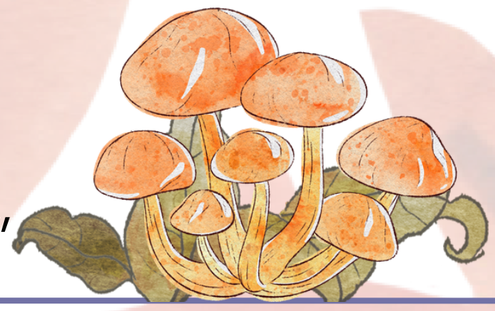
BioS Reports

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.

Ode to the Yucca Moth, Bringer of 50 Million Dollars

Lisa Bialas



National Parks are invaluable for conserving biodiversity and protecting landscapes while generating significant economic benefits. For example, in 2024, the Joshua Tree National Park generated $214 million [1]. Located in the Mojave Desert, the Park hosts a unique ecosystem renowned for its iconic landscape. Visitor numbers have tripled over the last 25 years, showing that the demand for nature-based recreation is constantly growing [2]. The Joshua tree landscape is estimated to motivate at least 25% of these visits, contributing $53.5 million annually. This amazing tree population depends heavily on one organism: the yucca moth [3]. Pollinating thousands of flowers, their service is worth 2 cents per pollination*.

Two sister groups of the yucca moth (*Tegeticula synthetica* and *Tegeticula antithetica*) exclusively pollinate the two species of Joshua trees: *Yucca jaegerina* and *Yucca brevifolia* [4]. These trees annually produce blooming bisexual flowers, which give rise to fertilized seeds and fruits when pollen from a flower's male anther is transferred to another flower's female stigma. However, Joshua tree flowers produce very little pollen and no nectar, making them unattractive to most insects. Additionally, they grow in dense, sticky panicles that make wind pollination almost impossible [4,5]. Two major challenges are posed for animals that pollinate Joshua trees: the sticky pollen must be collected, then correctly deposited on the stigma. Because bees and flies seldom pollinate Joshua trees by chance, the abundance of yucca moths immensely influences the pollination of fertile seeds [4,5]. Though there are 54 species of yucca moths in the genera *Tegeticula*, *Parategeticula* and *Prodoxus*, not all of them are able to perform this special task [4]. While the genus *Prodoxus* doesn't pollinate at all, certain species of the genera *Tegeticula* and *Parategeticula* evolved tentacle-like outgrowths of mouthparts for collecting and depositing sticky pollen [4,6]. However, most of them exhibit differing pollination behavior and lack another necessary adaptation. An organ called the "ovipositor" has to match the design of the tree's flower precisely in order for the moth to place its eggs. This allows the offspring to feed on a fraction of the fertilized seeds [7,8]. Both characteristics are only found in *T. synthetica* and *T. antithetica*, highlighting the mutual adaptation between Joshua trees and yucca moths [8].

Yucca moths secure the production of seeds, fruits and stability of the Joshua tree population, which serve as food and habitat for desert wildlife. This maintenance creates the iconic landscape that tourists flock to, providing economic growth in a subtle and indirect, but no less vital, manner.

**There are 870,000 Joshua trees in Joshua Tree National Park [2]. Each tree has 4.7 inflorescences per year, with 100–1,000 flowers each [9]. Therefore, the calculation was performed as follows:*
4.7 x ((100 + 1,000)/2) = 2,585 flowers per tree per year
2,585 x 870,000 = 2,248.95 x 10^6 flowers in Joshua Tree National Park per year
53.5 x 10^6/(2,248.95 x 10^6) = 0.023789 € per pollinated flower (= ~ 2 cents)

EXCURSIONS AND OTHER NEWS

Lifting the Veil: Who will join BioS in 2026?

Klaus Reinhardt

As the winter semester kicks off and our newest BioS cohort hits the lecture halls, you might wonder: who made the cut this year, and who actually attended the introductory week in Kollm? Klaus Reinhardt shares insights into the applicants and the selection process behind the 2026 cohort.

Just like in recent years, we received more than 130 applications, of which a handful did not make it to our desks due to formal shortcomings. Of the 95 applications that made it through, there were quite a few written using AI, despite the warnings on our website. We interviewed 50 people from 28 different nationalities. New to the mix were applicants from Albania, Algeria, Iceland, Morocco, and New Zealand. In the end, we found 28 people who demonstrated sufficient knowledge of and motivation for the BioS course topics. We – that is Professor Zierau, Ecren Ariöz, a final-year BioS student and member of BioS Reports, and me.

Just like from 2023 to 2025, the Bangladesh-India-Pakistan triangle remained very strong in terms of applicant numbers (53), yet recorded a notably low acceptance rate, with only 6 applicants accepted overall (11%). Bangladesh stood out with 20 applicants and a comparatively higher success rate of 20%. We still need to determine which parameters lower acceptance rates and which cultural nuances we fail to properly consider during the interviews.

Türkiye (3 out of 3) and Germany (5 out of 7, 71%) had high acceptance rates. Other countries of origin (not necessarily current residences) that made the cut were Albania, Algeria, Brazil, China, Ghana, Iran, Kazakhstan, Morocco, Nepal, New Zealand, Russia, Serbia, Taiwan, and Ukraine. We already know that we will have to wait another year for at least five candidates to arrive because their visas won't be issued in time. On the bright side, five candidates whose visas were delayed last year will finally join us now, bringing the total number of students in Kollm to 19. **Stay tuned for a full recap of the introduction week in our next issue!**

EXCURSIONS AND OTHER NEWS

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

Alien Skulls and the Science of Misinformation

Jovana Delic, Emily Franke and Sana Navas



In a museum room in coastal Peru, one can encounter the Paracas skulls. These skulls don't quite look human: they are smooth and very elongated. The internet has been talking about these skulls for years, claiming alien ancestry and secret archeology that has been hidden by world leaders. Any attempts to make counter arguments have been met with whiplash and conspiracy claims. So are aliens the actual explanation for these curious skulls, or is something different at play? And more importantly, what role do human cognition and evolution play in the phenomenon of conspiracy theories?

The alien claims use technical terminology and are backed up by the reported DNA analysis which supposedly shows non-human origins. However, this "proof" does not require a deep dive to reveal the problems with the claim: the alleged genetic evidence has not been supported by accessible raw sequences or published datasets, while the claims have largely circulated through non-peer-reviewed or otherwise questionable sources [1,2]. For non-specialists, however, distinguishing credible research from scientific-sounding misinformation can be difficult.

Reliable scientific evidence provides a human explanation for these skulls. Those familiar with archaeological forensics know that DNA undergoes postmortem damage that can introduce sequencing artefacts and unusual mutations, complicating comparisons with modern human DNA. Ancient DNA analysis accounts for these characteristic patterns of damage when authenticating and interpreting ancient sequences [3,4]. Additionally, cranial deformation was a relatively widespread cultural practice in which sustained pressure was applied to the still-flexible skulls of infants in order to change their shape. This modification could communicate identity, beauty, group membership, or social status [5,6]. The recurring forms of artificial deformation documented in the Andes are consistent with culturally patterned rather than random cranial variation [5].

It is easy to question the character of conspiracy theorists, but the tendency for conspiracy theories actually makes sense from an evolutionary perspective. Humans are highly sensitive to patterns and connections, even when events are coincidental. Historically, avoidance of potential dangers could have provided an evolutionary advantage because the costs of failing to detect a genuine threat could be greater than those of mistakenly detecting one. The adaptive-conspiracism hypothesis proposes that suspicion of hostile coalitions may have helped humans respond to social threats, particularly in environments with fewer formal institutions for regulating conflict [7]. Today, this tendency may still manifest itself, for example, as a belief in shadow governments or in the idea that science as a whole is part of a conspiracy.

Another hypothesis, the by-product hypothesis, claims that conspiracy theories emerged accidentally from cognitive systems that evolved for other reasons. One example is hyperactive pattern recognition: our tendency to perceive meaningful patterns even when none are actually there. Humans evolved to detect patterns quickly and anticipate danger, but that also means our brains sometimes struggle to distinguish coincidence from intentional design. Indeed, illusory pattern perception has been associated with stronger belief in conspiracies and supernatural phenomena [8]. This is closely related to agency detection bias, in which ambiguous or unusual events are interpreted as having been caused intentionally by an agent [7]. This provides one possible explanation for why some people may interpret the unusual appearance of the skulls as evidence of alien intervention rather than human cultural modification.

Conspiracy theories can transform uncertainty into a clear narrative, while also offering a sense of belonging and a social "reward" for "uncovering the truth" [9,10]. Social media can intensify these dynamics through likes, comments, and shares, which function as forms of social feedback that influence engagement [11]. Sharing sensational or novel information can therefore become socially reinforcing, particularly when it attracts attention from others. This may help explain why, despite substantial evidence for a human origin of the skulls, conspiracy narratives continue to circulate on social media years after the original claims emerged.

The case of the Paracas skulls is not the most fascinating part by itself. Rather, it is the way in which evolutionary survival mechanisms may still persist in today's society, and how these tie in with modern social dynamics such as social media, the sense of belonging in societies larger than ever, and the relationship between science and sensationalism. The most important question raised by the Paracas skulls is therefore not "Were they aliens?" but "Why were so many of us eager to believe they were?"



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