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ANTHROPOLOGY

Traces of goat domestication in Iran's Zagros Mountains

Goat hoofprint impressions in brick from the Aceramic Neolithic site of Ganj Dareh. Image credit: The Central Zagros Archaeological Project.

The initial domestication of several species, including goats, occurred in the Fertile Crescent during the Aceramic Neolithic Period, around 9600–7500 BCE. However, the regional centers of such domestication remain unclear. Kevin Daly et al. combined ancient genome sequencing and archaeozoological evidence from two sites in the central Zagros Mountains to trace the domestication of the goat (*Capra aegagrus hircus*) from the wild bezoar goat (*Capra aegagrus*). The two sites, Ganj Dareh and Tepe Abdul Hosein, are located in present-day western Iran, and radiocarbon dating indicates that the sites were occupied between 8200 and 7600 BCE. The authors sequenced DNA from bone samples and compared the sequences with modern and ancient goat genomes. The results suggest that initial goat herds were genetically distinct from hunted wild goats and do not show evidence of a severe genetic bottleneck, morphological divergence, or apparent changes in appearance until 7000 BCE. Bone analysis from this transitionary period revealed a selective culling of young male goats consistent with animal husbandry—a finding bolstered by the presence of greater diversity of mitochondrial lineages compared with Y-chromosome lineages. According to the authors, goats from these sites in the Zagros Mountains are likely genetically basal to other domestic goats and may represent the earliest known examples of goat herding. — M.H.

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ECOLOGY

Accelerated burning of Rocky Mountain forests

The western United States has experienced increased wildfire activity in recent years. To understand the causes and consequences of extreme fire seasons, particularly in forests with historically infrequent fires, Philip Higuera et al. examined 20 previously published fire reconstructions in the central Rocky Mountains spanning the last 2,000 years. Charcoal from lake-sediment records primarily aided the reconstructions. The authors also examined 1984–2020 US government records of fire activity. Since 1984, the burnt area across the central Rocky Mountains has increased significantly. In high-elevation subalpine forests of the central Rocky Mountains, wildfires that occurred in 2020 accounted for 72% of the total burnt area since 1984. Current burning rates are higher than at any point over the past 2,000 years, including during the early Medieval Climate Anomaly (MCA) of 770–870 CE, when the Northern Hemisphere's average temperature was higher than it was during the 20th century. Increasingly warm, dry conditions, the authors note, are enabling accelerated rates of forest burning. As average 21st-century temperatures continue surpassing those of the MCA, the Rocky Mountains are likely to experience continued acceleration of wildfire activity for at least several decades, according to the authors. — M.S.

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The Calwood Fire erupts west of Boulder, CO, on October 17, 2020.

IMMUNOLOGY AND INFLAMMATION

How fever influences immune cell responses

Fever is a common and metabolically intense physiological response to infection that can have beneficial effects on immunity, but its effects on T cell metabolism are not well understood. David O'Sullivan et al. found that activation of $CD8^+$ T cells at a febrile temperature of 39 °C alters the cells' metabolic profile to increase glucose metabolism and cytokine production. Febrile temperatures also resulted in up-regulation of mitochondrial pathways, consistent with the increased mitochondrial mass and metabolic activity seen in $CD8^+$ T cells exposed to 39 °C. Exposing T cells to febrile temperatures prior to adoptive transfer into tumor-bearing mice revealed enhanced antitumor responses, suggesting that exposure of T cells to febrile temperatures during activation contributes to the development of robust and protective T cell responses. Using genetic and pharmacological approaches, the authors found that mitochondrial translation was crucial to the enhanced mitochondrial mass and function of $CD8^+$ T cells exposed to febrile temperatures, including for optimal antitumor responses. The results indicate that fever may play a potentially beneficial role in influencing the metabolic and functional responses of $CD8^+$ T cells, according to the authors. — S.R.

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Dromedary camels from a study site in Ethiopia.

MICROBIOLOGY

Zoonotic potential of MERS coronaviruses in Africa

Dromedary camels are the zoonotic source of Middle East Respiratory Syndrome coronavirus (MERS-CoV). Although 70% of MERS-CoV–infected camels are found in Africa, human disease has been reported only in the Arabian Peninsula. Ziqi Zhou, Kenrie Hui, et al. compared the infection rates of six genetically diverse MERS-CoV strains from Africa with a human strain and a camel strain from Saudi Arabia. The authors measured the replication competence of the coronaviruses in human bronchial and lung tissue cultures as well as in human-DPP4 knockin mice, which are susceptible to MERS-CoV infection, and found that the coronaviruses from Saudi Arabia have replication rates up to 100-fold higher than coronaviruses from Africa. Next, the authors analyzed the impact of spike protein differences on infection rates, using lentiviruses carrying MERS-CoV spike proteins as well as recombinant viruses produced through reverse genetics. The results revealed that the spike protein of a West African coronavirus is less successful at entering a respiratory epithelial cell line compared with the spike protein of a Saudi Arabian coronavirus, suggesting that spike protein differences contribute to the difference in virulence. According to the authors, MERS-CoV in Africa might carry the potential for an outbreak of global concern if the coronaviruses there adapt for increased transmission and virulence in humans. — M.H.

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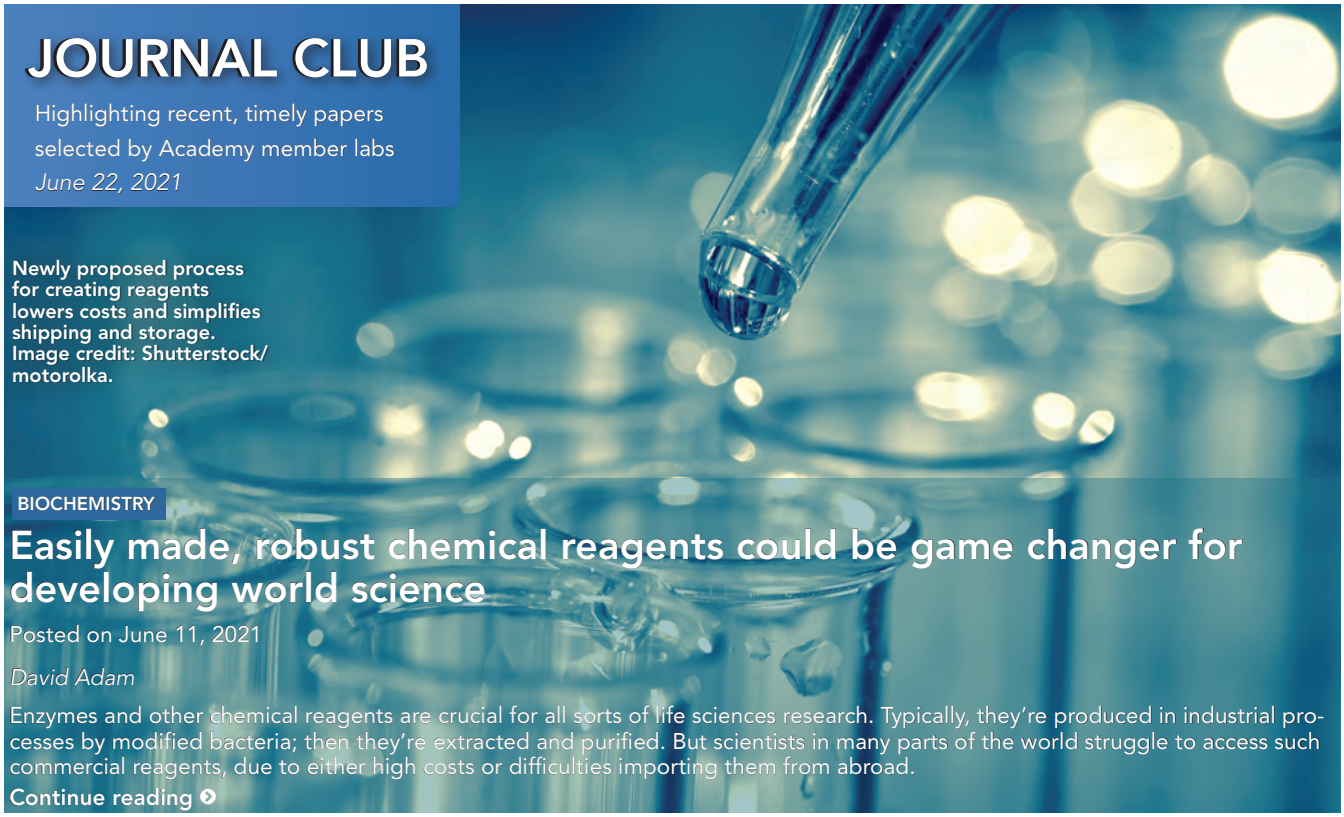
June 22, 2021



Newly proposed process for creating reagents lowers costs and simplifies shipping and storage. Image credit: Shutterstock/ motorolka.

BIOCHEMISTRY

Easily made, robust chemical reagents could be game changer for developing world science

Posted on June 11, 2021

David Adam

Enzymes and other chemical reagents are crucial for all sorts of life sciences research. Typically, they're produced in industrial processes by modified bacteria; then they're extracted and purified. But scientists in many parts of the world struggle to access such commercial reagents, due to either high costs or difficulties importing them from abroad.

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https://doi.org/10.1073/iti2521118