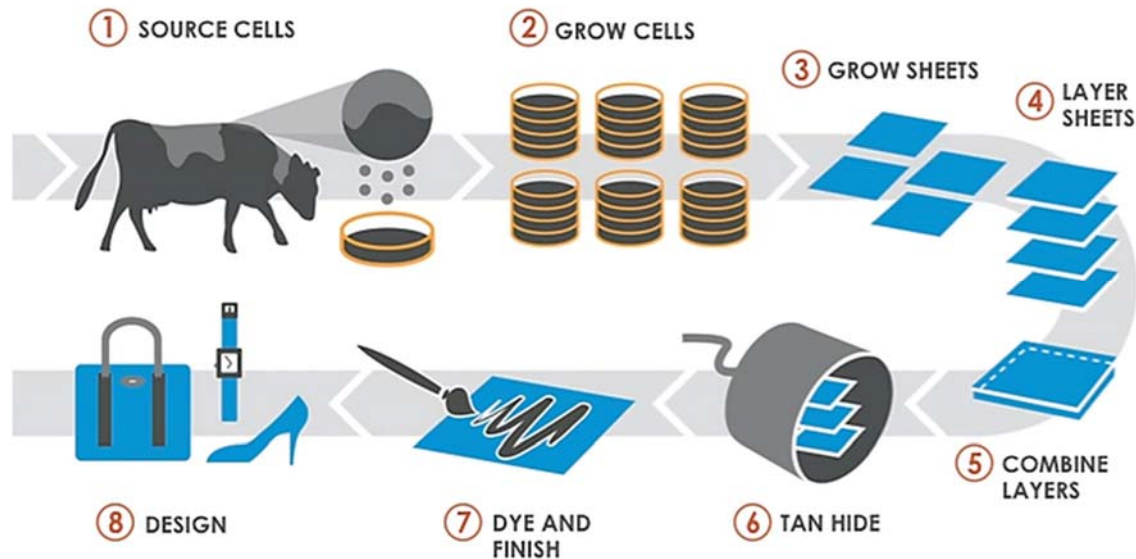


BIOFABRICATION OF LEATHER IN NJ, NY

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Biofabrication Presents a New Paradigm

Biofabrication *is* advanced manufacturing. Sophisticated equipment is used for growing materials into set shapes. Post treatment(s) are then applied. The last step is explaining why you'd want to switch from conventional leather to a textile grown from stem cells, mushrooms, waste fruit or other bio-material. We will answer this question later.

Fabrication in this area means controlled growing of cell lines. In that sense, it is like biopharma production of vaccines. Much of the equipment is recognizably the same; the rest is quite innovative.

New Jersey could be a production center for advanced textiles and other biofabricated materials. Education and know-how in the workforce may be the key to keeping a leading producer here and attracting others.

Labor Force Takeaway

The proximity of two leading biofabricated leather producers offers New Jersey's manufacturing community a singular opportunity to track this emerging sector. Biofabrication is poised to grow in NJ, yet it will need a manufacturing workforce with some understanding of biology and cell growth.

The technology is already for sale and can move quickly. If we don't want to lose this industry to the Midwest, we should consider how to incorporate specific training now, so as to be ready in 2-3 years.

Biofabrication involves everything NJ does well

New Jersey has pharmaceutical manufacturing knowledge, food manufacturing knowledge, advanced manufacturing facilities and access to both Wall Street and NYC's fashion industry. It's the perfect place to biofabricate leather. There is currently a company, [Modern Meadow](#), doing just that in Nutley, NJ. Three hours north of NJ in Green Island, NY, [Ecovative Design LLC](#), is growing a leather-like textile from farm waste and mushrooms. Ecovative has been in production for several years and their technology is currently available for license.

Biofabrication can be defined as the production of complex living or non-living products from raw materials such as live animal cells, extracellular matrices and other biomaterials. Vaccines and biologic medical treatments are included. (Biologics are cocktails of proteins as opposed to a single purified small molecule. They are used to treat immune-mediated inflammatory disorders and cancers.) **Training materials** for biologics manufacturing are **now available**.

The pharmaceutical manufacturing industry is not likely to extend beyond production of human tissue, organs and other medically relevant materials. Nor are highly paid production associates in the bio-pharma likely to take a pay-cut to grow food, non-woven cloth and packing materials indoors. If biofabrication facilities are to flourish in NJ, the *manufacturing labor force* will need to learn enough cell biology to understand cell-growth processes.

In the case of Ecovative's process, **they explain it this way**: (1) Agricultural waste is sourced from regional farmers (2) Waste is cleaned and introduced to mycelium (the root structure of tree fungus) (3) Loose particles are packed into the growth tray/mold where the mycelium grows through and around the particles binding them together (4) Parts are grown for 6 days and then removed from the growth tray (5) Parts are dried and shipped to the customer.

Biofabrication has arrived. The workforce is currently tiny yet offers excellent pay. Needed skills should be assessed, as they are going to be quite eclectic.

Modern Meadow's leather growing process is illustrated in the figure on page 1. On the spectrum of biofabrication complexity, one could describe Modern Meadow as being in between Ecovative's operations and a biopharma facility. Ecovative has tight process parameters based on the properties in their customers specification, but no need for sterilization or protective equipment beyond dust masks, work gloves, etc. Given the structural nature of their product lines, Ecovative has a few regulations to track.

Modern Meadow's operation involves growing stem cells. At the point where Modern Meadow produces beef, food safety procedures will be required. Yet there is unlikely to be a need for one-time use equipment the way there is in biopharma production. There's unlikely to be regulation on the level of medicine.

Why one would switch to a bio-material? The sobering answer is that megatrends of climate change, impending resource scarcities and urbanization are going to change many economic equations. Biofabrication has many highly-attractive attributes: high performing, resource efficient, rapidly renewable, compostable, etc.

Biofabrication, regardless of its level of sophistication, creates good jobs. An investment of time and talent to research a portfolio of needs, and then produce training materials, could have an excellent payoff.