BioS Reports

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

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ANIMALS AND MONEY

This part of BioS Reports unravels relationships between animals and the economy.

Tiny Worms, Huge Gains: Mealworms and Europe's Protein Future

Matilda Bieder

With an ever-growing global population, there is a need for dietary plans to shift. Specifically, there has been an increase in the demand for alternative and sustainable protein sources [1]. Traditional protein sources, including chicken and soy, are connected to significant environmental and economic challenges such as high greenhouse gas emissions and intense water consumption. Conventional livestock farming alone accounts for about 19% of global greenhouse gas emissions [2]. Humble though it may seem, the mealworm (*Tenebrio molitor*) could be the alternative and sustainable protein source the world desperately needs.

Mealworms, which are the larval form of the yellow mealworm beetle, have emerged as a potential game-changer in the protein market. Insects offer a protein source with a much lower environmental footprint than traditional livestock, thanks to their high food conversion efficiency. For example, insects need half of the feed needed by pigs or broiler chickens, four times less than sheep, and six times less than cattle to produce the same amount of animal protein [3]. Additionally, mealworm farms require much less water, have lower greenhouse gas emissions, and occupy significantly less land compared to traditional livestock cultivation [4]. In fact, insect farming can reduce land use requirements for protein production by up to 98% when compared to soybean–fish meal protein mixtures [5]. Clearly, as livestock and aquaculture industries are under pressure to adopt more sustainable feeding practices, mealworms offer an ideal alternative [6]. This raises important questions: How economically viable is insect protein? Could it be used as a standard feed in livestock production? And perhaps most intriguingly, could it become a widely accepted protein choice for human consumption?

In 2022, the EU imported 28.1 million tonnes of soy for feed [7]. With the price of one metric ton being US$675 in 2022 [8], the EU spent around US$20 billion just for importing soy to feed livestock. As insects need only a fraction of the plant protein to produce one kg of animal protein, the expenditure on imported soy could be significantly reduced. This cost could be reduced even further, as mealworms are able to thrive on agricultural by-products and food waste that would otherwise hold little economic value, contributing to a circular economy [9].

While the economic potential of mealworm farming is evident, certain barriers remain. Mealworm farming also requires significant research, innovation, and investment to become truly cost-competitive [10]. Beyond the economic challenges, cultural acceptance also plays a critical role. In many European countries, eating insects is still associated with disgust or food safety concerns, as insect consumption is not historically embedded in Western diets. This skepticism can make it difficult for insect protein to move forward quickly despite its clear advantages. Mealworms' high protein content, lower environmental footprint, and ability to contribute to a circular economy, will make them a key player in Europe's future of protein production. With continued innovation in farming techniques, market growth, and increased consumer acceptance, mealworms could revolutionise the sustainable protein industry. At present, insects as a food source represents a very small market in the EU. However, with the combination of both their environmental and economic benefits, the mealworm industry has the potential to fuel economic growth while reshaping how we think about food.

EXCURSIONS AND OTHER NEWS

Small insights in BioS points of view, field trips, and other stuff we do.

Sheepish Among Sheep – A Professor's Internship as a Shepherd's Assistant

Klaus Reinhardt

If you think internships are reserved for students, you are mistaken. After more than 10 years as a professor at TU Dresden, in May 2025, I took a week off to try something completely different: working as a shepherd's assistant.

The shepherd prefers to remain anonymous regarding his name, location, and flock size. He had some (well-deserved) pleasure in introducing me, the "Prof. Dr.", as his new assistant.

From 6:30 a.m. until 9:00 p.m., I joined in the routines: monitoring flocks, assisting with lambing, collecting and setting up the mobile electric fences, transporting sick or dead sheep, and carrying water and food to ill ones in the stable. One day, I helped move the flock to new ground. I walked at the tail end, keeping stragglers in line. The distance was only half a kilometre, but under the heat it felt like ten. It is hard to describe the feeling of achievement, usefulness, and yes, self-importance once all the sheep arrived safely. *I did it*. Even now, it feels unreal.

It was an utmost privilege to share the life of the shepherd and his family. I learned about their views on life, politics and, of course, wolves in particular. I am a big wolf fan. I didn't see one during my stay, but after a week of constant conversations I could hardly bear to hear the word anymore. Wolves seemed on everyone's mind, though few had ever seen one. Interestingly, the question of how to deal with them in the wild was not where the shepherd and I disagreed most. To my surprise, I also realized I could disagree – sometimes strongly – and still fully accept another's opinion.

For the rest of my life, I will hold my deepest respect for the dedication behind shepherding: no holidays (no, not one!), no weekends, no sick days in 30 to 50 years, and only a few hours off even for family celebrations, including weddings of their own children. Against this background, rejecting wolf-damage compensation claims because a fence was two centimetres too low feels shockingly disrespectful.

A glimpse into another world is almost always valuable, and I especially recommend it for professors. I saw an entirely different way of living. For me, this single week ranks among the most remarkable of the roughly 3,000 weeks of my life.

SCIENCE UNPACKED - THE BIOS PODCAST

Ezgi Ece Yavuz & Marit Scheuringer

In this episode Dr. Olya Vvedenskaya shares her unconventional path from medicine to lipidomics research and science communication at Lipotype. We talk about why career journeys don't need to be linear, how to make complex science accessible, and why burnout is a systemic issue, not an individual failure.

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Lab Rotation: Safeguarding the Genetic History of Flies

Asude Demir

Museum collections have become increasingly important for research in biodiversity, wildlife conservation, climate change, evolutionary biology, and phylogenetics - particularly, in the context of the accelerating global biodiversity loss. With an estimated three billion historical samples from around two million described species [1], natural history museums represent a vast reservoir of genetic material, including historical and ancient DNA. However, obtaining usable DNA from historical specimens remains challenging due to extensive degradation and fragmentation of the DNA [2]. Since the degree of tissue degradation differs among specimen types, applying non-destructive DNA extraction methods can become even more difficult - especially for fragile samples. During my lab rotation at the *Senckenberg Naturhistorische Sammlungen Dresden*, I had the opportunity to tackle this problem.

Together with Dr. Arianna Thomas-Cabianca, I was helping to develop a non-destructive DNA extraction protocol for ethanol-preserved museum specimens. With this project, we aimed to address an existing methodological gap, since only very few published studies have dealt with this issue. Our work focused specifically on preserved larvae of two-winged flies (Diptera), that were between 40 to 140 years old. We applied and evaluated two established methods for extracting historical DNA: First, a column-based approach using a DNA cleanup kit with a silica membrane and second, a silica magnetic bead-based method described by Tin *et al.* (2014) [3]. The first approach using the column-based kit proved to be more cost-effective, less hazardous, and at the same time preserved the morphological features of the specimens. Importantly, we were able to successfully extract DNA from historical Diptera larvae without compromising key traits needed for species identification.

It was an exciting experience to work with historical specimens and to attempt DNA extraction without damaging the samples to the point of losing crucial morphological information. Conducting this work in the historical DNA laboratory—with its high sterile standards—provided me with valuable advanced laboratory practice. This lab rotation once again showed me the depth of exploration that science allows. It also highlighted how important collaboration and communication between institutions are, in order to facilitate the exchange of samples and the gathering of data.

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