

Sciencewatch

COMPILED BY JOHN SWAIN, NORTHEASTERN UNIVERSITY

World's oldest wine found

Something resembling wine, made from a mixture of grapes, hawthorn fruit wine, rice beer and honey mead, appears to have been made in the Yellow Valley in China around 7000 BC. However, what about wine as we know it, made just from grapes? This goes back almost as far, according to a study by Patrick McGovern of the University of Pennsylvania Museum of Archaeology and Anthropology in Philadelphia in the US. Advanced archaeological, archaeobotanical, climatic, and chemical methods applied to newly excavated materials from two sites



in Georgia in the South Caucasus, reveal evidence for grape wine and viniculture in the Near East as early as 6000–5800 BC

Wine became the focus of religious cults, pharmacopoeias, cuisines, economies, and society in the ancient Near East, suggests new evidence.

during the early neolithic period. Wine is key to many civilisations and requires sophisticated horticultural techniques, such as domestication, propagation, pressing and the use of suitable containers.

● **Further reading**
P McGovern *et al.* 2017 *PNAS* **114** 12627.

Toroidal plasma

In a first for plasma physics, a stable room-temperature topologically confined plasma has been created without the need for external electromagnetic fields. Morteza Gharib of Caltech and colleagues fired a high-speed 100 micron jet of deionised water onto a polished quartz wafer. This, they found, creates a stable coherent toroid of glowing plasma for speeds of the water jet above 200 ms^{-1} . The mechanism appears to be tribo-electricification caused by the large hydrodynamic shear.

● **Further reading**
M Gharib *et al.* 2017 *PNAS* **114** 12657.

Ageing unavoidable

Hopes that aging might be defeated by identifying and interfering with culpable genes, have run into an obstacle. Paul Nelson and Joanna Masel of the University of Arizona in Tucson have shown that, while competition between cells within one organism should seemingly just remove ones that work less well, the need for cells to co-operate with other cells can also select ones which do not themselves work as well, but co-operate better. This is at odds with the idea that aging is simply due to a weakness in removing genes that only affect mortality late in life, and suggests aging is a fundamental feature of multicellular life.

● **Further reading**
P Nelson and J Masel 2017 *PNAS* **114** 12982.

Nuclear reactions in lighting

Following the observation of neutrons and gamma rays in association with lightning, a new study reports evidence that lightning also triggers specific nuclear reactions. On 6 February 2016, Teruaki Enoto of Kyoto University in Japan and colleagues observed a gamma-ray flash lasting less than 1 ms followed by an exponentially decaying gamma-ray spectrum and then prolonged line emission around 0.511 MeV (indicative of electron–positron annihilation). The process is well-explained by photo-dissociation processes such as $^{14}\text{N} + \gamma \rightarrow ^{13}\text{N} + n$ with emission of de-excitation gamma rays, followed by positron decay of the nucleus to ^{13}C , and finally the positron annihilating with an electron. In addition to its intrinsic interest, the result reveals a new source of isotopes, including ^{14}C , used for carbon dating.

● **Further reading**
T Enoto 2017 *Nature* **551** 481.



Lightning and thunderclouds are natural particle accelerators.

Quark fusion

Following the recent observation by the LHCb experiment of a doubly charmed baryon Ξ_{cc}^{++} with a large (130 MeV) binding energy between the two charm quarks, Marek Karliner of Tel Aviv University and Jonathan Rosner of the University of Chicago have shown that this opens the door for a quark analog of nuclear fusion. For example, two Λ_c baryons can fuse to form a Ξ_{cc}^{++} and a neutron, releasing an energy of 12 MeV, with an analogous process for b quarks releasing 138 MeV. While unlikely to ever be a source of useful energy, this novel form of fusion could help in studies of strange hadronic matter.

● **Further reading**
M Karliner and J Rosner 2017 *Nature* **551** 89.

Cosmic rays image pyramid

Modern particle physics has teamed up with ancient Egyptian archaeology to discover a void in the Great Pyramid, similar in size to the Grand Gallery but located above it. Kunihiro Morishima of Nagoya University in Japan and colleagues used cosmic-ray muons and external micro-pattern gaseous detectors to perform the analog of X-ray tomography. In addition to confirming earlier results, it brings the significance of the void now to almost six standard deviations. Half of the muon detectors positioned around the pyramid, based on a design by CEA SACLAY, were built at CERN.

● **Further reading**
K Morishima *et al.* 2017 *Nature* doi:10.1038/nature24647.



PARTICLE THERAPY
ACCELERATORS
ASTRONOMY
SPACE
FUSION

2018



MAY YOU PUSH THE FRONTIERS
OF YOUR ENDEAVOURS IN 2018 INTO
UNCHARTED TERRITORIES

Your **TRUSTED** Control System Partner



COSYLAB