

**Material Innovation Initiative Issues the
“What Makes Silk, Silk?” Report**
*A guide to the science of silk
and opportunities for next-gen silk innovation*

June 4, 2021 -- Material Innovation Initiative issued a report examining the unique properties of silk and exploring next-generation silk alternatives that are less harmful to both animals and the environment. The report’s author, MII’s Chief Scientific Officer Sydney Gladman, Ph.D., carefully considers the qualities of silk most important to fashion designers and expertly makes the latest material science accessible. This Silk Report is a one-of-a-kind resource for scientists, textile suppliers, and material innovators.

Why is next-gen silk needed?

Traditionally sourced silk is damaging to the environment and includes animal welfare concerns. Silk alternatives currently in the marketplace, such as polyester, viscose/rayon, and nylon, often fall short in terms of aesthetics, performance, and sustainability. Although a number of next-gen silk innovators exist, few are available at commercial scale.

Environmental Impact

Silk is one of the most environmentally damaging fabrics due to high water usage and greenhouse gas emissions emitted during the production process. According to a life cycle assessment conducted on raw silk produced in India, silk has the highest environmental footprint compared to cotton, nylon and wool.

Environmental impact of silk production compared with other fibers. Source: M.F. Astudillo et al., Life cycle assessment of silk production - a case study from India. *Handbook of Life Cycle Assessment (LCA) of Textiles and Clothing* (Elsevier Ltd., 2015): 255-274.

	Global warming potential (100 years; kg CO _{2eq} /kg)	Cumulative energy demand (renewable; MJ/kg)	Cumulative energy demand (nonrenewable; MJ/kg)	Ecotoxicity (CTU _e /kg)	Agricultural land occupation (m ² a/kg)	Blue water footprint (m ³ /kg)	Freshwater eutrophication (g P _{eq} /kg)
Raw silk (India)	51.5	1349.9	110.1	522.8	19.7	24.6	4.8
Cotton (China)	3.4	19.7	0.1	71.2	7.8	7	0.8
Nylon	8	1.3	0.0007	0.0006	0.0002	0.2	0.3
Sheep wool (US)	18.5	81.7	0.1	3.4	53.5	0.2	0.5

Animal Protection

Silk fabric is derived from the cocoons of growing silkworms via sericulture, the practice of farming silkworms. Each year, between 420 billion to 1 trillion silkworms are boiled or baked alive to harvest their silk cocoons.

How do we create next-gen silk?

According to Sydney Gladman, Ph.D., Chief Science Officer of MII, “Both scientists and fashion designers love silk, but until now there has been a disconnect between the scientific properties of silk and its desirable attributes as a fiber and fabric. In our report we connect the dots so that next-gen silk innovation, grounded in materials science, can meet the needs of the fashion industry and beyond.”

Generally speaking, there are two approaches to the creation of next gen silk: bottom-up materials design, which involves recombinant protein synthesis, and top-down materials design, which typically includes finding naturally-occurring or

synthetic materials that closely mimic the performance of silk fiber. Current innovators in the space include **Bolt Threads: Microsilk** and **Seevix: SVX**, among others.

According to Thomasine Dolan Dow, Fashion Design Specialist at MII, “Fashion has long relied on farming, for better or for worse, to supply luxury materials like silk. However, we are now on the cusp of creating another more sustainable bridge to fashion for these materials and this time it is coming from the lab. There could not be a more exciting time to be involved in science and fashion.”

For additional information on the next-gen technologies and other innovators in the space, see pages 39-45 of the report.

Why Should Scientific Researchers and Investors Focus on Next-Gen Silk?

There are significant market opportunities for researchers and investors who enter the next-gen silk market including:

1. The annual volume of silk is much smaller than other fabrics, so even limited production runs have the ability to make a large impact.
2. Silk’s luxury positioning comes with a high profit margin with the current global silk market estimated at \$17 billion annually.
3. Spider silk technology is an untapped market as it cannot be harvested naturally, and the resulting strong, tough silk fiber could be applied to new markets such as sports apparel and outerwear.
4. Alternative technologies could improve upon the drawbacks to silk: eliminate the use of animals; decrease the environmental footprint; improve launderability, shrinkage, durability, stain-resistance and UV resistance.
5. The next gen silk alternative space is a relatively uncrowded space with room for new players.
6. A high performing silk alternative could impact the enormous synthetics market.
7. Few next-gen technologies that do exist are currently available at commercial scale.

By understanding the science of silk and its unique properties, innovators have the opportunity to transform the textile market with high performing next-gen alternatives that are animal free and outperform silk both functionally and environmentally. To read the full “What Makes Silk, Silk?” report, please visit this [link](#).

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About Material Innovation Initiative

The Material Innovation Initiative is a nonprofit that accelerates the development of high performance, eco-friendly and animal-free materials for the fashion, automotive and home goods industries. MII serves as a critical connector along the path to market adoption for new materials, partnering with scientists, startups, brands, and retailers to direct the industry toward areas of maximum impact.

Learn more at materialinnovation.org