs-silhouette-healthy-1069892234</u>.

Slide 9:

Sudowoodo. "Senses Icon Set Stock Illustration." *IStock*, 17 Oct. 2017, https://www.istockphoto.com/vector/senses-icon-set-gm862112534-142884135.

"Full Visible Spectrum." Orca Grow Film, California Grow Films LLC, https://www.orcagrowfilm.com/Articles.asp?ID=145.

"Sense of Smell." *Nature Scent*, Nature Scent of the Ozarks Inc., 2018, <u>https://naturescent.com/sense-of-smell/</u>.

<u>Slide 10:</u>

Sudowoodo. "Senses Icon Set Stock Illustration." *IStock*, 17 Oct. 2017, <u>https://www.istockphoto.com/vector/senses-icon-set-gm862112534-142884135</u>.

"Ears and hearing." *DK Find Out!*, Dorling Kindersley Limited, 2021, https://www.dkfindout.com/us/human-body/senses/ears-and-hearing/.

Dragon Images, Dragon. "Female Hand Touching Prickly Cactus." *Shutterstock*, Shutterstock, Inc., <u>https://www.shutterstock.com/image-photo/female-hand-touching-prickly-cactus-260096384</u>.

<u>Slide 11:</u>

Barreto, Daniela. "Set of Different Bacteria and Viruses, for Medical Info Graphics. Hand Drawn Line Art Cartoon Vector Illustration." *Shutterstock*, Shutterstock, Inc., <u>https://www.shutterstock.com/image-vector/set-different-bacteria-viruses-medical-info-560228722</u>.

Cluett, Jonathan. "Materials Used to Make a Cast." *Verywell Health*, Verywell Health, 7 June 2020, https://www.verywellhealth.com/what-is-a-cast-for-broken-bones-made-out-of-2549317.

Smith, Irene. "Massage Therapy's Role in the Growing Hospice Movement." *MASSAGE Magazine*, 12 Oct. 2016, <u>https://www.massagemag.com/massage-therapys-role-in-the-growing-hospice-movement-40833/</u>.

Genome Research Limited. "What Types of Mutation Are There?" *Your Genome*, <u>https://www.yourgenome.org/facts/what-types-of-mutation-are-there</u>.

Slide 12:

bsd555. "Biomedical Engineering Word Concepts Banner." *IStock*, Getty Images, 23 Apr. 2020, <u>https://www.istockphoto.com/vector/biomedical-engineering-word-concepts-banner-biotechnology-for-health-healthcare-gm1220302093-357262972</u>

<u>Slide 13:</u>

"10 Science Clipart Images." *KindPNG.com*, Shenzhen BestAl Internet Co., <u>https://www.kindpng.com/imgv/TwxRmxx</u> 10-science-clipart-images-download-for-free-hd/.

"Bot Gears - Mechanical Engineering Clipart." *PngKit.com*, https://www.pngkit.com/view/u2q8a9q8w7o0u2e6_bot-gears-mechanical-engineering-clipart/.

<u>Slide 14:</u>

"History." *Navigate the Circuit*, American Institute for Medical and Biological Engineering (AIMBE), <u>https://navigate.aimbe.org/why-bioengineering/history/</u>.

Baicus, Anda. "History of polio vaccination." *World journal of virology* vol. 1,4 (2012): 108-14. doi:10.5501/wjv.v1.i4.108.

"End Chronic Kidney Disease Neglect." *Nature*, Springer Nature Limited, 11 Mar. 2020, <u>https://www.nature.com/articles/d41586-020-00691-4</u>.

Turina, Marko. "File:First Pacemaker (Siemens-Elema 1958).Jpg." *Wikimedia Commons*, University Hospital, Zurich, 9 Apr. 2009, <u>https://commons.wikimedia.org/wiki/File:First_pacemaker_(Siemens-Elema_1958).jpg</u>.

Hawk, Alan. "File:Hufnagel Heart Valve15111214-Photos 309.Jpg." *Wikimedia Commons*, 23 Aug. 2010, <u>https://commons.wikimedia.org/wiki/File:Hufnagel_heart_Valve15111214-photos_309.jpg</u>.

Davis, Charles Patrick. "What Is Polio? Symptoms and Vaccine." Edited by Jerry R Balentine, *MedicineNet*, WebMD, <u>https://www.medicinenet.com/polio_facts/article.htm</u>.

<u>Slide 15:</u>

"History." *Navigate the Circuit*, American Institute for Medical and Biological Engineering (AIMBE), <u>https://navigate.aimbe.org/why-bioengineering/history/</u>.

"1972: First Recombinant DNA." *Genome.gov*, National Human Genome Research Institute, 26 Apr. 2013, <u>https://www.genome.gov/25520302/online-education-kit-1972-first-recombinant-</u> <u>dna#:~:text=The%20first%20production%20of%20recombinant,host%20cell%2C%20often%20a%20bact</u> <u>erium</u>.

Image Citations

U.S. Department of Energy, Human Genome Project. "File:Logo HGP.jpg." *Wikimedia Commons*, 19 June 2006, <u>https://commons.wikimedia.org/wiki/File:Logo_HGP.jpg</u>.

Designua. "Plasmid and Recombinant DNA. Bacterial DNA in Which a Foreign DNA Fragment Is Inserted into a Plasmid Vector. ." *Shutterstock*, Shutterstock, Inc., <u>https://www.shutterstock.com/image-vector/plasmid-recombinant-dna-bacterial-which-foreign-794366641</u>.

Slide 16:

Borelli, Giovanni Alfonso. "File:Giovanni Borelli - Lim Joints (De Motu Animalium).Jpg." *Wikimedia Commons*, 1 Jan. 1980, <u>https://commons.wikimedia.org/wiki/File:Giovanni_Borelli_-</u> <u>lim_joints (De_Motu_Animalium).jpg</u>.

Kandola, Aaron. "What to Know about Heart Pacemakers." *Medical News Today*, Healthline Media, 11 Mar. 2019, <u>https://www.medicalnewstoday.com/articles/324662#outlook</u>.

Tontonoz Wednesday, Matthew. "Genetic 'Scars' Provide Clues for Tailoring Cancer Treatment." *Memorial Sloan Kettering Cancer Center*, Memorial Sloan Kettering Cancer Center, 11 Oct. 2017, https://www.mskcc.org/news/genetic-scars-provide-clues-tailoring-cancer-treatment.

Vision Online Marketing Team. "UC Berkeley Announces Advanced Bioimaging Center, Aims to Promote Imaging Technology in Life Sciences." *Automate*, A3 Association for Advancing Automation, 31 Mar. 2020, <u>https://www.automate.org/blogs/uc-berkeley-announces-advanced-bioimaging-center-aims-to-promote-imaging-technology-in-life-sciences</u>.

Market Research Future. "Tissue Engineering Market to Garner USD 53,424.00 Million by 2024, with a CAGR of 17.84% ." *Medgadget*, Medgadget, Inc., 20 June 2019,

https://www.medgadget.com/2019/06/tissue-engineering-market-to-garner-usd-53424-00-million-by-2024-with-a-cagr-of-17-84-global-industry-size-share-new-technology-trends-business-growthopportunities.html

<u>Slide 17:</u>

"Biomechanics." McCormick School of Engineering, Northwestern University, https://www.mccormick.northwestern.edu/biomedical/research/areas/biomechanics.html.

Goldin, Ian, and Chris Kutarna. "Our Michelangelo Moment: How to Protect the Legacy of Our Own Renaissance." *The Irish Times*, The Irish Times, 3 June 2016,

https://www.irishtimes.com/culture/books/our-michelangelo-moment-how-to-protect-the-legacy-ofour-own-renaissance-1.2671635.

<u>Slide 18:</u>

"Studying Blood Flow Dynamics to Identify the Heart of Vessel Failure." *DAIC*, Diagnostic and Interventional Cardiology, 16 Aug. 2016, <u>https://www.dicardiology.com/content/studying-blood-flow-dynamics-identify-heart-vessel-failure</u>.

Arizona State University. "New Study Explores Cell Mechanics at Work." *Phys.org*, Science X, 19 June 2018, <u>https://phys.org/news/2018-06-explores-cell-mechanics.html</u>.

Sasaki, Naoki. "Viscoelastic Properties of Biological Materials." *IntechOpen*, IntechOpen, 7 Nov. 2012, <u>https://www.intechopen.com/chapters/40738</u>.

<u>Slide 19:</u>

Kasemo, Bengt. "Biomaterials vs Tissue Engineering - What Is the Difference?" *Biolin Scientific*, Biolin Scientific, 5 May 2020, <u>https://www.biolinscientific.com/blog/biomaterials-vs-tissue-engineering-what-is-the-difference</u>.

Science Museum, London. "Hip Joint Replacement, United States, 1998." *Wellcome Collection*, Wellcome Collection, <u>https://wellcomecollection.org/works/fpnvsmum</u>.

Zia, Sonia & Mozafari, Masoud & G., Natasha & Tan, Aaron & Cui, Zhanfeng & Seifalian, Alexander. (2015). Hearts beating through decellularized scaffolds: whole-organ engineering for cardiac regeneration and transplantation. Critical reviews in biotechnology. 36. 1-11. 10.3109/07388551.2015.1007495.

"Bioprinting." Advanced BioMatrix, Advanced BioMatrix, https://advancedbiomatrix.com/bioprinting/.

Slide 20:

Business Industry Reports. "Outstanding Growth of Artificial Organs Market Is Estimated to Reach US\$ 25030 Million by 2023." *OpenPR.com*, OpenPR, 6 Dec. 2019, https://www.openpr.com/news/1876594/outstanding-growth-of-artificial-organs-market-is-estimated.

Whelan D, Caplice NM, Clover AJ. Fibrin as a delivery system in wound healing tissue engineering applications. *J Control Release*. 2014;196:1-8. doi:10.1016/j.jconrel.2014.09.023.

Max Planck- Gesselschaft. "Scientists Use Silk from the Tasar Silkworm as a Scaffold for Heart Tissue." *Phys.org*, Science X, 30 Jan. 2012, <u>https://phys.org/news/2012-01-scientists-silk-tasar-silkworm-scaffold.html</u>.

<u>Slide 21:</u>

Lam R.H.W., Chen W. (2019) Introduction to Biomedical Devices. In: Biomedical Devices. Springer, Cham. https://doi.org/10.1007/978-3-030-24237-4_1.

Image Citations

Foran, Jared R.H., and Michael B. Cross. "Revision Total Knee Replacement - Orthoinfo - Aaos." *Ortholnfo*, American Academy of Orthopaedic Surgeons, May 2021, <u>https://orthoinfo.aaos.org/en/treatment/revision-total-knee-replacement/</u>.

"Mechanical Prosthesis." *CThSurgery.com*, Cardiothoracic Surgery, <u>https://www.cthsurgery.com/mechanical-prosthesis.html</u>.

"First Insulin Pump That Acts like an Artificial Pancreas Launched for People with Type 1 Diabetes." *Diabetes Research & Wellness Foundation*, Diabetes Research & Wellness Foundation, 16 Apr. 2015, <u>https://www.drwf.org.uk/news-and-events/news/first-insulin-pump-acts-artificial-pancreas-launched-people-type-1-diabetes</u>.

Biggers, Alana. "What Is Dialysis, and How Can It Help?" *Medical News Today*, MediLexicon International, 17 July 2018, <u>https://www.medicalnewstoday.com/articles/152902</u>.

"X-Ray Machine." CGAxis, CGAxis, https://cgaxis.com/product/x-ray-machine/

Slide 22:

Aliverti, Andrea. (2017). Wearable technology: Role in respiratory health and disease. Breathe. 13. e27-e36. 10.1183/20734735.008417.

Model 7800, Ivy Biomedical Systems, https://www.ivybiomedical.com/model-7800.html.

Hemalatha, R.J., et al. "Biomedical Instrument and Automation: Automatic Instrumentation in Biomedical Engineering." *Handbook of Data Science Approaches for Biomedical Engineering*, 2020, pp. 69–101., https://doi.org/10.1016/b978-0-12-818318-2.00003-9.

Gordon, W.J., Stern, A.D. Challenges and opportunities in software-driven medical devices. *Nat Biomed Eng* 3, 493–497 (2019). <u>https://doi.org/10.1038/s41551-019-0426-z</u>.

Slide 23:

"BioImaging." *Georgia Tech: Bioengineering Interdisciplinary Graduate Program*, Parker H Petit Institute for Bioengineering & Bioscience,

https://bioengineering.gatech.edu/node/5335#:~:text=Bioimaging%20refers%20to%20methods%20and,used%20visualize%20fixed%20biological%20samples.

Image Citations

"Brain-Computer Interfaces and Neural Engineering." *University of Essex*, University of Essex, <u>https://www.essex.ac.uk/departments/computer-science-and-electronic-engineering/research/brain-computer-interfaces-and-neural-engineering</u>.

Mayo Clinic Staff. "Fetal Ultrasound." *Mayo Clinic*, Mayo Foundation for Medical Education and Research, <u>https://www.mayoclinic.org/tests-procedures/fetal-ultrasound/about/pac-20394149</u>.

"Rhythm Recognition." *ACLS Medical Training*, ACLS Medical Training, <u>https://www.aclsmedicaltraining.com/rhythm-recognition/</u>.

<u>Slide 24:</u>

"Rhythm Recognition." *ACLS Medical Training*, ACLS Medical Training, <u>https://www.aclsmedicaltraining.com/rhythm-recognition/</u>.

Pamies, Pep. "Ultrafast Ultrasound Microscopy of Deep Brain Vessels." *Nature News*, Nature Publishing Group, 16 Mar. 2021, <u>https://bioengineeringcommunity.nature.com/documents/mar-21</u>.

Mikhael, Alexandra, and Christian Nasr. "Chest X-Ray Prior to Thyroidectomy: Is It Really Needed?" *Consult QD*, Cleveland Clinic, 16 Apr. 2018, <u>https://consultqd.clevelandclinic.org/chest-x-ray-prior-to-thyroidectomy-is-it-really-needed/</u>.

"Signal-to-Noise Ratio (SNR) and Image Quality." *MRIMaster*, MRIMaster, <u>https://mrimaster.com/technique%20SNR.html</u>.

Slide 25:

"Specialisation Cellular and Molecular Biotechnology." WUR, Wageningen University & Research, https://www.wur.nl/en/education-programmes/master/msc-programmes/mscbiotechnology/specialisations-of-biotechnology/cellular-and-molecularbiotechnology.htm#:~:text=Focus%20on%20the%20practical%20application,micro%2Dorganisms%20or %20cell%20cultures.

Image Citations

"Pharma Fermenters." *GEA*, GEA Group, <u>https://www.gea.com/en/products/distillation-fermentation/fermenters/pharma-fermenters.jsp</u>.

"What Is Plasmid Design?" GenoFAB, GenoFAB, 22 Aug. 2019, https://blog.genofab.com/plasmid-design.

nextmsc. "Microfluidics Market Research Report and Forecast 2021." *The Manomet Current*, The Manomet Current, 29 June 2021, <u>https://manometcurrent.com/microfluidics-market-research-report-and-forecast-2021-fluidigm-corporation-agilent-technologies-bio-rad-laboratories-inc/</u>.

Center for Biologics Evaluation and Research. "Vaccines." *FDA*, U.S. Food and Drug Administration, 27 Jan. 2021, <u>https://www.fda.gov/vaccines-blood-biologics/vaccines</u>.

<u>Slide 26:</u>

Douglass, Eugene, and Chad Miller. "Binding #2: The Michaelis-Menton Equation." *Practically Science*, Practically Science, 18 May 2014, <u>https://www.practicallyscience.com/binding-kinetics-101-2-the-michaelis-menton-equation/</u>.

"What Can I Do with a Pharmaceutical Sciences Major?" UCI School of Pharmacy and Pharmaceutical Sciences, UCI School of Pharmacy and Pharmaceutical Sciences, 11 Aug. 2020, https://pharmsci.uci.edu/can-pharmaceutical-sciences-major/.

Lee, Esther J., et al. "Adeno-Associated Virus (AAV) Vectors: Rational Design Strategies for Capsid Engineering." *Current Opinion in Biomedical Engineering*, vol. 7, Sept. 2018, pp. 58–63., <u>https://doi.org/10.1016/j.cobme.2018.09.004</u>.

<u>Slide 27:</u>

"Neuroengineering." *College of Engineering - University of Wisconsin-Madison*, University of Wisconsin-Madison, <u>https://www.engr.wisc.edu/department/biomedical-</u> engineering/research/neuroengineering/.

Stone, Mark. "UW Bioengineering Advances Solutions to Neural Engineering Challenges with New Research Area." *UW Bioengineering | University of Washington Department of Bioengineering*, Center for Sensorimotor Neural Engineering, 26 Oct. 2020, <u>https://bioe.uw.edu/announcing-neural-engineering/</u>.

"Cochlear Implant Surgery." *Johns Hopkins Medicine*, The Johns Hopkins University, The Johns Hopkins Hospital, and Johns Hopkins Health System, <u>https://www.hopkinsmedicine.org/health/treatment-tests-and-therapies/cochlear-implant-surgery</u>.

Greenemeier , L. FDA Approves First Retinal Implant. *Nature* (2013). <u>https://doi.org/10.1038/nature.2013.12439</u>.

Slide 28:

Imran, Alishba. "Robotic Hand That Can See for Itself." *The Knowledge Society*, TKS, <u>https://tks.world/artificial-intelligence/robotic-hand-that-can-see-for-itself/</u>.

Graczyk EL, Schiefer MA, Saal HP, Delhaye BP, Bensmaia SJ, Tyler DJ. The neural basis of perceived intensity in natural and artificial touch. *Sci Transl Med*. 2016;8(362):362ra142. doi:10.1126/scitranslmed.aaf5187.

Willett, F.R., Avansino, D.T., Hochberg, L.R. et al. High-performance brain-to-text communication via handwriting. *Nature* 593, 249–254 (2021). <u>https://doi.org/10.1038/s41586-021-03506-2</u>.

<u>Slide 36:</u>

"Biomedical Engineering Society Code of Ethics - BMES." *BMES*, Biomedical Engineering Society, Feb. 2004, <u>https://www.bmes.org/files/CodeEthics04.pdf</u>.

Saha, S, and P S Saha. "Biomedical ethics and the biomedical engineer: a review." *Critical reviews in biomedical engineering* vol. 25,2 (1997): 163-201.

<u>Slide 37:</u>

"Biomedical Engineering Society Code of Ethics - BMES." *BMES*, Biomedical Engineering Society, Feb. 2004, <u>https://www.bmes.org/files/CodeEthics04.pdf</u>.

Saha, S, and P S Saha. "Biomedical ethics and the biomedical engineer: a review." *Critical reviews in biomedical engineering* vol. 25,2 (1997): 163-201.

"File:Scales of Justice.svg." *Wikipedia*, Wikimedia Foundation, 29 Sept. 2020, <u>https://en.wikipedia.org/wiki/File:Scales_Of_Justice.svg</u>.