

Dr. Astrid Layton
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The following are a variety of resources to help get you started with bio-inspired design (by seeing what others have done) and help move you forward with your designs with some tools that have been developed for applying inspiration from nature.

YouTube Videos:

“The world is poorly designed. But copying nature helps.” Vox (2017)

<https://youtu.be/iMtXqTmfta0>

“What is Biomimicry?” Fast Company (2011) Speaker Janine Benyus

<https://youtu.be/FBUpnG1G4yQ>

“Bio-Inspiration: Nature as Muse | KQED QUEST” KQED (2008)

<https://youtu.be/JnBkbaFsZOY>

“What Can a Humpback Whale Teach a Wind Turbine? | Think Like a Tree” WIRED (2015)

<https://youtu.be/FMG5Ah1g8rM>

“The Promise of Biomimicry” Biomimicry Institute (2020)

<https://youtu.be/Muzfdq25Qbc>

“Janine Benyus: Biomimicry in action” TED (2009)

https://youtu.be/k_GFq12w5WU

“The Innovators Using Nature's Design Principles to Create Green Tech” Bloomberg (2016)

<https://youtu.be/6WjBvFwQpYU>

“Natural Velcro” New Atlantis WILD (2015)

<https://youtu.be/hitt-tCguLw>

“Why Don't Ants Get Stuck In Traffic?” It's Okay To Be Smart PBS (2016)

<https://youtu.be/kkiuwOHbRq4>

“The bizarre physics of fire ants” Vox (2017)

<https://youtu.be/NpiDADw5Omw>

“See How Termites Inspired a Building That Can Cool Itself | Decoder” National Geographic (2018)

<https://youtu.be/620omdSZzBs>

“Why Does Everyone Hate Pigeons?” It's Okay To Be Smart PBS (2016)

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<https://youtu.be/L8Y7Q1eja-E>

“Why Nature Loves Hexagons” It’s Okay To Be Smart PBS (2017)

https://youtu.be/Pypd_yKGYpA

“Rolling Salamanders & Caterpillars - Weird Nature - BBC animals” BBC Studios (2009)

<https://youtu.be/HmLS2WXZQxU>

“Feedback loops: How nature gets its rhythms - Anje-Margriet Neutel” TED-Ed (2014)

<https://youtu.be/inVZoI1AkC8>

“Shellfish Inspire UC Berkeley Scientists To Develop A New Surgical Glue” KPIX CBS SF Bay Area (2016)

<https://youtu.be/ONvzmQPBWMo>

“Submarines learning from tiny jellyfish” Cosmos Magazine (2015)

<https://youtu.be/24AeEnRhqD8>

“Dead stuff: The secret ingredient in our food chain - John C. Moore” TED-Ed (2014)

https://youtu.be/KI7u_pcfAQE

Online Resources:

Biodiversity Heritage Library (BHL) <https://www.flickr.com/photos/biodivlibrary/>

AskNature: Innovation Inspired By Nature <https://asknature.org/>

“Find biological strategies and inspired ideas relative to your innovation challenges, so you can emulate time-tested forms, processes, and systems.” Warning: these are primarily all biological strategies that have already been applied as bio-inspiration/biomimicry. It’s a great place to start but it can be a difficult place to find novel ideas.

Also includes the new “BioMole” tool <http://biomole.asknature.org/index.html>

Biomimicry Institute <https://biomimicry.org/>

“The Biomimicry Institute provides tools to develop sustainable solutions for a balanced ecosystem by empowering people to learn and apply nature-inspired strategies in design. We offer access to free online resources, design challenges where people learn by practicing, support for bringing solutions to market, and serve as a connective tissue for a global network of innovators.”

Biomimetica <http://biomimetic.pbworks.com/>

This resource is older (2010 last update) but it contains a scholarly paper index of biomimetic papers, a Biomimetic Technology Tree, and a glossary of common biological terms written from an engineering perspective.

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News Articles:

“Airport Screening Machines Use Echolocation Like Bats Do” (2015) Charley Locke WIRED

<https://www.wired.com/2015/12/airport-screening-machine-bats/>

“Immortal jellyfish: How does this species skip steps in its lifecycle?” (2019) Research @ Texas A&M

<https://research.tamu.edu/2019/10/31/immortal-jellyfish-how-does-this-species-skip-steps-in-lifes-cycle/>

“The Future of Innovation is Here: 8 Inventions from Nature’s Laboratory (2019) The Biomimicry Institute

<https://biomimicry.org/the-future-of-innovation-is-here-8-inventions-from-natures-laboratory/>

Publications:

Goel, A. K., D. A. McAdams, and R. B. Stone (2014). “Biologically Inspired Design: Computational Methods and Tools” Springer.

Farzaneh, H. H. and U. Lindemann (2018) “A Practical Guide to Bio-Inspired Design” Springer Vieweg.

Jenkins, C. (2012) “Bio-Inspired Engineering by Chris Jenkins” Momentum Press.

Chapter 4: “A Thesaurus for bioinspired engineering Design” Jacquelyn K.S. Nagel

In book: “Biologically Inspired Design: Computational Methods and Tools” (2014) Publisher: Springer, Eds. Ashok K. Goel, Daniel A. McAdams, Robert B. Stone. DOI: 10.1007/978-1-4471-5248-4_4

https://www.researchgate.net/publication/281033986_A_Thesaurus_for_Bioinspired_Engineering_Design

“The Engineering to Biology Thesaurus” by Jacquelyn Nagel (2012) Zygote Quarterly ISSN 1927-8314

https://issuu.com/eggermont/docs/zq_issue_02final/103?e=2346520/1920397

“Biomimicry - A Review” (2004) Mark Ayre, European Space Agency, 2(3).

<https://www.esa.int/gsp/ACT/doc/BIO/ACT-RPT-BIO-GSP-BiomimeticsSpaceSystemDesign%20-%20TechnicalNote2b%20-%20Biomimicry-AReview.pdf>

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Mattson, C. A., and A. E. Wood (2014). “Nine Principles for Design for the Developing World as Derived From the Engineering Literature” Journal of Mechanical Design 136: 121403.

Brehm, C. and A. Layton (2019). "Designing eco-industrial parks in a nested structure to mimic mutualistic ecological networks." Procedia CIRP 80: 590-595.

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Volstad, N. L. and C. Boks (2012). "On the use of biomimicry as a useful tool for the industrial designer." *Sustainable Development* 20: 189-199.

Helms, M. and A. K. Goel (2014). "The Four-Box Method: Problem Formulation and Analogy Evaluation in Biologically Inspired Design" *Journal of Mechanical Design* 136: 111106.

Dave, T. and A. Layton (2020). "Designing Ecologically-Inspired Robustness into a Water Distribution Network." *Journal of Cleaner Production* 254(1): 120057.

Fath, B. D. (2014). "Quantifying economic and ecological sustainability." *Ocean & Coastal Management* 108: 13-19.

Cheong, H., I. Chiu, L. H. Shu, R. B. Stone, and D. A. McAdams (2011). "Biologically Meaningful Keywords for Functional Terms of the Functional Basis" *Journal of Mechanical Design* 133: 021007.

Yen, J., M. Helms, S. Vattam and A. K. Goel (2010). "Evaluating Biological Systems for their potential in engineering design." *Advances in Natural Science* 3(2): 27-40.

Layton, A., B. Bras and M. Weissburg (2016). "Designing Industrial Networks Using Ecological Food Web Metrics." *Environmental Science & Technology* 50(20): 11243-11252.

Fath, B. D. (2017). "Systems Ecology, Energy Networks, and A Path To Sustainability." *International Journal of Design & Nature and Ecodynamics* 12(1): 1-15.

Knight, D. J. (2009). "Inspired by Nature." *New York State Conservationist* 63(6): 30.

Lurie-Luke, E. (2014). "Product and technology innovation: what can biomimicry inspire?" *Biotechnology Advances* 32(8): 1494-1505.

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Nagel, R., P. A. Midha, A. Tinsley, R. B. Stone, D. A. McAdams, and L. H. Shu (2008). "Exploring the Use of Functional Models in Biomimetic Conceptual Design" *Journal of Mechanical Design* 130: 121102.

Reap, J. and A. Layton (2017). "Lessons from Living Systems for the Development of Sustainable Industrial Resource Networks." *Journal of Energy Challenges and Mechanics* 4(1): 1-10.

Imani, M., M. Donn, and B. Vale (2017) "Biomimicry as Innovation: a systematic review" 51st International Conference of the Architectural Science Association.