BioS Reports

Glimpse into the activities of the
Master's course "Biology in Society"

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EXCURSIONS AND OTHER NEWS

Small insights in student's or professor's points of view, field trips, and other stuff we do.

Tiny Organism Could be a Huge Help: ReFiBa iGem Project

Cosima Sagurna

In this year's international iGEM competition, in which teams develop biotechnological solutions to global problems, a group of students from TU Dresden is participating, including many students from Biology in Society.

Today, over 92 million tons of textile waste are produced annually, of which over 85% ends up in landfills or is incinerated. Only around 10% is recycled [1]. This amount of textile waste is an exponentially growing problem. According to the European Environmental Agency (EEA), the number of used textiles exported from the EU has tripled in the last 20 years. In addition, the fashion industry is responsible for about 10% of global CO2 emissions, more than international air and sea shipping combined [1]. Textiles made of cotton are considered biodegradable as the fibers are made of organic cellulose. However cotton alone cannot meet today's demand for materials and are therefore often processed into mixed textiles with plastic fibers. Over 60% of the textiles produced today are made of plastic, primarily Polyethylene terephthalate (PET) [2], and half of these are mixed with cotton [3]. This makes them quite difficult to recycle. To add to this, the crystalline structure of the plastic fibers doesn't allow for complete degradation. New, sustainable and innovative ways of recycling textile waste are therefore essential for modernizing the textile industry.

This is where our iGEM project comes in: ReFiBa aims to create a green approach to textile recycling. Cellulose fibers and PET can be broken down enzymatically using the enzymes cellulase and PETase. To do this, the enzymes are immobilized on the spores of the bacterium, Bacillus subtilis, to stabilize their activity. This creates the possibility of repeating the degradation reaction of the textiles. Monomers such as glucose, ethylene glycol (EG) and terephthalic acid (TPA) are produced from the reaction. These can not only be easily extracted from the solution afterwards, but the mix of EG and glucose can also be used to produce valuable chemicals. ReFiBa aims to lead us to a circular economy in which mixed textiles can be easily and sustainably decomposed into usable chemicals.

EXCURSIONS AND OTHER NEWS

Lab Rotation: Combating Bone Loss

Aleksandra Brylant

Healthy bones are essential for mobility and participation in daily life. Most people take mobility for granted until it is lost due to disease or aging. Bone quality deteriorates with age, therefore keeping bones healthy throughout life is a major challenge. The Bone Lab in Dresden is working on new approaches to treating bone loss, which is often caused by hormonal, inflammatory and malignant diseases.

During my lab rotation at the Bone Lab, I wanted to test the potential use of spermine and spermidine, two biogenic polyamines, to prevent the development of inflammation in bones and its further effects. I performed experiments with bone marrow cells of mice. In culture the cells differentiated into two types of bone cells, osteoblasts and osteoclasts. Osteoblasts are responsible for the formation of new bone tissue, while osteoclasts are responsible for resorption, i.e, removal of old bone tissue. Cells were treated with bacterial toxin Lipopolysaccharide, to provoke an inflammatory response in the cells and create inflammation conditions. Finally, they were treated with the polyamines.

The results were most significant in osteoclasts, the cells which are responsible for the destruction of old bone tissue. Osteoclasts, under induced inflammation conditions, showed a greater degree of differentiation. This may indicate their enhanced activity, leading to increased bone loss. However, cells treated with polyamines were able to maintain normal function despite the presence of the inflammatory factor. This suggests that polyamines may counteract the pro-inflammatory and bone-damaging effects of the bacterial toxin. According to my results, polyamines may be useful in the treatment of bone diseases associated with excessive osteoclast activity, such as osteoporosis or inflammatory bone diseases.

I am pleased that these promising results emerged during my lab rotation, which was an extremely rewarding experience for me. I am grateful that I had the opportunity to work with a great team who introduced me to the interesting world of work in the laboratory.

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ANIMALS AND MONEY

This part of BioS Reports unravels interesting relation between animals and the economy

Mink Fur Production in Denmark: The Collapse of an Industry

Sophie Merz

In 2020, a decision by the Danish government shocked the world: the population of seventeen million minks in Denmark was culled due to an outbreak of Covid-19 on mink farms. This meant the loss of an industry worth 2.5 billion DKK ($335 million USD) [1] and the 6th most important contributor to the Danish economy [2]. Within the agricultural sector, mink fur production was holding 11.3% of the total export [3]. Apart from having a significant impact on the economy, it is a reminder how social and ethical factors shape political decisions: Since the culling could not be justified legally, the prime minister "was forced to call a snap general election, leading to a change of government" [4].

In Denmark, mink farming has a long history and is well established [5] - with 778 farms and a contribution of 36% [6] to the global fur market up until 2019. Denmark was the second largest producer of mink skins globally [7]. A key factor for the success of Danish mink fur was the Copenhagen Fur company overseeing the farms and the price development. The farms combined were producing 25-30 million mink pelts per season [8]. Being such a highly productive economic field, the mink production in Denmark was recognized as one of the 29 Danish special competence clusters [9].

In response to the economic impact of the culling, the Danish government offered a "compensation package with two options: 1) economic hibernation mode (state bears the maintenance costs) or 2) give up production capacity and assets to state and receive compensation" [6]. The financial aid amounts to $3 billion USD in total and lasts till 2030 [10]. Out of the 778 farms, the majority chose the second option and only thirteen breeders remained. The decisions were influenced by the disruption of the cooperative-based infrastructure from Copenhagen Fur and the loss of the unique genotype of female minks, making it harder to rebuild their competitive business. Due to the culling, raw mink skin production decreased by 25% and global raw skin trade dropped by 30 % [11]. The overall numbers for mink production are declining globally from 113 million in 2014 to 17 million in 2022. In the years of the ban in Denmark (2020-22), the number of farmed minks halved [12].

In January of 2023, the ban from fur production was lifted but its impact was still present: investment and resources (e.g. tools) in mink production are so specific that outside of this industry they would have no value. The production sites used to be in rural areas, where unemployment is high, hence many fur farmers might struggle to find a new job in their region [8]. While the farmers were wondering how to return from this devastating loss, a debate started (and is still ongoing) on whether to totally ban fur production. In several EU states it is already banned, such as Germany [13]. Despite being confronted by PETA, it looks like the EU is not ready for banning fur production yet. The ESFA needs to conduct scientific advice by March 2025 and the Commission will not communicate before March 2026 [14]. This leaves Denmark with two more years to decide about the future of a controversial practice.

[7] Danish Agriculture & Food Council. (2019). Denmark – a Food and Farming Country Facts & Figures [Brochure].

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