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Biofabrication: Lab-Grown Animal Products

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Abstract **–** A field of biotechnology called "biofabrication" focuses on the study and development of biologically engineered processes for the creation of functional products. Scientists from a variety of backgrounds are entering the subject of biofabrication as it develops and grows. One of the most widely used fabrics in the world, leather, is currently created using this technology. Leather is a strong, flexible, and long-lasting material, obtained from the tanning, or chemical treatment of animal skins and hides. Clothing, shoes, handbags, furniture, tools, and sporting goods can all be made from leather, and it is durable for many years. The main protein of leather, collagen can be grown artificially by using the process of biofabrication, which involves DNA modification. Additionally, it makes precise use of 3D printing technology to combine materials and cells to cultivate tissues. After introducing Lab-grown burgers, it is nowadays no surprise to bio-fabricate leather which is an environmentally friendly, efficient, and novel way of production. With the help of this technique, the leather may be produced with arranged elasticity, flexibility, and thickness. This study presents information about the biofabrication of lab-grown animal products.

Keywords – Biofabrication, Stem Cells, Leather, Collagen

I. INTRODUCTION

The demand for products grows dramatically along with the global population. Urgent needs frequently inspire exceptional innovation. One of the most appealing new answers to this expanding issue is in the field of bioengineering, in particular biofabrication (Gutermuth, 2018). Biofabrication is known as the production of complex living and non-living biological products from raw materials including living cells, molecules, extracellular matrices, and biomaterials (Mironov et al., 2009).
The production of functional products in biofabrication is carried through bioprinting or bioassembly (Yi et al., 2005) and subsequent tissue maturation processes (Moroni et al., 2018). Biofabrication is still under the process of development and research, this field is much newer than others. It is maturing and growing, and scientists with different backgrounds are joining this field.

II. LAB-GROWN ANIMAL PRODUCTS

As a result of ongoing research conducted throughout the world, scientists have discovered that skeletal muscle cells and adipocytes, or fat, tissues, are essential parts of meat. Today, a particularly special kind of cell that may be used to produce muscle and fat tissues has made it possible to create meat in a lab: stem cells (Li, 2021).

A. Lab-grown meat

The Cultured Beef Project researchers take muscle cells from a cow's shoulder and place them in a petri dish with a nutritional solution. They grow into tissue. The beef was grown using stem cells from a shoulder over the course of three months. By using tissue engineering, it is feasible to grow tons of meat from a small number of beginning cells. In 2013, the

Dutch business Mosa Meat introduced its first hamburger (Fig. 1) in London (Bertalan, 2018).

Figure 1. Lab-Grown Burgers (www.mosameat.com)

B. *Lab-grown leather*

After introducing Lab-grown burgers, it is nowadays no surprise to bio-fabricate leather which is an environmentally responsible, efficient, and humane way, instead of animal slaughtering. Thus, one of the most widely used fabrics in the world, leather, is currently created using this technology.

Leather is a strong, flexible, and long-lasting material, obtained from the tanning, or chemical treatment of animal skins and hides. Clothing, shoes, handbags, furniture, tools, and sporting goods can all be made from leather, and it is durable for many years.

Leather making has been practiced for more than 7000 years. The process involves three basic steps: pre-tanning, tanning, and post-tanning, which are followed by a last finishing step before commercialization.

The series of operations involved in leather production require a huge amount of water and other chemical substances, discharging solid and liquid wastes into the environment. Estimates of the carbon footprint of bovine leather range from 65 to 150 kg of CO_2 equivalent per square meter of production.

However, the main protein of leather, collagen, and other proteins can be grown artificially by using the process of biofabrication, which involves DNA modification. Additionally, it makes precise use of 3D printing technology to combine materials and cells to cultivate tissues (Fig. 2).

The leather is produced using collagen developed from yeast in a lab. Collagen is a protein found in an animal's hide or skin that gives flexibility and gracefulness and is vital to the attractive attributes of leather.

Figure 2. The Process of Lab-Grown Leather (https://www.tetrafab.com/biofabrication-future-leather/)

The world's first bio calfskin brand – Zoa is bio-manufactured bio-fabricated leather, it can be poured, shower paint, and utilize 3D printing, to make it thick, slender, and so forth (Fig. 3). This new material can even be made in a liquid leather form and is animal-free. With the help of this technique, the leather may be produced with arranged elasticity, flexibility, and thickness.

Figure 3. Biofabricated Leather Brand – Zoa (https://www.modernmeadow.com/)

It has no hair flesh and fat, so the liming process can be eliminated. The material is also precisely cut and measured beforehand, so the wastes formed during the manufacture of leather goods are eliminated as well.

III. CONCLUSION

Maybe it will be possible in the near future to see:

- a material that is a combination of different animals,
- or a selection of desired properties from a number of species
- producing more expensive skin of animals such as alligators, crocodiles, snakes, etc.

The major challenge is streamlining the engineering process in order to reduce cost, but this leather is special and unique.

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