

OPUNTIA
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Opuntia is published by Dale Speirs, Calgary, Alberta. It is posted on www.efanzines.com and www.fanac.org. My e-mail address is: opuntia57@hotmail.com When sending me an emailed letter of comment, please include your name and town in the message.

ABOUT THE COVER: *Clematis* cultivar Honora blooming on the south wall of Chez Opuntia.

PARTY HEARTY IN COWTOWN

photos by Dale Speirs

Calgary is a great city for ethnic and street festivals. Once the Stampede rodeo concludes in early July, the festival season kicks into high gear. Every weekend of the summer there are two or three events covering the downtown core.

I'm not going to report on every single event I attended. That would take about three issues of this zine and 100 megabytes of photos. Here are just a few.



Fiestaval.

First out of the starting gate after Stampede was Fiestaval (note the spelling) on the weekend of July 21 to 23.

This was a full weekend event at the Olympic Plaza, sponsored by all the Hispanic and Brazilian groups in Calgary.

Above: I'm a barbeque man, so the Brazilian grille (at left) is always my first stop. Their sampler is my favourite. From top to bottom are a pork smokie, roast beef slices, and turkey leg.



Above: Part of the Olympic Plaza. There were more kiosks behind the camera, around the top of the amphitheatre.

At left: One of many dance and musical acts.

Inglewood Sunfest.

The following weekend, on Saturday, July 29, I visited the Inglewood Sunfest street festival along 9 Avenue SE.

Inglewood was the original residential district of Fort Calgary, on the east bank of the Elbow River across from the fort. Today it is rapidly being condominiumized along 9 Avenue, while the old houses on the back avenues are assessed in the millions. A 10-minute walk from downtown.

At right: The side streets were for performing acts such as this acrobat.



Food trucks, of course.

Below: I didn't know the Asians had tacos and French fries.

At right: This was the first VW bus I've ever seen used as a food truck.





Above right: Striped perogies seemed interesting so I went over to have some. They didn't have them in the booth but only sold them online with free delivery in Calgary. I don't think they understood the concept of street festivals.



Heritage Day.

2023-08-07

The first Monday in August is a civic holiday in most of Canada, known by various names. In Alberta it is called Heritage Day. I celebrated by going down to Olympic Plaza to watch the music and dancers. More importantly, I had a popular Canadian dish from a food kiosk, the bacon waffle. Crunchy.



Dragon Boat Races.

2023-08-12

The second weekend in August had the Dragon Boat Races on Glenmore Reservoir in southwest Calgary. I could fill an entire issue about just this event alone but confine myself to a few sample photos.





Above: And they're off! A 5-boat race begins. On the far shore is the Rockyview General Hospital complex.

At left: The next set of racers prepare to embark.

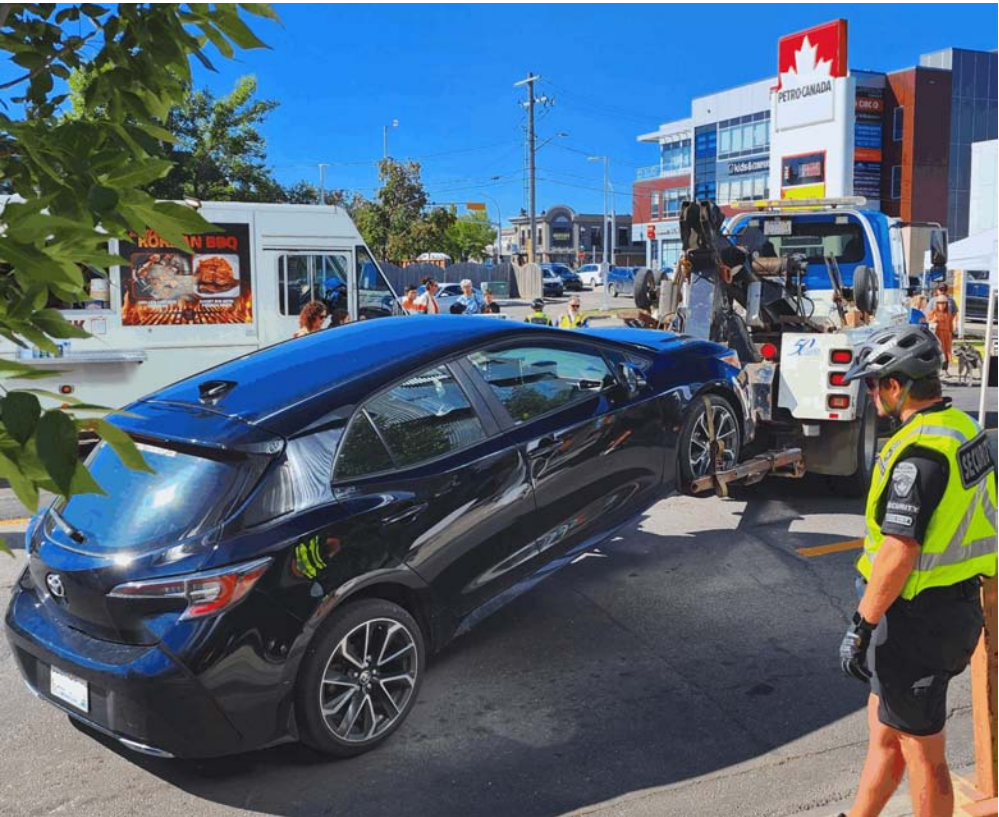
The next day, on Sunday, I visited the Marda Gras Street Festival. The event was on 33 Avenue SW in the Marda Loop district of southwest Calgary, only a 15-minute walk from my house. Note the spelling; Marda, not Mardi.



A beautiful day except for one car owner who will henceforth take traffic signs more seriously. The festival began at 10h00. I arrived at 10h30, just in time to see this car being towed.

Probably an apartment dweller who took no note of the signs.

Several years ago I gave a friend a ride down to the City impound lot to recover his towed car. It cost him \$160 to retrieve his vehicle. Undoubtedly the fee has since gone up.



Below: This person dressed as a traffic cone was funnier to Marda Loop residents than outlanders. From this July until the end of the construction season, most of Marda Loop's main drags will be torn up for long overdue renovation.

Businesses and residents are not happy at the disruption. I live at the far end of the district away from the construction but even so have to drive zigzag detours through the neighbourhood.



Perfect weather for a street festival.

29°C and not a cloud in the sky.



At left: I had Canada's national dish, poutine. A full meal in itself, and I ate nothing else the rest of the day.

For outlanders not familiar with it, the basic recipe is French fries and cheese curds topped with gravy. Other toppings are commonly added. For this one, I had the grilled chicken pieces.

Below: What caught my eye were the girls back stage, who were imitating their mothers and aunties on stage. The girls were copying the dance movements and, I'm sure, dreaming of the day they would go on stage.



The Carribean groups have their turn every August third weekend. Carifest began with a parade along 8 Avenue South from one end of the downtown core to the other.







Alberta dinosaurs seemed to be this year's theme for the parade.

CRY UNCLE AND LET SLIP THE DOGS OF WAR: PART 6

by Dale Speirs

[Parts 1 to 5 appeared in OPUNTIA's #361 to 364, and 462.]

Pastiches.

“The Tenth Nazgul Affair” (1966) by William Baker Glass was an unfinished Man From U.N.C.L.E. fan fiction story in one of his zines. The premise was Illya Kuryakin in Middle Earth. I got this as a free download from conchord.org/xeno/nazgul/index.html

The story shifted between text and rough outlines. During the opening sequence, Kuryakin was transported to Middle Earth after being hit by a lightning bolt.

Napoleon Solo had his own excitement on our Earth. The alarums spread hither and yon in both worlds. Spreading even more so were frequent infodumps.

In one world the Dark Wraith was on the attack, while in the other world THRUSH was moving. Illya snatched the One Ring, then a short time later was sent back to Earth by another lightning bolt. He arrived just in time to save Solo's life. The ring, however, was now just a lump of lead.

Man From Monthly Magazines.

THE MAN FROM U.N.C.L.E. MAGAZINE was digest-sized and published from February 1966 until January 1968. I don't have a complete run nor any mint-condition copies, but do have a fair number of issues in what is politely described as good reading condition.

Each issue contained an UNCLE novella, always described as a “*complete novel*”. This was the usual pulp fiction exaggeration since the stories were only about 70 pages or so. The rest of the issue was filled with unrelated short fiction, mostly mystery, twist-ending crimes, and two-fisted action stories.

The UNCLE stories were all credited to Robert Hart Davis, a house name of the publisher Leo Margulies. A wide variety of genre authors penned these stories. When the television series died, so did the magazine.

Man From Preview.

Margulies had numerous magazine and book series under contract. Richard S. Prather published a series of novels from 1950 about private eye Shell Scott, an imitation of Mike Shayne. In February 1966, Margulies published the first issue of SHELL SCOTT MYSTERY MAGAZINE.

That issue is the only one I have, a poor reading copy missing the back cover. It contained a 7-page extract of “The Howling Teenagers Affair”, which was to appear in full in the first issue of TMFU MAGAZINE. Basically a teaser to get crossover readers. Unfortunately I am missing the first issue of TMFUM.

Man From Regular Issues.

“The Unspeakable Affair” (1966 April, TMFUM) began with an UNCLE agent dying after discovering something. Napoleon Solo and Illya Kuryakin found him alive but he was unable to speak or write by hand.

Back at headquarters, the details were filled in. There was trouble afoot in two remote locations, one in New Mexico and the other in Montana. Strange UFOs had been seen in those skies, not like the regular UFOs.

The first set of alarums converged toward New Mexico, where mad scientist Dr Ernesto Guerre was working for THRUSH. He had invented a nuclear-powered aircraft with unlimited speed, lifting power, and range.

He also invented metabala-G, a drug to help pilots withstand the enormous G-forces and speeds. In normal conditions on the ground it left people unable to speak or write, so the substance made a good weapon.

Solo and Kuryakin blew up Guerre's secret underground laboratory in New Mexico, much to his annoyance. However he escaped in his nuclear-powered aircraft to another base in Venezuela.

Out in the jungles he was about to launch a superscience space station with six nuclear spaceplanes attached as boosters. More alarums but Guerre overcame them. Kuryakin was a clever little Russkie. Not being able to stop the launch, he pulled out a bolt from a vital connection inside the spaceship engines. He and Solo fled, then watched the launch from a safe distance.

The spaceship rose up into the air a short distance. Something snapped inside because a bolt wasn't holding that something in place. The craft fell back inside the launch silo, detonated, and obliterated Guerre and the THRUSH agents. Foiled again.

The next issue of TMFUM that I have is January 1967, which has "The Light Kill Affair", about THRUSH's attempted use of giant carnivorous plants to conquer the world. I reviewed that in my "Botanical Fiction" column in OPUNTIA #316.

The February 1967 issue carried the novella "The Deadly Dark Affair", which had another mad scientist on the loose. The action began in San Francisco where Napoleon Solo and Illya Kuryakin were in the middle of a rooftop gun battle with drug dealers.

The combat was interrupted when a power blackout rolled in from Marin County and covered the city. Not just on the ground. Aircraft fell out of the skies, their avionics dead. THRUSH was testing a new superscience weapon. After 30 minutes the electricity revived.

Back at New York headquarters, the only lead was Martin Bell, who had been working on electrical field theory and what he called an anti-generator. He suddenly disappeared. In view of what happened at San Francisco, it was believed he had been kidnapped by THRUSH and forced to work for them.

Off to Spoon Forks, Alabama, where Bell lived. He had last been seen on his way to the circus, which was in town. The reader will suspect that Crackerby's Combined Shows & Mammoth Motorized Midway was a THRUSH front. The reader will be correct.

There was a mad scientist in the circus, Dr Leonidas Volta. Shots were fired, excursions were made, the usual drill. Kuryakin was kidnapped and the bad guys got away with him.

The blackouts became a series, from Omaha to Chicago to New York City. The trail of the kidnappers led to Doomsday Creek, Ontario. As you may have gathered by now, pulp writers were never subtle about naming characters or places.

Thence to Kingston, which is in fact a real Canadian city on the shore of Lake Ontario. Volta bwah-ha!-ha!-ed at Kuryakin. Bell's design had been materialized by Volta with THRUSH money. The next target of the anti-generator was Toronto. The attack, Volta said, would plunge the world into terror.

Given the fact that most people outside Canada would be hard-pressed to find Toronto on a map, this seemed unbelievable. Nor was the American pulp writer who wrote this story aware of the old Canadian joke that the only thing holding the provinces together in Confederation was mutual hatred of Toronto. But I digress.

Everything ended with a gunfight in Volta's laboratory just as the attack against Toronto was to commence. Volta was electrocuted when he fell into the anti-generator. Bell, Toronto, and the world were saved.

The Man From Paperbacks.

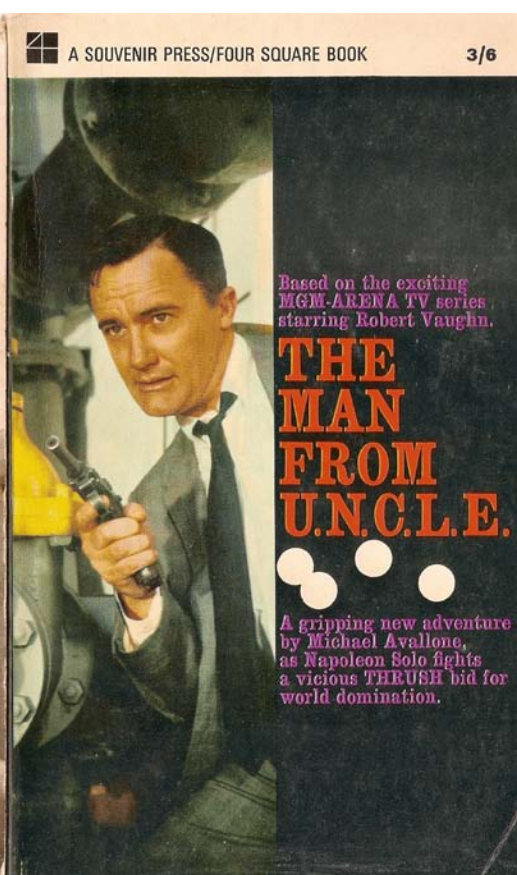
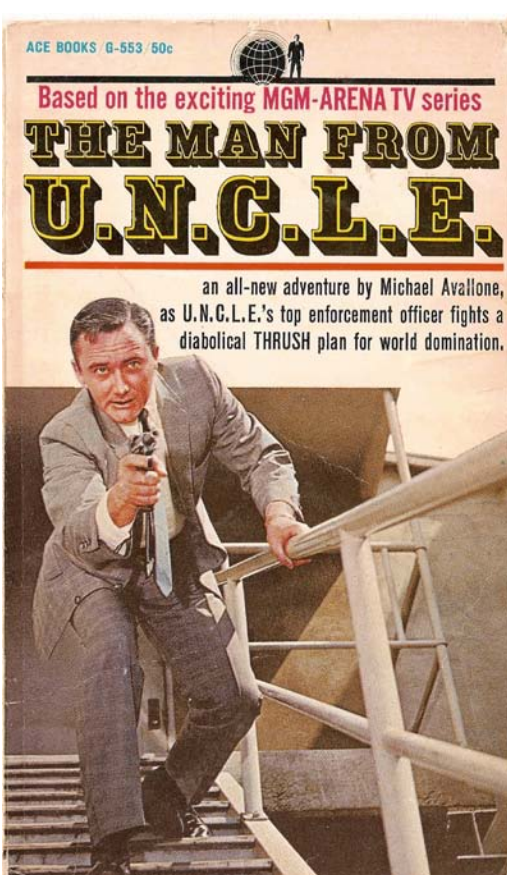
The first paperback in the series was originally titled THE MAN FROM U.N.C.L.E. (1965, written by Michael Avalone). The generic title was on the presumption that the paperback would be a one-off.

The unexpected success of the book resulted in 23 published novels. Subsequent books were numbered on their covers. This was the most successful tie-in series ever published until Star Trek, and sold in the millions.

The 24th paperback THE FINAL AFFAIR was written in 1968 by David McDaniel but never published because the television show was cancelled. The manuscript was eventually scanned and as of 2023 is available at www.archive.org as a free download. I'll review that in a future column.

TMFU paperbacks were published in British and American editions. The numbering of the British and American editions was not synchronized. The first three titles matched, but THE STONE-COLD DEAD IN THE MARKET AFFAIR was British #4 and the American #22.

I'll use the American numbering since not all the paperbacks were reprinted in Britain. Paperbacks #10 to 15 and 17 were only published in American editions.



American and British editions of the first TMFU paperback.

I have a mixture of both American and British editions, collected in the 1980s when Calgary had dozens of secondhand bookstores. (Today, its population doubled to 1.4 million people, Calgary has only one such store.) In those pre-Internet days I accumulated all the American paperbacks except #21 and #23, plus a couple of British editions that somehow made their way to Calgary.

I have both British and American editions of the first novel, which was retroactively re-titled THE THOUSAND COFFINS AFFAIR in lists, although not on the actual books. See OPUNTIA #362 for a review. Also in that issue is a review of the second volume, THE DOOMSDAY AFFAIR.

TMFUP #3 was THE COPENHAGEN AFFAIR (1965) by John Oram. There was something rotten in the state of Denmark, where THRUSH was testing superscience aircraft with more than a passing resemblance to UFOs.

Despite the title of the novel, Napoleon Solo and Illya Kuryakin spent most of their time on excursions around Jutland. THRUSH eventually got their magnetodynamic aircraft working and lost no time in arming the craft with hydrogen bombs.

The usual ending followed. The secret underground laboratory went ka-boom!, the aircraft likewise on its maiden flight, and the mad scientist fell to his death. The rest was silence.

THE DAGGER AFFAIR (1965) by David McDaniel was TMFUP #4. Napoleon Solo and Illya Kuryakin found themselves working with THRUSH against a third party DAGGER, controlled by a mad scientist Kim Keldur who wanted to destroy civilization.

This was, incidently, where the acronym THRUSH was first revealed: Technological Hierarchy for the Removal of Undesirables and the Subjugation of Humanity.

Further explanation by the satrapy commander dated the present organization back to 1895. The First Council had reconstructed itself from the ruins of Professor Moriarty's organization, which broke apart after his death in 1891.

Keldur had worked for the San Francisco satrapy of THRUSH before he went rogue. He now had an Energy Damper device that could black out anything electrical. Used on a wide scale, humans would be reduced to a collection of medieval villages.

Smaller units were tested, one at UNCLE headquarters in New York City and another at Boulder Dam. The UNCLE-THRUSH alliance learned that Keldur was working on a full-scale device in San Francisco, so the action adjourned there.

Keldur was located, he bwah-ha!-ha!-ed at them, there was a fight to the death and the machine was destroyed. THRUSH and UNCLE agents shook hands as they watched the ruins burn, then went their separate ways.

UNCLE Hardcover.

Two young-adult hardcovers were published by Whitman Publishing, both authored by Brandon Keith, an apparent house name.

THE AFFAIR OF THE GENTLE SABOTEUR (1966) began with surveillance of Albert Stanley, a British THRUSH agent who specialized in sabotage where it would cause the greatest disruption. He arrived in New York City and was immediately tailed by Napoleon Solo and Illya Kuryakin.

They caught Stanley in the act but in turn THRUSH later captured Kuryakin and the son of a British diplomat. The high command from British THRUSH was in New York City with their own ideas.

The demand from THRUSH was a two-for-one trade. This set off a series of excursions but in the end the two men were rescued. Not all the THRUSH personnel received the justice they should have, but enough were run in to call a win for UNCLE.

THE AFFAIR OF THE GUNRUNNERS' GOLD (1967) began with UNCLE taking into custody a big-time gunrunner named Howard Ogden. Posing as a machine parts salesman, the samples he carried were pure gold with a patina of iron as disguise.

He was a freelance courier working for THRUSH, who were fomenting revolution in various South American countries. They sold guns for gold.

Ogden's American controllers had accumulated \$6 million in gold in their New York City vault. At \$35 per Troy ounce in 1967, that would be 171,429 ounces. Today that gold would be worth about \$342 million at the current price of about \$2,000 per Troy ounce.

THRUSH was going to arrange the transfer of this gold to Switzerland by smuggling it through an international circus. One can easily guess the types of alarums and lions and tigers and bears, oh my. The circus may have traveled overseas but the gold stayed in the clutches of UNCLE.

The Girl From U.N.C.L.E.

THE GIRL FROM U.N.C.L.E.MAGAZINE was as short-lived as the television series upon which it was based. Seven issues were published between December 1966 and December 1967. The novellas were written by a variety of pulp authors under the house name Robert Hart Davis.

In issue #363 of this zine I discussed some aspects of The Girl From UNCLE, including re-used cover art. I'm missing a couple of magazine issues and the ones I have are what is called "good reading condition". Starting off the series was "The Sheik Of Araby Affair" (1966 December, TGFUM), which I reviewed in OPUNTIA #363.

"The Velvet Voice Affair" (1967 February, TGFUM) began in a fictitious South American republic called Lombodia. April Dancer and Mark Slate were dispatched there to find out why the population was experiencing lassitude that was crippling their economy.

Instead of working, the peons were daydreaming. The cause was determined to be a massive hypnotism campaign broadcast in the guise of advertising jingles for Fritos. This led me to wonder why the writer bothered to use a fictitious country name if he was using Fritos as a THRUSH front.

Off Dancer and Slate went to accumulate plot coupons here, there, and everywhere. Napoleon Solo and Illya Kuryakin made guest appearances. Eventually everything was sorted and Fritos had to switch to a different advertising campaign.

At UNCLE headquarters in New York City, a teenaged intern named Randy Kovac was introduced. Think Wesley Crusher, and just as annoying.

"The Deadly Drug Affair" (1967 June, TGFUM) began with an intelligence briefing by the boss Alexander Waverly to April Dancer and Mark Slate, plus Kovac. The kid no more belonged there than Crusher did on a starship bridge.

Dancer and Slate went snooping and learned that THRUSH was testing a new drug that turned people into obedient slaves. Trouble was, the drug soon killed them. THRUSH agents learned of an unrelated drug that would fix the problem by limiting the intensity of the zombie drug and thus keep the victims alive.

At the UNCLE end, the trail led to Pig Wallow, Missouri, a one-street hamlet somewhere in the Ozarks. THRUSH had taken over a bakery and turned it into a factory producing the zombie drug.

When Dancer and Slate arrived in the hamlet, they had no trouble with the locals, all of whom were quiet and obedient. After the usual sort of contretemps with the conspirators, the factory was destroyed and the THRUSH agents dealt with. The good news, discovered because Dancer had a headache, was that the antidote to the drug was aspirin.

“The Stolen Spaceman Affair” (1967 October, TGFUM) appeared, it must be remembered, in the aftermath of the Apollo 1 disaster. The American space programme lost a year while the Apollo spacecraft were overhauled.

The plot began with an astronaut and his spacecraft snatched out of orbit as they were working on a secret military project. The thieves might have been THRUSH, Red China, or an unknown organization.

The spaceship had been brought down by triggering its retrorockets early and dropping it into the fictional country of Khmerrania, said to be a neighbour of Thailand and Cambodia. Look for it on Google Maps as you like.

That country refused to allow the Americans in to search for the astronaut, so UNCLE was assigned to do so covertly. THRUSH was also in the chase. The mysterious third party had created a cosmic ray beam that would crispy-fry the major cities of the world.

Everyone converged in the mountainous jungles during a typhoon. April Dancer and Mark Slate rescued the astronaut, and whatever bullets didn’t take care of, the landslides did.

The final issue of TGFUM was dated December 1967. The novella was “The Sinister Satellite Affair”, which I reviewed in issue #363 of this zine.

SEEN IN THE LITERATURE

Astronomy.

Pombo, A.M., and I. Saltas (2023) **A Sun-like star orbiting a boson star.** MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY 524:doi.org/10.1093/mnras/stad2151

[Bosons are particles which carry subatomic forces, as opposed to fermions, which are particles that make up solid matter.]

Authors’ abstract: *The high-precision astrometric mission GAIA recently reported the remarkable discovery of a Sun-like star closely orbiting a dark object with a semimajor axis and period of 1.4 AU and 187.8 days, respectively.*

While the plausible expectation for the central dark object is a black hole, the evolutionary mechanism leading to the formation of such a two-body system is highly challenging.

Here, we challenge the scenario of a central black hole and show that the observed orbital dynamics can be explained under fairly general assumptions if the central dark object is a stable clump of bosonic particles of spin-0 or spin-1, known as a boson star.

Aside from possible formation mechanisms leading to a star orbiting a boson star, we show that the theory space of boson stars allows for a fairly natural mimicker of binary observations such as the recent one by GAIA.

Caiazzo, I., et al (2023) **A rotating white dwarf shows different compositions on its opposite faces.** NATURE 620:doi.org/10.1038/s41586-023-06171-9 (available as a free pdf)

Authors’ abstract: *White dwarfs, the extremely dense remnants left behind by most stars after their death, are characterized by a mass comparable to that of the Sun compressed into the size of an Earth-like planet.*

In the resulting strong gravity, heavy elements sink towards the centre and the upper layer of the atmosphere contains only the lightest element present, usually hydrogen or helium.

Several mechanisms compete with gravitational settling to change a white dwarf's surface composition as it cools, and the fraction of white dwarfs with helium atmospheres is known to increase by a factor of about 2.5 below a temperature of about 30,000 kelvin.

Therefore, some white dwarfs that appear to have hydrogen-dominated atmospheres above 30,000 kelvin are bound to transition to be helium-dominated as they cool below it.

Here we report observations of ZTF J203349.8+322901.1, a transitioning white dwarf with two faces: one side of its atmosphere is dominated by hydrogen and the other one by helium.

This peculiar nature is probably caused by the presence of a small magnetic field, which creates an inhomogeneity in temperature, pressure or mixing strength over the surface.

ZTF J203349.8+322901.1 might be the most extreme member of a class of magnetic, transitioning white dwarfs, together with GD 323, a white dwarf that shows similar but much more subtle variations.

The white dwarf ZTF J203349.8+322901.1, which we nicknamed Janus after the two-faced Roman god of transition, was found during a search for periodically variable white dwarfs with the Zwicky Transient Facility¹³ (ZTF).

The white dwarf's spectrum transitions from showing only hydrogen lines at a phase of approximately 0 (the phase of maximum brightness in the photometric light curve) to only helium lines at a phase of approximately 0.5 (minimum brightness).

These spectroscopic and photometric variations rule out the hypothesis of Janus being a binary system composed of a white dwarf with a hydrogen-dominated spectrum (usually called a DA white dwarf) and one with a helium-dominated one (called DB).

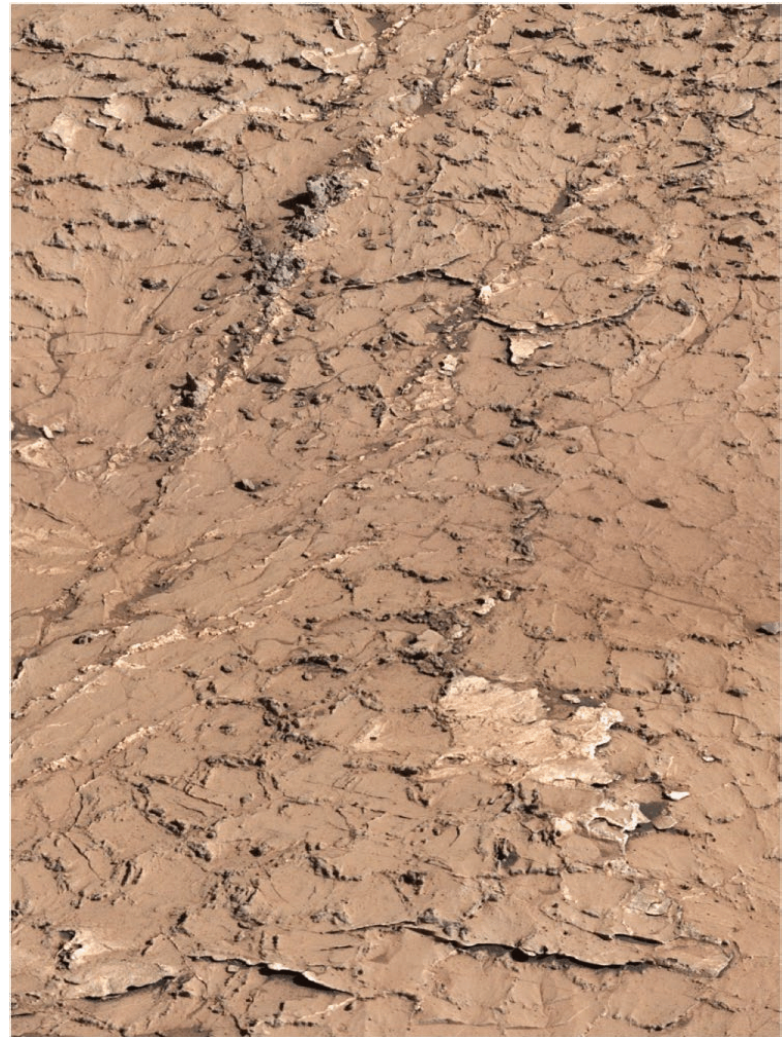
Planets.

Rapin, W., et al (2023) **Sustained wet-dry cycling on early Mars.** NATURE 620:doi.org/10.1038/s41586-023-06220-3 (available as a free pdf)

Authors' abstract: *The presence of perennially wet surface environments on early Mars is well documented, but little is known about short-term episodicity in the early hydroclimate.*

Post-depositional processes driven by such short-term fluctuations may produce distinct structures, yet these are rarely preserved in the sedimentary record. Incomplete geological constraints have led global models of the early Mars water cycle and climate to produce diverging results.

Here we report observations by the Curiosity rover at Gale Crater indicating that high-frequency wet-dry cycling occurred in early Martian surface environments. We observe exhumed centimetric polygonal ridges with sulfate enrichments, joined at Y-junctions, that record cracks formed in fresh mud owing to repeated wet-dry cycles of regular intensity.



Instead of sporadic hydrological activity induced by impacts or volcanoes, our findings point to a sustained, cyclic, possibly seasonal, climate on early Mars. Furthermore, as wet-dry cycling can promote prebiotic polymerization⁷, the Gale evaporitic basin may have been particularly conducive to these processes.

The observed polygonal patterns are physically and temporally associated with the transition from smectite clays to sulfate-bearing strata, a globally distributed mineral transition.

This indicates that the Noachian-Hesperian transition (3.8 to 3.6 billion years ago) may have sustained an Earth-like climate regime and surface environments favourable to prebiotic evolution.

[Image is from this paper.]

Liu, J., et al (2023) **Martian dunes indicative of wind regime shift in line with end of ice age.** NATURE 620:doi.org/10.1038/s41586-023-06206-1 (available as a free pdf)

Authors' abstract: *Orbital observations suggest that Mars underwent a recent 'ice age' (roughly 0.4 to 2.1 million years ago), during which a latitude-dependent ice-dust mantle (LDM) was emplaced. A subsequent decrease in obliquity amplitude resulted in the emergence of an 'interglacial period' during which the lowermost latitude LDM ice was etched and removed, returning it to the polar cap.*

These observations are consistent with polar cap stratigraphy, but lower- to mid-latitude in situ surface observations in support of a glacial-interglacial transition that can be reconciled with mesoscale and global atmospheric circulation models is lacking.

Here we present a suite of measurements obtained by the Zhurong rover during its traverse across the southern LDM region in Utopia Planitia, Mars.

We find evidence for a stratigraphic sequence involving initial barchan dune formation, indicative of north-easterly winds, cementation of dune sediments, followed by their erosion by north-westerly winds, eroding the barchan dunes and producing distinctive longitudinal dunes, with the transition in wind regime consistent with the end of the ice age.

The results are compatible with the Martian polar stratigraphic record and will help improve our understanding of the ancient climate history of Mars. Conclusive evidence for the nature and causes of Mars climate history has been elusive due to the extreme complexity of past weather, climate and atmosphere, and the spin-axis or orbital parameters known to exert strong climate influence.

Forward-modelling, from the ancient geological record to today, has been used, but key missing elements of the early geological record have precluded a robust pathway.

Some have used inverse modelling, using known current conditions and the most recent geological record (polar deposits and the stratigraphically youngest geologic units) to infer recent climate conditions, an approach made more powerful by the robust prediction of spin-axis or orbital conditions for the last 20 Myr (million years).

The inverse modelling approach has provided orbital geological evidence for a recent ice age during which increased obliquity amplitude mobilized polar ice and deposited a metres-thick ice and dust layered mantle down to the lower mid-latitudes.

This decreased the obliquity amplitude roughly 0.4 Ma and mobilized marginal LDM ice, returning it to the polar layered terrain.

Satellites.

Naito, M., et al (2023) **Global dose distributions of neutrons and gamma-rays on the Moon.** SCIENTIFIC REPORTS 13:doi.org/10.1038/s41598-023-40405-0 (available as a free pdf)

Authors' abstract: *Dose assessment on the lunar surface is important for future long-term crewed activity. In addition to the major radiation of energetic charged particles from galactic cosmic rays (GCRs), neutrons and gamma-rays are generated by nuclear interactions of space radiation with the Moon's surface materials, as well as natural radioactive nuclides.*

We obtained neutron and gamma-ray ambient dose distributions on the Moon using Geant4 Monte Carlo simulations combined with the Kaguya gamma-ray spectrometer measurement dataset from February 10 to May 28, 2009.

The neutron and gamma-ray dose rates varied in the ranges of 58.7 to 71.5 mSv/year and 3.33 to 3.76 mSv/year, respectively, depending on the lunar geological features.

The lunar neutron dose was high in the basalt-rich mare, where the iron- and titanium-rich regions are present, due to their large average atomic mass.

As expected, the lunar gamma-ray dose map was similar to the distribution of natural radioactive elements (^{238}U , ^{232}Th , and ^{40}K), although the GCR-induced secondary gamma-ray dose was significant at ~ 3.4 mSv/year.

The lunar secondary dose contribution resulted in an additional dose of 12 to 15% to the primary GCR particles. Global dose distributions on the lunar surface will help identify better locations for long-term stays and suggest radiation protection strategies for future crewed missions.

Caplan, M.E., et al (2023) **Lunar collision rate with primordial black holes.** MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY 524:doi.org/10.1093/mnras/stad1846

Authors' abstract: *A recent letter studied cratering during collisions between rocky bodies and primordial black holes. Hydrodynamic simulations in that work showed that ejecta blankets from these collisions are steeper because the black holes completely penetrate the target, potentially making these craters distinguishable from traditional point-like impactors.*

This may allow us to use lunar craters to constrain primordial black holes in the asteroid-mass window, about 10^{17} to 10^{19} grames. In this work, we calculate the lunar dark matter flux from the Galactic halo and several models for a dark disc.

We consider several effects that may enhance the dark matter flux, such as gravitational focusing on the Solar system and historical modulations due to the Solar system's galactic orbit.

We find that non-detection of novel craters on the Moon can constrain relativistic compact MACHO dark matter up to 10^{17} grammes at 95 per cent confidence, motivating a detailed search through lunar surface scans.

In addition, we show that fluxes near Earth from dark discs may be significantly enhanced by gravitational focusing and that the relative velocity between the disc and the Sun can result in annual modulations out of phase with the annual modulations from the halo.

Asteroids.

Jewitt, D., et al (2023) **The Dimorphos boulder swarm.** ASTROPHYSICAL JOURNAL LETTERS 952:doi.org/10.3847/2041-8213/ace1ec (available as a free pdf)

Authors' abstract: *We present deep Hubble Space Telescope images taken to examine the ejecta from the DART spacecraft impact into asteroid Dimorphos. The images reveal an extensive population of co-moving boulders, the largest of which is ~ 7 metres in diameter (geometric albedo 0.15 assumed).*

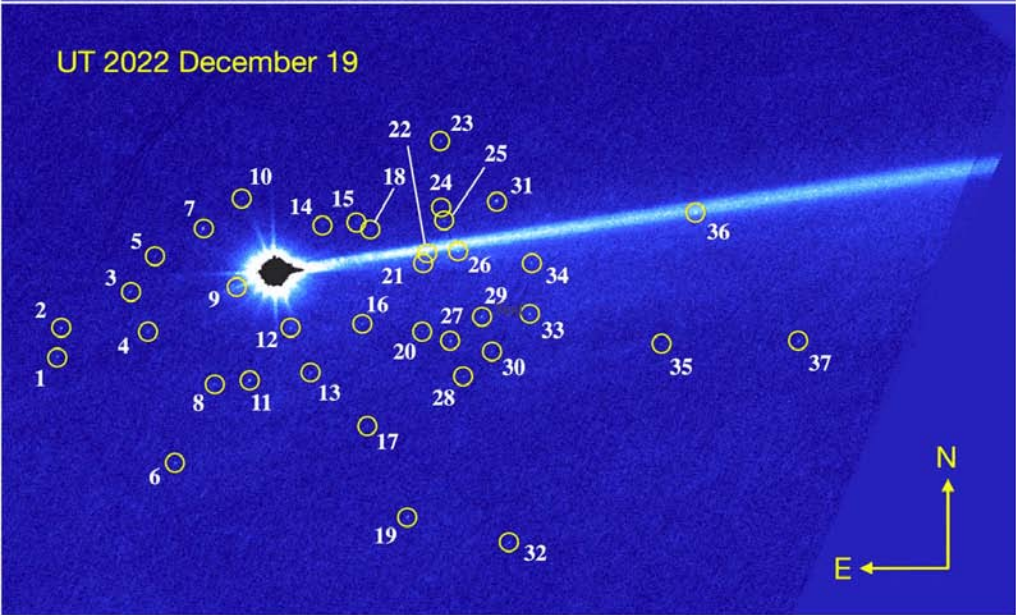
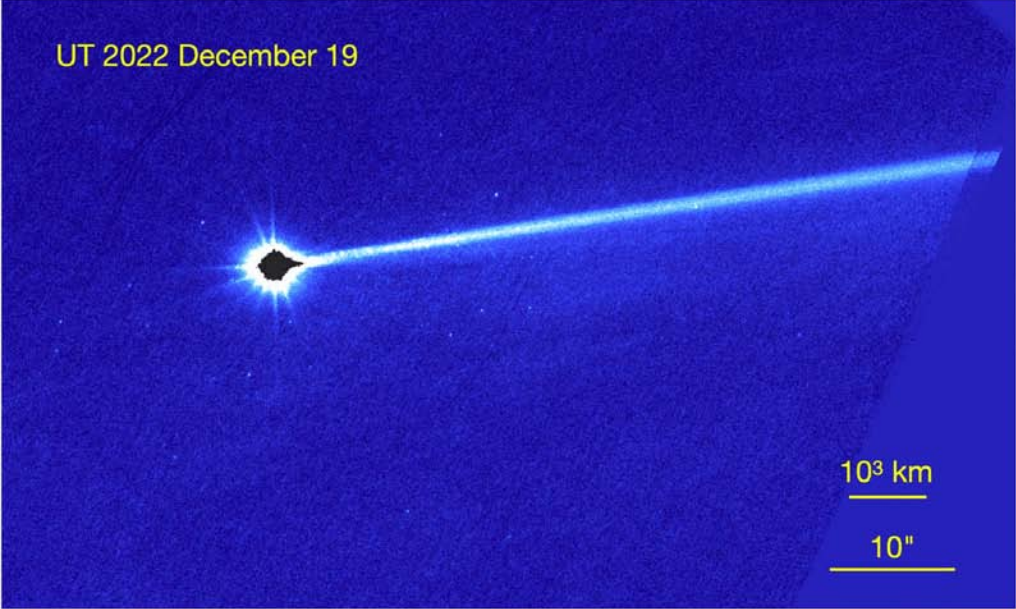
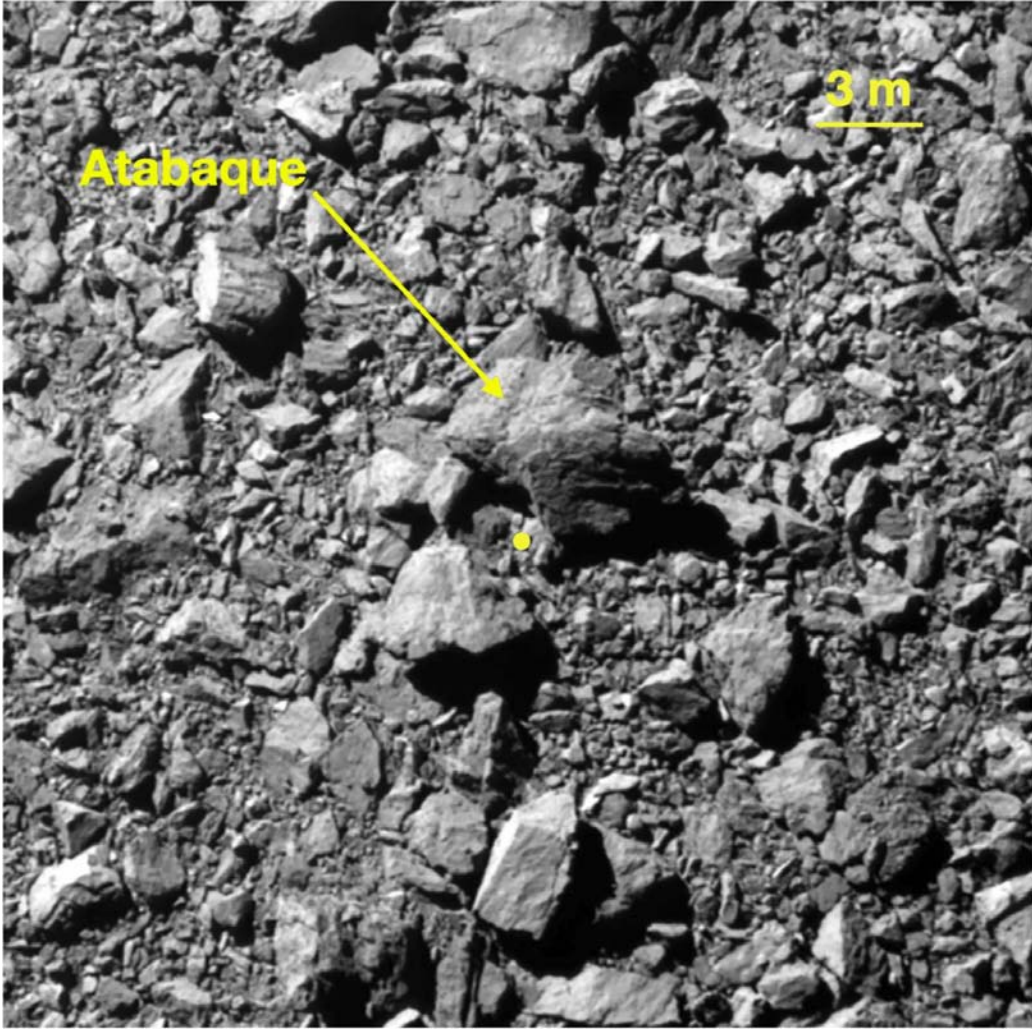
Measurements of 37 boulders show a mean sky-plane velocity dispersion of 0.30 ± 0.03 metres sec^{-1} , only slightly larger than the 0.24 metres sec^{-1} gravitational escape velocity from the Didymos-Dimorphos binary system.

The total boulder mass, $M_b \sim 5 \times 10^6$ kg (density 2200 kg metre^{-3} assumed), corresponds to about 0.1% of the mass of Dimorphos, and the boulders collectively carry about 3×10^{-5} of the kinetic energy delivered by the DART spacecraft impact.

The sky-plane distribution of the boulders is asymmetric, consistent with impact into an inhomogeneous, likely rubble-pile, body.

Surface boulder counts on Didymos show that the observed boulder swarm could be ejected from as little as 2% of the surface of Dimorphos (for example, a circular crater at the impact point about 50 metres in diameter).

[Images on the next page are from this paper. The close-up of the asteroid was the penultimate photo before impact at the yellow dot. The large boulder at point of impact was named Atabaque.]



Paleobiology.

Shapiro, J.A. (2023) **Engines of innovation: biological origins of genome evolution.** BIOLOGICAL JOURNAL OF THE LINNEAN SOCIETY 139:doi.org/10.1093/biolinnean/blac041

Author’s abstract: *Genome change does not occur accidentally. The conventional Modern Synthesis view of gradual evolution guided solely by natural selection fails to incorporate many important lessons from direct examination of genome structure by cytogeneticists and modern genomic sequencers.*

Among other discoveries is the major role that interspecific hybridization has played in the rapid generation of new species.

Interspecific hybrids display altered epigenetic regulation and genome expression, great genome variability (including activation of transposable elements and chromosome rearrangements), and frequently whole genome duplication (WGD) as well.

These changes produce novel species with adaptively altered phenotypes and reproductive isolation due to meiotic incompatibility with the progenitor species.

Genomics has revealed that hybrid speciation and WGD have been widespread among all types of eukaryotes, from yeast and diatoms to flowering plants and primates.

The maintenance of the biological responses to interspecific hybridization across virtually all eukaryotic history indicates that eukaryotes have continuously inherited a capability for rapid evolutionary change.

In other words, the best-documented path to the origin of species we have is an inherited biological process, not a series of accidents.

Moon, J., et al (2023) **A macroscopic free-swimming medusa from the middle Cambrian Burgess Shale.** PROCEEDINGS OF THE ROYAL SOCIETY OF LONDON 290B:doi.org/10.1098/rspb.2022.2490 (available as a free pdf)

[A medusa is a jellyfish.]

Authors’ abstract: *Cnidarians are regarded as one of the earliest-diverging animal phyla. One of the hallmarks of the cnidarian body plan is the evolution of a free-swimming medusa in some medusozoan classes, but the origin of this innovation remains poorly constrained by the fossil record and molecular data.*

Previously described macrofossils, putatively representing medusa stages of crown-group medusozoans from the Cambrian of Utah and South China, are here reinterpreted as ctenophore-grade organisms. Other putative Ediacaran to Cambrian medusozoan fossils consist mainly of microfossils and tubular forms.

*Here we describe *Burgessomedusa phasmiformis* gen. et sp. nov., the oldest unequivocal macroscopic free-swimming medusa in the fossil record. Our study is based on 182 exceptionally preserved body fossils from the middle Cambrian Burgess Shale (Raymond Quarry, British Columbia, Canada).*



Burgessomedusa possesses a cuboidal umbrella up to 20 cm high and over 90 short, finger-like tentacles. Phylogenetic analysis supports a medusozoan affinity, most likely as a stem group to Cubozoa or Acraspeda (a group including Staurozoa, Cubozoa and Scyphozoa).

Burgessomedusa demonstrates an ancient origin for the free-swimming medusa life stage and supports a growing number of studies showing an early evolutionary diversification of Medusozoa, including of the crown group, during the late Precambrian-Cambrian transition.

[Image is from this paper.]

Stundl, J., et al (2023) **Ancient vertebrate dermal armor evolved from trunk neural crest.** PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES USA 120:doi.org/10.1073/pnas.2221120120

Authors' abstract: *The body of early vertebrates was covered from the head to tail with extensive dermal armor, comprised of dentin and bone. There has long been controversy over whether this armor arose from the neural crest, mesoderm, or both.*

Since odontoblasts (dentin-producing cells) are exclusively neural crest derived, we probed the developmental origin of the bony component of the dermal armor in the sterlet sturgeon, an early branching lineage of ray-finned fishes.

Here, we show that trunk neural crest of the sterlet gives rise to osteoblasts, producing the bone of the scutes.

Together, our results support a primitive skeletogenic role for the neural crest along the entire body axis, that was later progressively restricted to the cranial region during vertebrate evolution.

Bone is an evolutionary novelty of vertebrates, likely to have first emerged as part of ancestral dermal armor that consisted of osteogenic and odontogenic components. Whether these early vertebrate structures arose from mesoderm or neural crest cells has been a matter of considerable debate.

To examine the developmental origin of the bony part of the dermal armor, we have performed in vivo lineage tracing in the sterlet sturgeon, a representative

of nonteleost ray-finned fish that has retained an extensive postcranial dermal skeleton.

The results definitively show that sterlet trunk neural crest cells give rise to osteoblasts of the scutes. Transcriptional profiling further reveals neural crest gene signature in sterlet scutes as well as bichir scales.

Finally, histological and microCT analyses of rayfined fish dermal armor show that their scales and scutes are formed by bone, dentin, and hypermineralized covering tissues, in various combinations, that resemble those of the first armored vertebrates.

Taken together, our results support a primitive skeletogenic role for the neural crest along the entire body axis, that was later progressively restricted to the cranial region during vertebrate evolution. Thus, the neural crest was a crucial evolutionary innovation driving the origin and diversification of dermal armor along the entire body axis.

Strullu-Derrien, C., et al (2023) **Hapalosiphonacean cyanobacteria (Nostocales) thrived amid emerging embryophytes in an early Devonian (407-million-year-old) landscape.** iSCIENCE 26:doi.org/10.1016/j.isci.2023.107338 (available as a free pdf)

[Embryophytes are plants that have spores or seeds. Cyanobacteria are commonly known as blue-green algae and are close ancestors to land plants.]

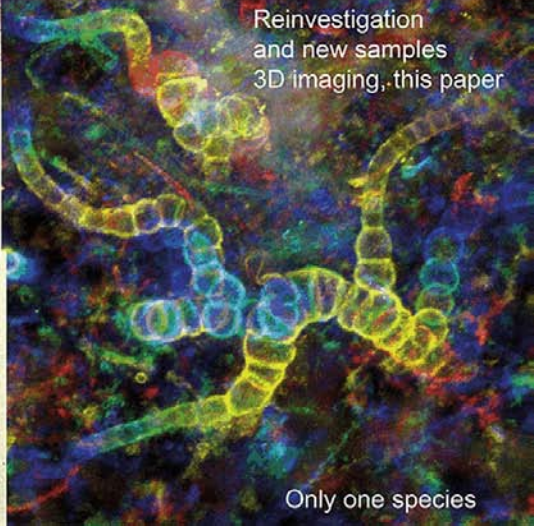
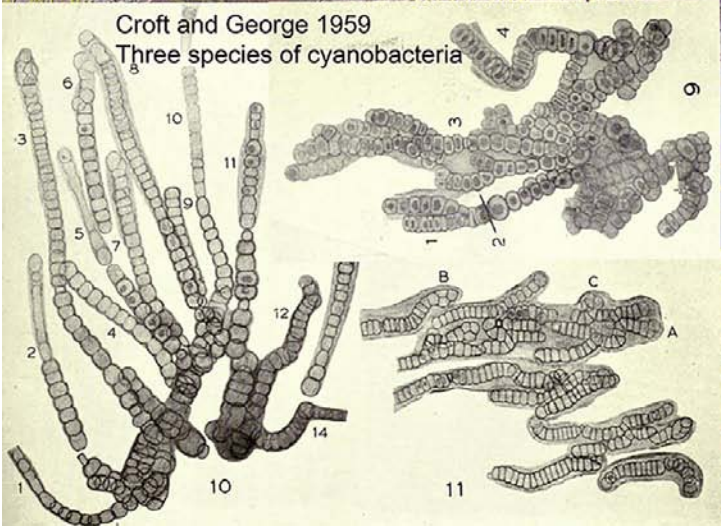
Authors' abstract: *Cyanobacteria have a long evolutionary history, well documented in marine rocks. They are also abundant and diverse in terrestrial environments; however, although phylogenies suggest that the group colonized land early in its history, paleontological documentation of this remains limited.*

The Rhynie chert [Scotland] (407 megayears old), our best preserved record of early terrestrial ecosystems, provides an opportunity to illuminate aspects of cyanobacterial diversity and ecology as plants began to radiate across the land surface.

We used light microscopy and super-resolution confocal laser scanning microscopy to study a new population of Rhynie cyanobacteria. We also reinvestigated previously described specimens that resemble the new fossils.

Our study demonstrates that all are part of a single fossil species belonging to the Hapalosiphonaceae (Nostocales). Along with other Rhynie microfossils, these remains show that the accommodation of morphologically complex cyanobacteria to terrestrial ecosystems transformed by embryophytes was well underway more than 400 million years ago.

[Images are from this paper.]



Caron, A., et al (2023) **A fish for Phoebe: a new actinopterygian from the Upper Carboniferous Coal Measures of Saddleworth, Greater Manchester, UK, and a revision of *Kansasiella eatoni***. ZOOLOGICAL JOURNAL OF THE LINNEAN SOCIETY 198:957-981 (available as a free pdf)

Authors' abstract: *The ray-finned fishes (Actinopterygii) are comprised of over 32,513 extant species, account for over half of modern vertebrate diversity and have an evolutionary history reaching back at least 425 megayears.*

The origin of crown Actinopterygii has been dated to near the Devonian-Carboniferous boundary, but poor phylogenetic signal occludes the origin of modern actinopterygian biodiversity.

Scarcity of comparative endoskeletal anatomy from this period likely contributes to the uncertainty.

For example, only a handful of neurocrania have been described from the Carboniferous period despite an abundance of fossil taxa.

*Here we present a new actinopterygian, *Phoebeannaia mossae* gen. et sp. nov., from the Bashkirian Coal Measures of Saddleworth, Greater Manchester, UK, represented by an exceptionally preserved neurocranium and associated dermal bones.*

*Morphological similarities to the Virgilian *Kansasiella eatoni* prompted comparative study and construction of a new neurocranial character matrix.*

Subsequent systematic analysis enabled identification of a cluster of similar Late Palaeozoic neurocrania, exploration of trends in braincase evolution across time, and investigation of potential causes of cladistic instability.

*Our neurocranial dataset reliably places this new specimen on the neopterygian stem near *Kansasiella*, but it struggles to incorporate extant taxa such as*

Polypteriformes, leading to uncertainty in branching pattern and inferred neurocranial transformation series.

This work triples the number of complete Carboniferous neurocrania described with modern microcomputed tomography and provides a framework for future testing of large-scale hypotheses regarding the diversification and origin of ray-finned fishes.

Augustin, F.J., et al (2023) **A new specimen of *Solnhofia parsonsi* from the Upper Jurassic (Kimmeridgian) Plattenkalk deposits of Painten (Bavaria, Germany) and comments on the relationship between limb taphonomy and habitat ecology in fossil turtles.** PLOS ONE 18:doi.org/10.1371/journal.pone.0287936 (available as a free pdf)

Authors’ abstract: *The limestones of the Solnhofen area in southern Germany are one of the most important fossil Lagerstätten from the entire Mesozoic era, especially famous for the exquisitely preserved vertebrates.*

The turtles from the Solnhofen Limestone have been always of special interest because they include some of the best-preserved specimens from the Mesozoic.

*Here, we describe a new turtle specimen from the Torleite Formation (Kimmeridgian) of Painten and refer it to the thalassochelydian turtle *Solnhofia parsonsi* based on the presence of a unique combination of characters.*

The far majority of morphological differences from previously published specimens can be explained by ontogeny as the new specimen represents a larger, more ossified, and presumably older individual.

*Additionally, the specimen from Painten is the first described specimen of *S. parsonsi* preserving the largely complete and articulated limbs, the preservation of which indicates that the taxon did not possess stiffened paddles present in more pelagic marine turtles and is consistent with a previously inferred nearshore marine lifestyle.*

Contrary to previous inferences, we argue that taphonomic preservation of digits in articulated fossil turtles from laminated deposits cannot be used alone to infer marine or freshwater habitat.



Finally, the new specimen from Painten is only the second, for which detailed information on its stratigraphic position and locality of origin are known.

[Images are from this paper. Entire fossil at left and enlargement of head below.]

Carlisle, E., et al (2023) **A timescale for placental mammal diversification based on Bayesian modeling of the fossil record.** CURRENT BIOLOGY 33:doi.org/10.1016/j.cub.2023.06.016 (available as a free pdf)

Authors’ abstract: *The timing of the placental mammal radiation has been the focus of debate over the efficacy of competing methods for establishing evolutionary timescales.*

Molecular clock analyses estimate that placental mammals originated before the Cretaceous-Paleogene (K-Pg) mass extinction, anywhere from the Late Cretaceous to the Jurassic.

However, the absence of definitive fossils of placentals before the K-Pg boundary is compatible with a post-Cretaceous origin. Nevertheless, lineage divergence must occur before it can be manifest phenotypically in descendent lineages.

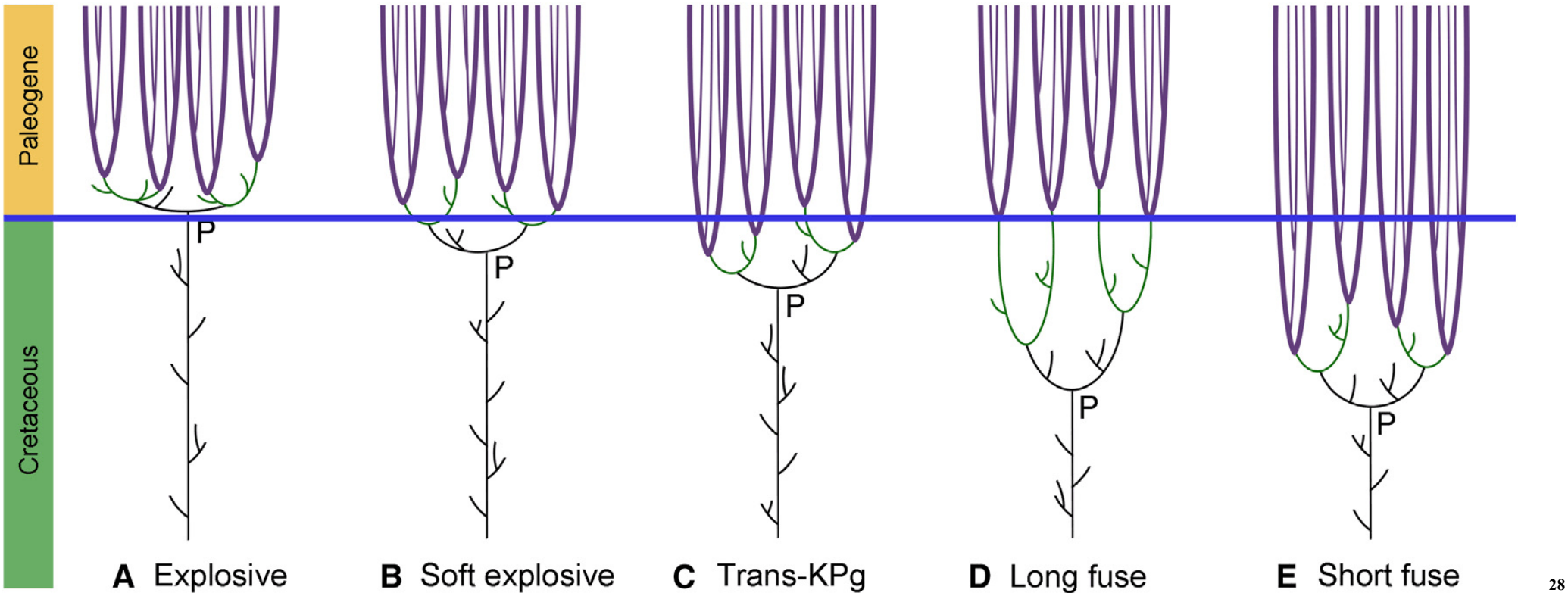
This, combined with the non-uniformity of the rock and fossil records, requires the fossil record to be interpreted rather than read literally. To achieve this, we introduce an extended Bayesian Brownian bridge model that estimates the age

of origination and, where applicable, extinction through a probabilistic interpretation of the fossil record.

The model estimates the origination of placentals in the Late Cretaceous, with ordinal crown groups originating at or after the K-Pg boundary. The results reduce the plausible interval for placental mammal origination to the younger range of molecular clock estimates.

Our findings support both the Long Fuse and Soft Explosive models of placental mammal diversification, indicating that the placentals originated shortly prior to the K-Pg mass extinction. The origination of many modern mammal lineages overlapped with and followed the K-Pg mass extinction.

[Chart is from this paper.]



O’Keefe, F.R., et al (2023) **Pre-Younger Dryas megafaunal extirpation at Rancho La Brea linked to fire-driven state shift.** SCIENCE 381:doi.org/10.1126/science.abo3594 (available as a free pdf)

Authors’ abstract: *The cause, or causes, of the Pleistocene megafaunal extinctions have been difficult to establish, in part because poor spatiotemporal resolution in the fossil record hinders alignment of species disappearances with archeological and environmental data.*

We obtained 172 new radiocarbon dates on megafauna from Rancho La Brea in California spanning 15.6 to 10.0 thousand calendar years before present (ka).

Seven species of extinct megafauna disappeared by 12.9 ka, before the onset of the Younger Dryas. Comparison with high-resolution regional datasets revealed that these disappearances coincided with an ecological state shift that followed aridification and vegetation changes during the Bølling-Allerød (14.69 to 12.89 ka).

Time-series modeling implicates large-scale fires as the primary cause of the extirpations, and the catalyst of this state shift may have been mounting human impacts in a drying, warming, and increasingly fire-prone ecosystem.

Whales ‘N Things.

[By coincidence, several papers discussed whales big and small, and whale origins. Whales are descended from hippos. Didn’t know that, did you? To be honest, neither did I.]

Orliac, M.J., et al (2023) **Evolution of semiaquatic habits in hippos and their extinct relatives: insights from the ear region.** ZOOLOGICAL JOURNAL OF THE LINNEAN SOCIETY 198:1092-1105 (available as a free pdf)

Authors’ abstract: *Since molecular data identified hippopotamids as the closest living relatives of cetaceans, a common aquatic/semiaquatic ancestor hypothesis for these modern taxa has naturally been proposed.*

However, recent molecular studies concluded that most molecular adaptations in extant cetaceans occurred after their split from hippopotamids.

If the question of aquatic affinities of the first cetaceans has been investigated at large, it has not been the case for the forebears of hippopotamids. Sensory organs are drastically affected by underwater perception.

In this work, we question the aquatic affinities of fossil hippopotamoids through an investigation of the morphology and morphometrics of the petrosal bone and cochlea of 12 extinct hippopotamoid taxa.

Petrosal and bony labyrinth morphological characters constitute a source of structured phylogenetic signal, both supporting major hippopotamoid clades and bringing original relationships.

The morphometric study of functional measurements of the cochlear canal shows that anthracotheres bridge the morphological gap between terrestrial artiodactyls and modern hippopotamids.

The integrated functional signal of the ear region further supports convergent acquisitions of semiaquatic behaviour in hippopotamids and cetaceans and indicates that terrestrial hearing was an ancestral trait among Hippopotamoidea.

Bianucci, G., et al (2023) **A heavyweight early whale pushes the boundaries of vertebrate morphology.** NATURE 620:doi.org/10.1038/s41586-023-06381-1 (available as a free pdf)

Authors’ abstract: *The fossil record of cetaceans documents how terrestrial animals acquired extreme adaptations and transitioned to a fully aquatic lifestyle. In whales, this is associated with a substantial increase in maximum body size.*

Although an elongate body was acquired early in cetacean evolution, the maximum body mass of baleen whales reflects a recent diversification that culminated in the blue whale. More generally, hitherto known gigantism among aquatic tetrapods evolved within pelagic, active swimmers.

Here we describe Perucetus colossus, a basilosaurid whale from the middle Eocene epoch of Peru. It displays, to our knowledge, the highest degree of bone mass increase known to date, an adaptation associated with shallow diving.

The estimated skeletal mass of P. colossus exceeds that of any known mammal or aquatic vertebrate. We show that the bone structure specializations of aquatic mammals are reflected in the scaling of skeletal fraction (skeletal mass versus whole-body mass) across the entire disparity of amniotes.

We use the skeletal fraction to estimate the body mass of P. colossus, which proves to be a contender for the title of heaviest animal on record. Cetacean peak body mass had already been reached around 30 million years before previously assumed, in a coastal context in which primary productivity was particularly high.

The fossil record of cetaceans provides one of the most notable documentations of an evolutionary transition of lifestyle. This transition brought a fully terrestrial group of mammals back to water, over 300 million years after tetrapods first gained ground.

Early to middle Eocene artiodactyls with a chevrotain-like morphology (such as Indohyus) are understood to be the closest known relatives of cetaceans. Becoming increasingly specialized for aquatic life during this global greenhouse stage, cetaceans quickly evolved larger body sizes, with a first notable trend of body elongation seen in late Eocene basilosaurines.

The true gigantism and associated body mass seen in baleen whales is nevertheless a recent acquisition, probably associated with the cooling trend and seasonality installed in the late Cenozoic era.

Furthermore, the largest cetacean is the extant blue whale (Balaenoptera musculus), which is also the heaviest animal currently known. More generally, the largest taxa among aquatic tetrapods (which include marine reptiles such as ichthyosaurs) known to date are all pelagic, active swimmers.

As animals acquire more aquatic habits, buoyancy becomes a critical aspect of their biology. Bone is dense relative to most other tissues and present in large quantities in the tetrapod body, probably explaining why bone mass specializations are documented in a myriad of tetrapod lineages that independently evolved aquatic habits.

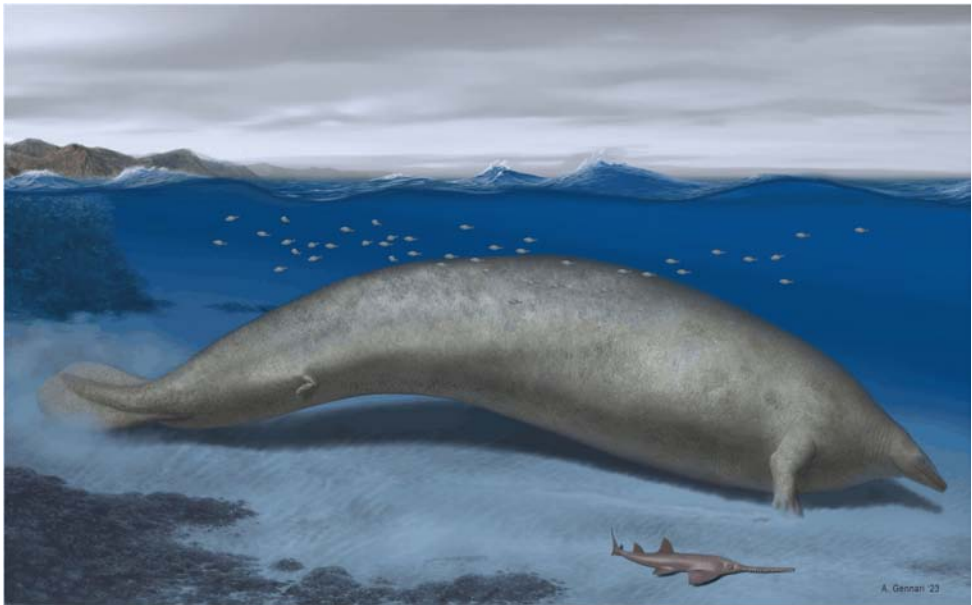
The adaptations of shallow-diving, slow-swimming species often comprise bone mass increase (BMI). This is produced by the infilling of the inner cavities of skeletal elements with compact bone (that is, osteosclerosis) and, in the more extreme cases, by additional deposition of bone on their external surface (that is, pachyostosis sensu stricto).

BMI is documented in cetaceans' amphibious close relatives, as well as early members of the clade, the basilosaurids in particular. Extant cetaceans have conversely acquired an entirely different bone microanatomy, with an osteoporotic-like structure typical of pelagic, secondarily aquatic tetrapods with more active swimming.

Basilosaurids are therefore unique in the sense that they acquired large sizes (up to around 20 metres in body length) and BMI. The degree of their BMI nevertheless did not match, up until now, that of some sirenians, for example, of which the whole rib cage is both strongly osteosclerotic and pachyostotic.

Here we describe a basilosaurid whale that substantially pushes the upper limit of skeletal mass in mammals, as well as in aquatic vertebrates in general. This early whale combines a gigantic size and, to our knowledge, the strongest degree of BMI known to date. It also potentially represents the heaviest animal ever described.

[Image is from this paper.]



Antar, M.S., et al (2023) **A diminutive new basilosaurid whale reveals the trajectory of the cetacean life histories during the Eocene.** COMMUNICATIONS BIOLOGY 6:doi.org/10.1038/s42003-023-04986-w (available as a free pdf)

Authors' abstract: *Soon after whales originated from small terrestrial artiodactyl ancestors, basal stem forms (archaeocetes) came to inhabit more specialized aquatic ecologies and underwent a tremendous adaptive radiation that culminated in the adoption of a fully aquatic lifestyle.*

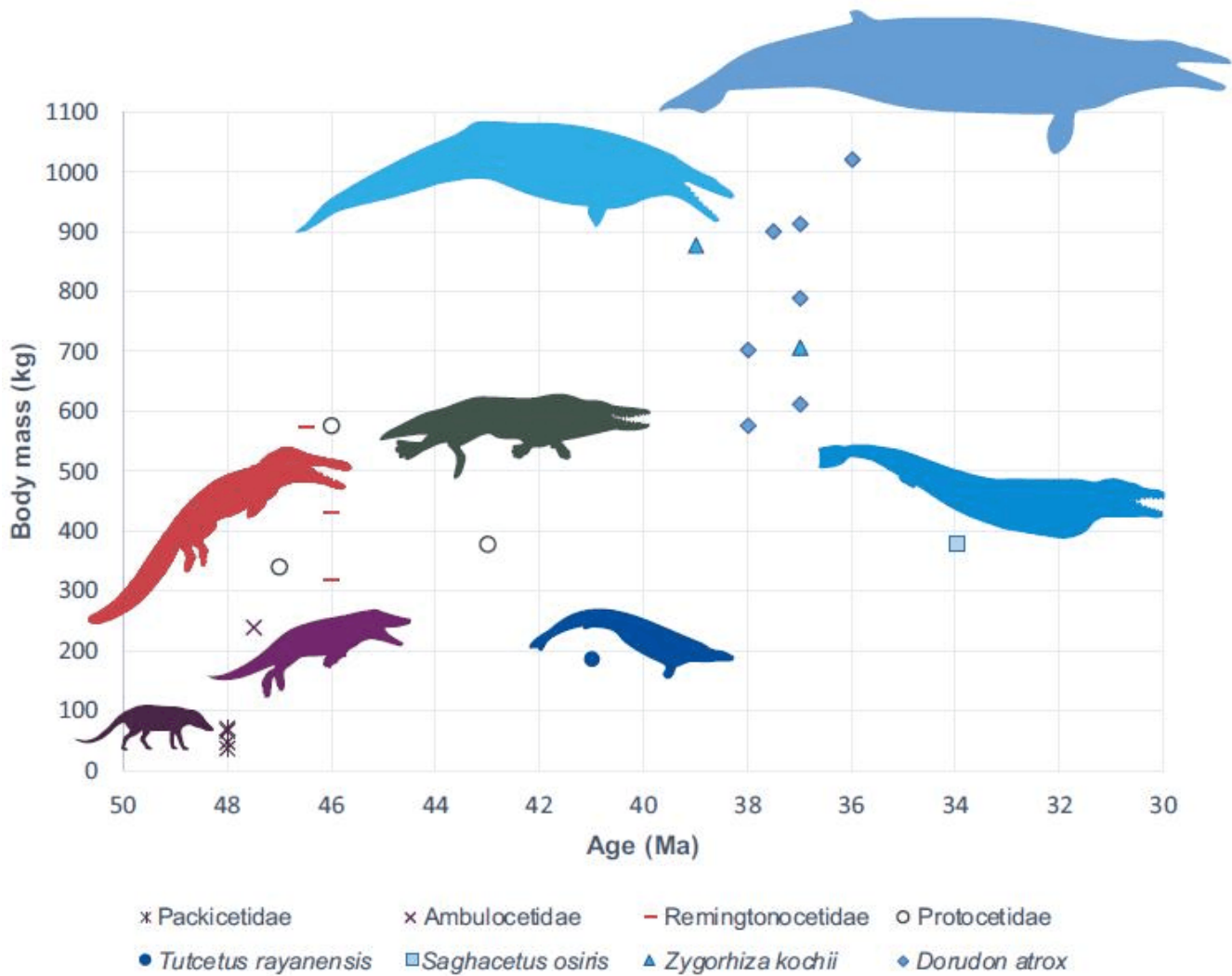
This adaptive strategy is first documented by the geographically widespread extinct family Basilosauridae. Here we report a new basilosaurid genus and species, Tutcetetus rayanensis, from the middle Eocene of Fayum, Egypt.

This new whale is not only the smallest known basilosaurid, but it is also one of the oldest records of this family from Africa.

Tutcetetus allows us to further test hypotheses regarding basilosaurids' early success in the aquatic ecosystem, which lasted into the latest Eocene, and their ability to outcompete amphibious stem whales and opportunistically adapt to new niches after they completely severed their ties to the land.

Tutcetetus also significantly expands the size range of the basilosaurids and reveals new details about their life histories, phylogeny, and paleobiogeography.

[Chart is from this paper.]



Dinosaurs.

Müller, R.T., et al (2023) **New reptile shows dinosaurs and pterosaurs evolved among diverse precursors.** NATURE 620:589-594 (2023)

Authors’ abstract: *Dinosaurs and pterosaurs have remarkable diversity and disparity through most of the Mesozoic Era. Soon after their origins, these reptiles diversified into a number of long-lived lineages, evolved unprecedented ecologies (for example, flying, large herbivorous forms) and spread across Pangaea.*

Recent discoveries of dinosaur and pterosaur precursors demonstrated that these animals were also speciose and widespread, but those precursors have few if any well-preserved skulls, hands and associated skeletons.

Here we present a well-preserved partial skeleton (Upper Triassic, Brazil) of the new lagerpetid Venetoraptor gassenae gen. et sp. nov. that offers a more comprehensive look into the skull and ecology of one of these precursors.

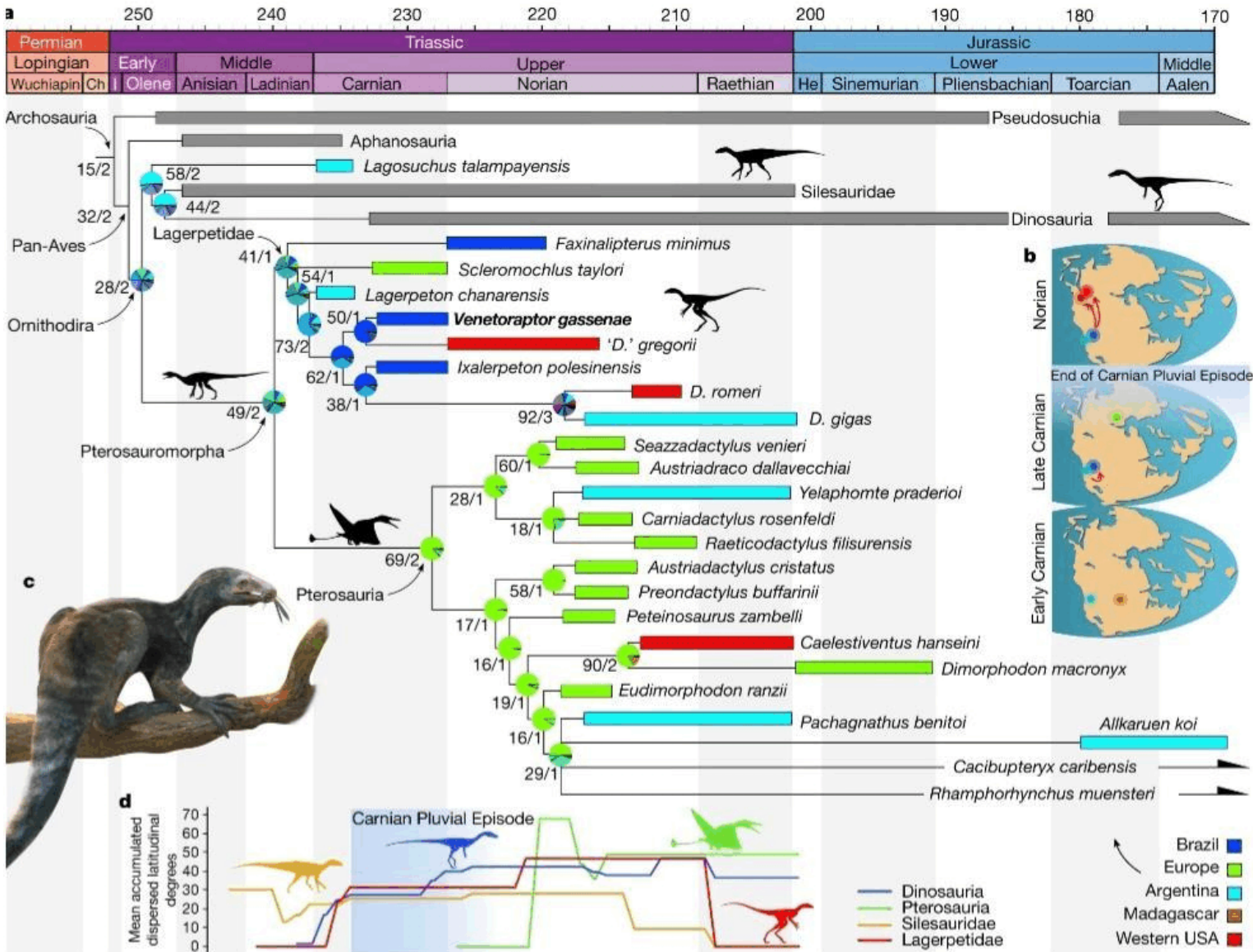
Its skull has a sharp, raptorial-like beak, preceding that of dinosaurs by around 80 million years, and a large hand with long, trenchant claws that firmly establishes the loss of obligatory quadrupedalism in these precursor lineages.

Combining anatomical information of the new species with other dinosaur and pterosaur precursors shows that morphological disparity of precursors resembles that of Triassic pterosaurs and exceeds that of Triassic dinosaurs.

Thus, the ‘success’ of pterosaurs and dinosaurs was a result of differential survival among a broader pool of ecomorphological variation.

Our results show that the morphological diversity of ornithodirans started to flourish among early-diverging lineages and not only after the origins of dinosaurs and pterosaurs.

[Chart is from this paper.]



Li, Q., et al (2023) **Puberty in a Mesozoic reptile.** CURRENT BIOLOGY 33:doi.org/10.1016/j.cub.2023.05.073

Authors’ abstract: *The histology of bone can be preserved virtually unaltered for hundreds of millions of years in fossils from all environments and all vertebrate taxa, giving rise to the flourishing field of paleohistology.*

The shafts of long bones are formed by the apposition of periosteal bone tissue, similar to the growth of wood, and preserve, an often cyclical, record of the growth of the individual and events in its life history.

One such event is sexual maturation or puberty, during which hormonal changes transform the juvenile into a sexually mature adult. Puberty has been well studied in humans and some other living vertebrates.

Here, we describe puberty in Keichousaurus, a small sexually dimorphic and live-bearing marine reptile from Middle Triassic rocks of SW China, about 240 million years old.

Using a combination of bone histology and morphology, we detected puberty as one of the four life stages (the others being fetus, juvenile, and adult). Adult Keichousaurus males have a more robust humerus than females, with pronounced muscle attachment sites and a triangular shaft cross section.

Midshaft sections of the humeri of the males show the transition from the rounded juvenile cross section to the triangular adult cross section, as reflected in the contour of the growth marks.

This shape change is produced by differential bone apposition of the periosteum, presumably triggered by sex hormones, as in humans, and influenced by changes in loading regime during puberty. This is the first report of puberty in a fossil amniote.

Kiat, Y., and J.K. O’Connor (2023) **Rarity of molt evidence in early pennaraptoran dinosaurs suggests annual molt evolved later among Neornithes.** COMMUNICATIONS BIOLOGY 6:doi.org/10.1038/s42003-023-05048-x (available as a free pdf)

Authors’ abstract: *Feathers are a primitive trait among pennaraptoran dinosaurs, which today are represented by crown birds (Neornithes), the only clade of dinosaurs to survive the end Cretaceous mass extinction.*

Feathers are central to many important functions and therefore, maintaining plumage function is of great importance for survival. Thus, molt, by which new feathers are formed to replace old ones, is an essential process.

Our limited knowledge regarding molt in early pennaraptoran evolution is based largely on a single Microraptor specimen. A survey of 92 feathered non-avian dinosaur and stem bird fossils did not find additional molting evidence.

Due to its longer duration, in ornithological collections evidence of molt is found more frequently in extant bird species with sequential molts compared to those with more rapid simultaneous molts.

The low frequency of molt occurrence among fossil specimens resembles collections of bird species with simultaneous molts.

The dearth of molt evidence in the forelimbs of pennaraptoran specimens may have interesting implications regarding molt strategy during early avian evolution, and suggests that the yearly molting cycle may have evolved later, among crown birds.

Zoology.

Schmidt, R.C., et al (2023) **Two new species of suckermouth catfishes (Mochokidae: Chiloglanis) from upper Guinean forest streams in West Africa.** ICHTHYOLOGY AND HERPETOLOGY 111:/doi.org/10.1643/i2022067 (available as a free pdf)

Authors’ abstract: *Suckermouth catfishes of the genus Chiloglanis are found throughout tropical Africa. Recent studies highlighted the diversity within this*

genus remains incompletely documented and nearly 20 new species have been described in the past ten years.

Here we describe two new species of *Chiloglanis* from streams in the Upper Guinean Forest. *Chiloglanis fortuitus*, new species, is only known from one specimen collected in the St. John River drainage in Liberia and is readily distinguished from other species of *Chiloglanis* by the number of mandibular teeth and the length of the barbels associated with the oral disc.

Chiloglanis frodobagginsi, new species, from the upper Niger River was previously considered to be a disjunct population of *C. micropogon*. A combination of several characters diagnoses *C. frodobagginsi*, new species, from topotypic *C. micropogon* in the Lualaba River (Congo River basin) and from Central African populations of *Chiloglanis* cf. *micropogon* in the Benue, Ndian, and Cross River drainages.



The biogeographical implications of the recognition of *C. frodobagginsi*, new species, the likelihood of finding additional diversity in the streams of the Upper Guinean Forests, and the taxonomy of *C. micropogon* and *C. batesii* are also discussed.

[Image is from this paper and shows the type specimen of *Chiloglanis frodobagginsi*.]

Brozou, A., et al (2023) **A dietary perspective of cat-human interactions in two medieval harbors in Iran and Oman revealed through stable isotope analysis.** SCIENTIFIC REPORTS 13:doi.org/10.1038/s41598-023-39417-7 (available as a free pdf)

Authors’ abstract: *Cats are hypercarnivorous, opportunistic animals that have adjusted to anthropogenic environments since the Neolithic period.*

Through humans, either by direct feeding and/or scavenging on food scraps, the diet of cats has been enriched with animals that they cannot kill themselves (e.g., large mammals, fish).

Here, we conducted carbon and nitrogen stable isotope ratio analysis to reconstruct the diet of medieval cats and investigate cat-human interactions in two medieval harbor sites (Qalhât, Oman and Siraf, Iran).

The analysis included 28 cat individuals and 100 associated marine and terrestrial faunal samples pertaining to > 30 taxa. The isotopic results indicate a high marine protein based diet for the cats from Qalhât and a mixed marine-terrestrial (C4) diet for the cats from Siraf.

Cats at these sites most likely scavenged on both human food scraps and refuse related to fishing activities, with differences in the two sites most likely associated with the availability of marine resources and/or the living conditions of the cats.

By shedding light on the dietary habits of cats from two medieval harbors in the Arabian Gulf and Gulf of Oman, this study illustrates the potential of stable isotope analysis in reconstructing human-cat interactions in the past.

Geology.

Bletery, Q., and J.M. Nocquet (2023) **The precursory phase of large earthquakes.** SCIENCE 381:doi.org/10.1126/science.adg2565 (available as a free pdf)

Authors’ abstract: *The existence of an observable precursory phase of slip on the fault before large earthquakes has been debated for decades.*

Although observations preceding several large earthquakes have been proposed as possible indicators of precursory slip, these observations do not directly precede earthquakes, are not seen before most events, and are also commonly observed without being followed by earthquakes.

We conducted a global search for short-term precursory slip in GPS data. We summed the displacements measured by 3,026 high-rate GPS time series, projected onto the directions expected from precursory slip at the hypocenter, during 48 hours before 90 (moment magnitude =7) earthquakes.

Our approach reveals a about 2-hour-long exponential acceleration of slip before the ruptures, suggesting that large earthquakes start with a precursory phase of slip, which improvements in measurement precision and density could more effectively detect and possibly monitor.

Botany.

Gostincar, C., et al (2023) **Extremophilic and extremotolerant fungi.** CURRENT BIOLOGY 33:R752-R756 (available as a free pdf)

Authors’ extracts: *Bacteria and archaea that live in extreme environments often cannot survive in temperate conditions. In contrast, the ecological amplitude of most fungi from these environments is greater; they are extremotolerant rather than extremophilic.*

Fungi have been found in hypersaline lakes and seas around the world, as well as in the brine of man-made salt pans.

Not all deserts are in hot climates. Some of the driest places on earth are in Antarctica, where the lack of water is accompanied by extremely low

temperatures, yet these environments still support local fungal life. Fungi are also found in permafrost and glacial ice on both poles as well as in the cold waters of the deep sea.

Most fungi prefer a slightly acidic pH. However, only a few species are known to colonise the most acidic environments, such as mine drainage waters and volcanic lakes. At the other end of the pH spectrum, some fungi are found in alkaline soda soils.

The remarkable adaptability of fungi to extreme environments also includes resistance to radiation. For example, some species found at the heavily contaminated sites of the Chernobyl nuclear power plant can tolerate levels of ionising radiation that exceed those found in nature by many orders of magnitude.

The seemingly counterintuitive evolution of such ‘unnecessary’ resistance can be explained as exaptation, an adaptation to a different selection pressure, but one that is also useful against radiation.

As with bacteria, this actual selection pressure is believed to be desiccation, since radiation resistance strongly correlates with desiccation resistance across the tree of life.

Ahmed, I., et al (2023) **Einkorn genomics sheds light on history of the oldest domesticated wheat.** NATURE 620:doi.org/10.1038/s41586-023-06389-7 (available as a free pdf)

Authors’ abstract: *Einkorn (Triticum monococcum) was the first domesticated wheat species, and was central to the birth of agriculture and the Neolithic Revolution in the Fertile Crescent around 10,000 years ago.*

Here we generate and analyse 5.2-Gb genome assemblies for wild and domesticated einkorn, including completely assembled centromeres. Einkorn centromeres are highly dynamic, showing evidence of ancient and recent centromere shifts caused by structural rearrangements.

Whole-genome sequencing analysis of a diversity panel uncovered the population structure and evolutionary history of einkorn, revealing complex patterns of hybridizations and introgressions after the dispersal of domesticated

einkorn from the Fertile Crescent. We also show that around 1% of the modern bread wheat (Triticum aestivum) A subgenome originates from einkorn.

These resources and findings highlight the history of einkorn evolution and provide a basis to accelerate the genomics-assisted improvement of einkorn and bread wheat.

Einkorn (T. monococcum) was the first wheat species that humans domesticated around 10,000 years ago in the Fertile Crescent, a region in the Near East that is often referred to as the Cradle of Civilization.

Wild einkorn was an ingredient of the oldest known bread-like products, baked by hunter-gatherers in modern-day Jordan four millennia before the dawn of agriculture.

Einkorn had a pivotal role in the establishment of agriculture in the Fertile Crescent and it is the only diploid wheat species ($2n = 2x = 14$, AmAm genome) of which both wild and domesticated forms exist.

A noticeable morphological difference between wild and domesticated einkorn is the grain dispersal system. Wild einkorn has a fragile rachis that facilitates seed dispersal, whereas the rachis in domesticated einkorn is non-brittle.

Einkorn is closely related to Triticum urartu, the A genome donor of tetraploid durum (Triticum durum) and hexaploid bread wheats (T. aestivum).

In contrast to T. urartu, wild and domesticated einkorn have a long history of cultivation and human selection in diverse environmental conditions, which makes einkorn a valuable source of genetic variation for wheat breeding.

Multiple natural and artificial einkorn introgressions into bread wheat containing agriculturally important genes have been described. Population genetic analyses indicate that wild einkorn clusters into three distinct groups and point to a region around the Karacada mountains in Southeastern Turkey as the site of einkorn domestication.

Environmental Sciences.

Vilovic, I., et al (2023) **Variations in climate habitability parameters and their effect on Earth’s biosphere during the Phanerozoic Eon.** SCIENTIFIC REPORTS 13:doi.org/10.1038/s41598-023-39716-z (available as a free pdf)

Authors’ abstract: *Environmental factors, such as temperature, oxygen content, relative humidity and carbon dioxide levels have played a significant role in the ecology of our biosphere throughout geological time.*

Specifically, during the Phanerozoic Eon, which spans from 542 megayears ago until today, habitable ecological regions fragmented into niches and complex life arose.

We compiled environmental and biological properties of the Phanerozoic Eon from various published data sets and conducted a correlation analysis to assess variations in parameters relevant to the habitability of Earth’s biosphere.

We showed that environmental parameters such as oxygen, global average surface temperatures, runoff rates and carbon dioxide are interrelated and play a key role in the changes of biomass and biodiversity.

We showed that there were several periods with a highly thriving biosphere, with one even surpassing present day biodiversity and biomass.

Those periods were characterized by increased oxygen levels and global runoff rates, as well as moderate global average surface temperatures, as long as no large or rapid positive and/or negative temperature excursions occurred.

High oxygen contents are diagnostic of biomass production by continental plant life. We find that exceptionally high oxygen levels can at least in one instance compensate for decreased relative humidities, providing an even more habitable environment compared to today.

Beyond Earth, these results will help us to understand how environmental parameters affect biospheres on extrasolar planets and guide us in our search for extraterrestrial life.

Cordero, R.R., et al (2023) **Surface solar extremes in the most irradiated region on Earth, Altiplano.** BULLETIN OF THE AMERICAN METEOROLOGICAL SOCIETY 104:doi.org/10.1175/BAMS-D-22-0215.1 (available as a free pdf)

Authors’ abstract: *Satellites have consistently pointed to the Altiplano of the Atacama Desert [Chile] as the place on Earth where the world’s highest surface irradiance occurs.*

This region, near the Tropic of Capricorn, is characterized by its high elevation, prevalent cloudless conditions, and relatively low concentrations of ozone, aerosols, and precipitable water.

Aimed at studying the variability of the surface solar irradiance and detecting atmospheric composition changes in the Altiplano, an atmospheric observatory was set up in 2016 at the northwestern border of the Chajnantor Plateau (5,148 m MSL, 22.95°S, 67.78°W, Chile).

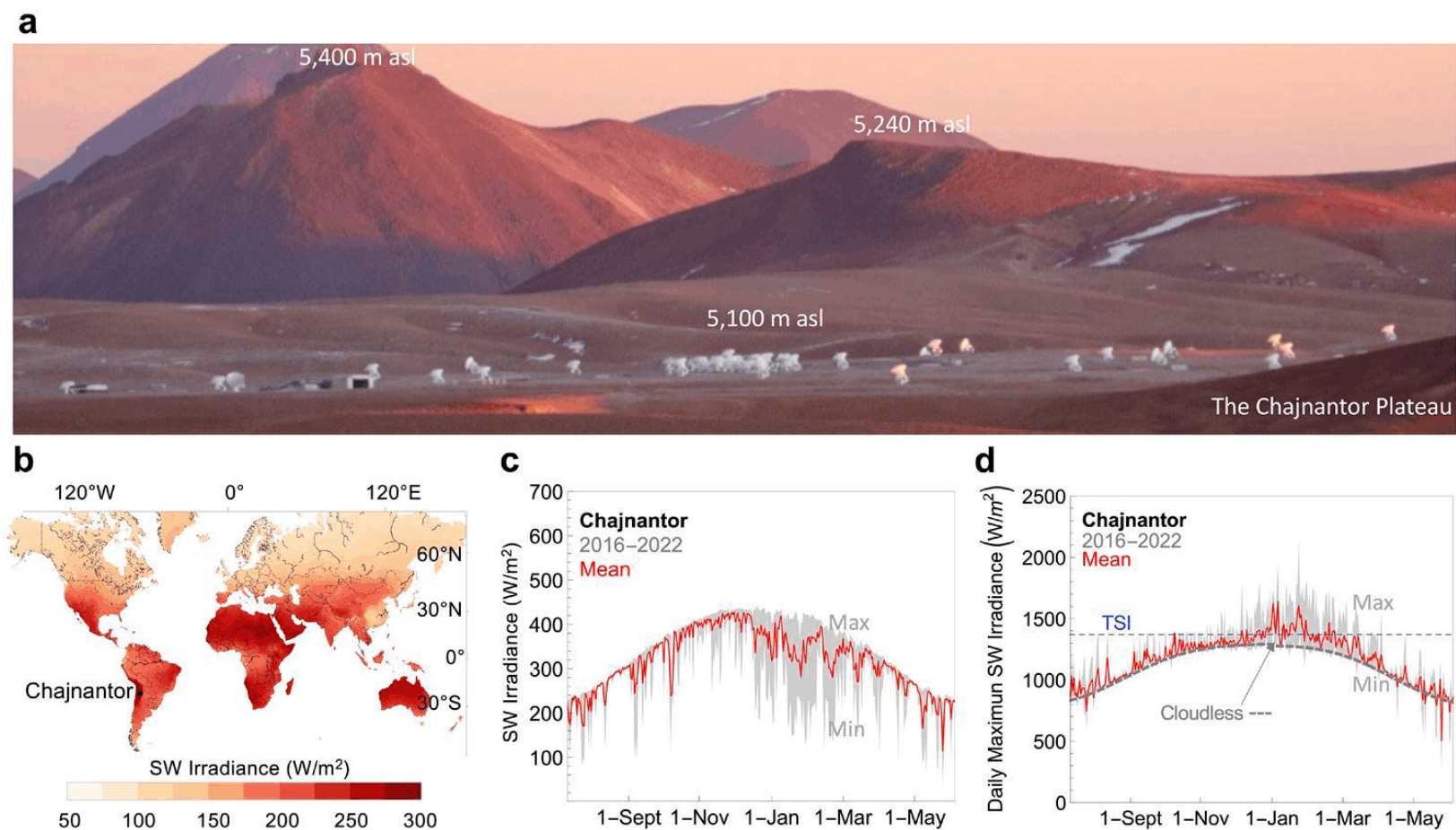
Here, we report on the first 5 years of measurements at this observatory that establish the Altiplano as the region that receives the highest-known irradiation on Earth and illuminate the unique features of surface solar extremes at high-altitude locations.

We found that the global horizontal shortwave (SW) irradiance on the plateau is on average 308 W m⁻² (equivalent to an annual irradiation of 2.7 MWh m⁻² yr⁻¹, the highest worldwide).

We also found that forward scattering by broken clouds often leads to intense bursts of SW irradiance; a record of 2,177 W m⁻² was measured, equivalent to the extraterrestrial SW irradiance expected at approximately 0.79 astronomical units (AU) from the Sun.

These cloud-driven surface solar extremes occur on the Chajnantor Plateau at a frequency, intensity, and duration not previously seen anywhere in the world, making the site an ideal location for studying the response of photovoltaic (PV) power plants to periods of enhanced SW variability.

[Image is from this paper and shows the observatories on the Altiplano, Chile.]



Klasios, N., and M. Tseng (2023) **Microplastics in subsurface water and zooplankton from eight lakes in British Columbia.** CANADIAN JOURNAL OF FISHERIES AND AQUATIC SCIENCES 80:doi.org/10.1139/cjfas-2022-0293

Authors’ abstract: *Microplastics are a global contaminant of concern, but we have little information on the characteristics and bioavailability of these pollutants in western Canadian lakes.*

Here, we quantify and characterize microplastics in subsurface water and zooplankton from eight lakes in BC, Canada. By sampling water and zooplankton, we provide insight into the fraction of microplastics entering the food web.

We found 0.607 ± 0.153 microplastics per litre in subsurface water, 0.01 ± 0.011 microplastics per copepod, and 0.02 ± 0.014 microplastics per Daphnia. Microplastic pollution was similar in all lakes sampled and showed no relationship with local population density.

Fibers were the dominant morphology observed in all lakes, and Raman spectroscopy identified polyester as the dominant polymer found both in lakes and within zooplankton.

Zooplankton generally ingested microplastics that were shorter than their body length and that fell on the smaller end of the range of available microplastics.

The prominence of polyester fibers and PET films and fragments suggests that the likely sources of microplastics to these lakes are recreational activities and atmospheric deposition.

Shlepr, K.R., et al (2023) **Commuters: a waterbird provides a new view of how species may utilize cities and wildlands.** ENVIRONMENTAL CONSERVATION 50:doi.org/10.1017/S0376892923000152 (available as a free pdf)

Authors’ abstract: *Traditional classifications of vertebrates’ responses to urbanization fail to capture the behaviour of those that rely on both urban and wildland resources for population persistence.*

Here, we use the wood stork (Mycteria americana), a species that makes daily foraging trips up to 74 km away from its nest, as an example of a previously unrecognized response to urbanization.

We monitored nests and sampled diets at stork colonies in south Florida (USA) during 2014-2020 to investigate how storks use urban habitats. We found that urban development now comprises up to 51.6% of the land cover within the 30-km core foraging area surrounding colonies and that storks access alternative prey types within these urban areas.

Our results also showed that urban-nesting storks outperformed wildland-nesting storks when the hydrological condition of the wetlands was suboptimal for foraging.

Though storks still require healthy wetlands for population persistence, urban habitat benefitted storks when hydrological patterns were not ideal for prey production in wildlands.

This ‘commuter’ response to urbanization, whereby individuals opt to utilize both urban and wildland resources within short time periods, may apply to other vertebrates with large home ranges.

Avila-Flores, R., et al (2023) **Behavioral observations of Molossus nigricans in a Neotropical city: a contribution toward understanding its urban tolerance.** CANADIAN JOURNAL OF ZOOLOGY 101:doi.org/10.1139/cjz-2022-0188

Authors’ abstract: *The family Molossidae includes several species of bats that thrive in tropical and subtropical cities of the world. It has been suggested that the remarkable tolerance of some molossid species to urban life might partially result from a suite of behavioral pre-adaptations.*

In this study, we described some aspects of the roosting, social, vocal, and foraging behavior of one of these species, Molossus nigricans in the tropical city of Villahermosa, in southeastern Mexico. We described roosting attributes and colony size in 54 roosts of M. nigricans between 2016 and 2018.

In a subsample of roosts, we registered emergence and return times throughout the night, described colony composition, and recorded vocalizations using a

full-spectrum ultrasonic detector. We found that M. nigricans exhibits high plasticity in its roosting behavior, occupying both natural and anthropogenic structures with narrow gaps and cracks.

Their social structure appears to be flexible, and their colonies are variable in size, allowing them to exploit a wide variety of roosts. Their high foraging efficiency, tolerance to artificial light, and its remarkable vocal plasticity seem to be other elements that may help us to better understand the success of M. nigricans in tropical urban environments.

Yelizarov, M., et al (2023) **Influence of the natural radon radiation on the spread of the COVID-19 pandemic.** SCIENTIFIC REPORTS 13:doi.org/10.1038/s41598-023-39705-2 (available as a free pdf)

Authors' abstract: *The statistics of COVID-19 accumulated in Ukraine show areas with a significantly lower incidence of diseases. The purpose of the study was to identify factors that could influence the pattern of the pandemic in a particular area.*

Within the study it was assumed that the level of health care is approximately the same throughout the country. Population density was considered the main factor influencing the dynamics of the spread of infection.

To reduce the impact of changes in population density across regions, it was normalized by the average population density in the country.

The normalization of statistics for the country resulted in a model in the form of a linear relationship between the normalized values of the number of COVID-19 cases in the region and the size of the region.

Subsequent analysis of the graphical data made it possible to identify four regions with the lowest incidence of COVID-19. The geographical proximity of these regions Dnipro, Kherson, Vinnytsia and Kirovograd, indicates the presence of a common factor for them, not typical for the rest of Ukraine.

Such a factor may be the location of 83% of Ukraine's uranium deposits in the territories around Kirovohrad. Radon is one of the decay products of uranium, so the population of these areas may experience increased exposure to radon.

This noble gas has more than a century of medical use, in particular for pulmonary diseases, although there is still no consensus about its effectiveness and side effects.

Considering that COVID-19 was often complicated by pulmonary diseases, it can be assumed that the geological specificity of these four regions of Ukraine had an impact on the course of the COVID-19 pandemic in their territories.

Human Prehistory.

Kun, E., et al (2023) **The genetic architecture and evolution of the human skeletal form.** SCIENCE 381:doi.org/10.1126/science.adf8009 (available as a free pdf)

Authors' abstract: *The human skeletal form underlies bipedalism, but the genetic basis of skeletal proportions (SPs) is not well characterized. We applied deep-learning models to 31,221 x-rays from the UK Biobank to extract a comprehensive set of SPs, which were associated with 145 independent loci genome-wide.*

Structural equation modeling suggested that limb proportions exhibited strong genetic sharing but were independent of width and torso proportions. Polygenic score analysis identified specific associations between osteoarthritis and hip and knee SPs.

In contrast to other traits, SP loci were enriched in human accelerated regions and in regulatory elements of genes that are differentially expressed between humans and great apes.

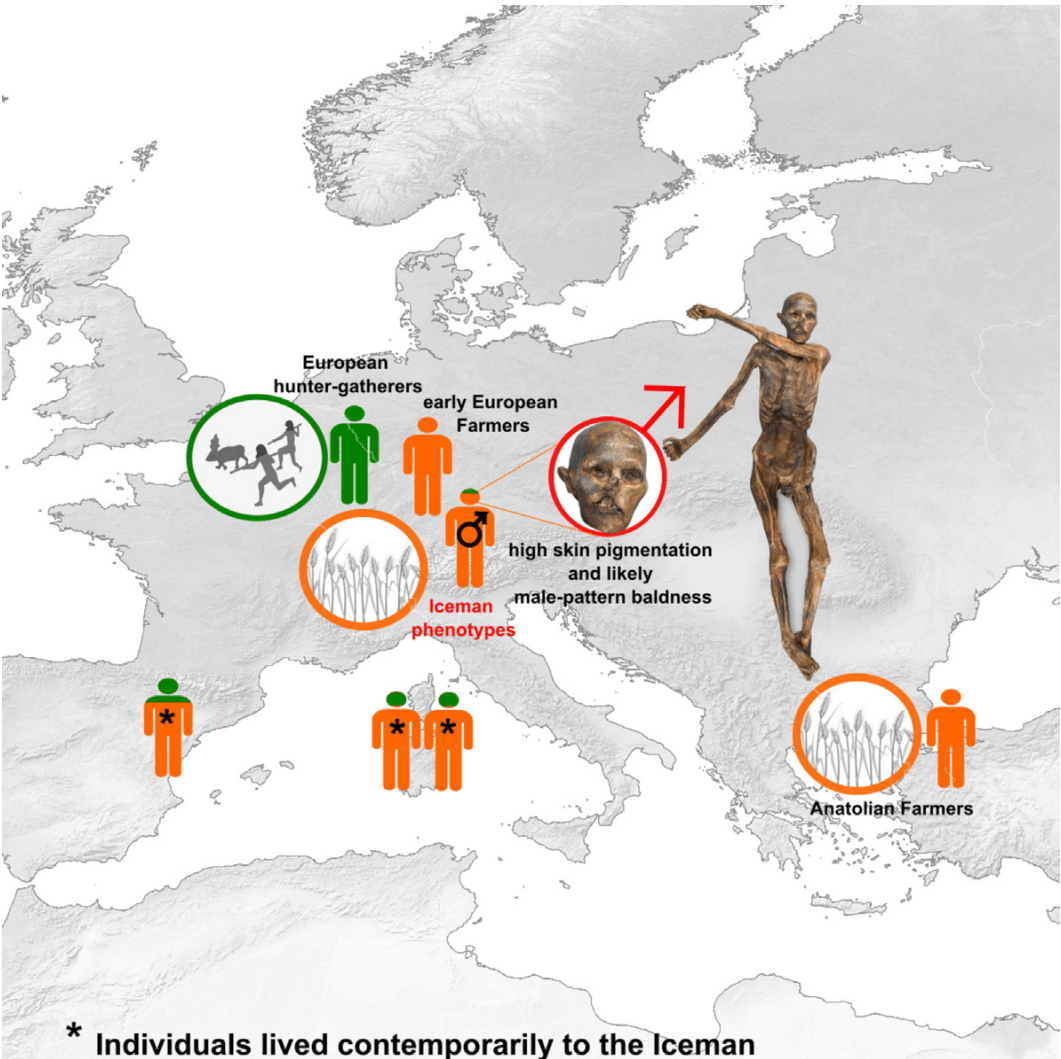
Combined, our work identifies specific genetic variants that affect the skeletal form and ties a major evolutionary facet of human anatomical change to pathogenesis.

Bipedalism is enabled by specific anatomical properties of the human skeleton, including shorter arms relative to legs, a narrow body and pelvis, and the orientation of the vertebral column. These broad changes to skeletal proportions likely began to occur around the separation of the human and chimpanzee lineages, and as a result, may have facilitated the use of tools and accelerated cognitive development.

Fossil evidence showing major morphological changes in the length of the limbs, torso, and body width suggest that these changes were gradual, with incremental development over the course of several million years.

Wang, K., et al (2023) **High-coverage genome of the Tyrolean Iceman reveals unusually high Anatolian farmer ancestry.** CELL GENOMICS 3:doi.org/10.1016/j.xgen.2023.100377 (available as a free pdf)

Authors’ abstract: *The Tyrolean Iceman is known as one of the oldest human glacier mummies, directly dated to 3350 to 3120 calibrated BCE. A previously published low-coverage genome provided novel insights into European prehistory, despite high present-day DNA contamination.*



Here, we generate a high-coverage genome with low contamination to gain further insights into the genetic history and phenotype of this individual. Contrary to previous studies, we found no detectable Steppe-related ancestry in the Iceman.

Instead, he retained the highest Anatolian-farmer-related ancestry among contemporaneous European populations, indicating a rather isolated Alpine population with limited gene flow from hunter-gatherer-ancestry-related populations.

Phenotypic analysis revealed that the Iceman likely had darker skin than present-day Europeans and carried risk alleles associated with male-pattern baldness, type 2 diabetes, and obesity-related metabolic syndrome.

These results corroborate phenotypic observations of the preserved mummified body, such as high pigmentation of his skin and the absence of hair on his head.

[Map is from this paper.]

Wang, W., et al (2023) **Earliest curry in Southeast Asia and the global spice trade 2000 years ago.** SCIENCE ADVANCES 9:doi.org/10.1126/sciadv.adh5517 (available as a free pdf)

Authors’ abstract: *The global spice trade has played an essential role in world history. However, because of poor preservation conditions, archaeobotanical remains of spices have been limited in archaeological contexts until now.*

This study reports evidence for spice processing from the archaeological site of Oc Eo in southern Vietnam, an entrepôt of the state of Funan that was occupied during the early centuries CE.

Analysis of plant microremains recovered from the surfaces of Oc Eo grinding stone tools thought to be of South Asian origin has identified culinary spices that include turmeric, ginger, fingerroot, sand ginger, galangal, clove, nutmeg, and cinnamon.

These spices are indispensable ingredients used in the making of curry in South Asia today. We suggest that South Asian migrants or visitors introduced this culinary tradition into Southeast Asia during the period of early trade contact via the Indian Ocean, commencing about 2,000 years ago.

Wertmann, P., et al (2023) **The earliest directly dated saddle for horse-riding from a mid-1st millennium BCE female burial in Northwest China.** ARCHAEOLOGICAL RESEARCH IN ASIA 35:doi.org/10.1016/j.ara.2023.100451 (available as a free pdf)

Authors' abstract: *The invention of the saddle substantially improved horseback-riding, which not only revolutionized warfare, but also eased long-distance speedy movement across Eurasia.*

Here we present the first detailed construction analysis and absolute age determination of a well-preserved soft leather saddle recovered from the tomb of a female deceased at the Yanghai cemetery site in the Turfan Basin at the eastern end of the Tian Shan mountains.

Compared with the oldest known saddle from the Scythian Pazyryk culture site Tuekta barrow no. 1 (430–420 BCE) in north-western Altai, the Yanghai specimen radiocarbon dated to 727–396 BCE (95.4% probability range) is contemporaneous or possibly older.

The saddle features the basic elements of soft saddle construction that are still used today: two stuffed, wing-shaped hides sewn together along the outer edges and separated by a central gullet-like spacer and lens-shaped support elements, resembling knee and thigh rolls of modern saddles.

Being a masterful piece of leather- and needlework, it is, however, less complex compared to Scythian saddles from the 5th–3rd centuries BCE. Another specimen from nearby Subeixi site, which is also described in detail for the first time in the present study, much closer resembles the Pazyryk saddles in shape, size and structure.

In Yanghai, equestrian paraphernalia appear in the grave assemblages during the entire burial period (ca. 1300 BCE to 200 CE), although in higher numbers only from ca. 300 BCE.

In the same way, the burial of horses was not common until then. Despite the generally very good preservation of leather, only two saddles were discovered in Yanghai which makes them an exception rather than the norm and raises the question of whether these saddles were acquired from more specialized horse breeders, riders, and saddlers in the North.

Delsol, M., et al (2023) **Ancient DNA confirms diverse origins of early post-Columbian cattle in the Americas.** SCIENTIFIC REPORTS 13:doi.org/10.1038/s41598-023-39518-3 (available as a free pdf)

Authors' abstract: *Before the arrival of Europeans, domestic cattle (*Bos taurus*) did not exist in the Americas, and most of our knowledge about how domestic bovines first arrived in the Western Hemisphere is based on historical documents.*

Sixteenth-century colonial accounts suggest that the first cattle were brought in small numbers from the southern Iberian Peninsula via the Canary archipelago to the Caribbean islands where they were bred locally and imported to other circum-Caribbean regions.

Modern American heritage cattle genetics and limited ancient mtDNA data from archaeological colonial cattle suggest a more complex story of mixed ancestries from Europe and Africa. So far little information exists to understand the nature and timing of the arrival of these mixed-ancestry populations.

In this study we combine ancient mitochondrial and nuclear DNA from a robust sample of some of the earliest archaeological specimens from Caribbean and Mesoamerican sites to clarify the origins and the dynamics of bovine introduction into the Americas.

Our analyses support first arrival of cattle from diverse locales and potentially confirm the early arrival of African-sourced cattle in the Americas, followed by waves of later introductions from various sources over several centuries.

Modern Humans.

Bellier, L., et al (2023) **Music can be reconstructed from human auditory cortex activity using nonlinear decoding models.** PLOS BIOLOGY 21:doi.org/10.1371/journal.pbio.3002176 (available as a free pdf)

Authors’ abstract: *Music is core to human experience, yet the precise neural dynamics underlying music perception remain unknown. We analyzed a unique intracranial electroencephalography dataset of 29 patients who listened to a Pink Floyd song and applied a stimulus reconstruction approach previously used in the speech domain.*

We successfully reconstructed a recognizable song from direct neural recordings and quantified the impact of different factors on decoding accuracy.

Combining encoding and decoding analyses, we found a right-hemisphere dominance for music perception with a primary role of the superior temporal gyrus (STG), evidenced a new STG subregion tuned to musical rhythm, and defined an anterior-posterior STG organization exhibiting sustained and onset responses to musical elements.

Our findings show the feasibility of applying predictive modeling on short datasets acquired in single patients, paving the way for adding musical elements to brain-computer interface (BCI) applications.

Meena, R., et al (2023) **Is it possible to estimate sex from signatures and handwriting? A review of literature, observations, and future perspectives.** THE SCIENCE OF NATURE 110,:doi.org/10.1007/s00114-023-01862-9

Authors’ abstract: *Estimation of sex holds great significance in the field of Forensic Science since it helps establish the identity of an individual during a crime scene investigation.*

Sex differences in human behaviour are the result of natural selection. Sexually dimorphic stimuli of cognitive and behavioural activities may influence the phenotypic expression of our motor skills.

Human traits such as signatures and handwriting are phenotypic manifestation of these skills. These phenotypic biological and behavioural traits have inherent

sexual dimorphism and may help to identify sex in different circumstances. For instance, to establish the sex of an individual or deceased, forensic samples of the human body such as voice samples, features of fingerprints and footprints, the skeleton, or its remains are helpful.

Similarly, the sex of an individual may also be identified from their corresponding handwriting and signature. Handwriting experts can extract peculiar features from handwriting and signatures which could help establish whether the signatures belong to a male or a female.

A female writer may have attractive, rounded, upright, tidy, skilled, well-formed strokes, artistic design, better penmanship, and greater length of the signature compared to the signature of a male.

Here, we review the studies related to the identification of sex from signatures and handwriting and present inferences about vital features and methods of sex identification through handwriting.

These mainly suggest that the accuracy of sex prediction from signature and handwriting ranges from 45 to 80%. We also present writing examples to show sex-based differences in the signature and handwriting of males and females.

The female’s handwriting is more decorative, arranged, aligned, neat, and clean as compared to that of the male.

Based on the writing samples and the review of literature, we suggest that forensic handwriting experts may eliminate suspects based on the sex of the writer, which can simplify the identification process of disputed or questionable signatures and handwriting.

Gusejnova, Dina (2023) **Librarians as agents of German foreign policy and the cultural consequences of the First World War.** HISTORICAL JOURNAL 66:doi.org/10.1017/S0018246X23000213 (available as a free pdf)

Author’s abstract: *In this article I explore the cultural impact of the First World War by analysing the work of libraries and librarians in different settings, from German-occupied Belgium and prisoner-of-war camps to Germany’s own public and private libraries.*

By examining the work of German, Russian, Polish, Ukrainian, and American librarians, the article makes a case for applying the notion of a ‘long’ First World War to cultural and intellectual history.

While these changes concerned librarians in all belligerent states, German librarians were particularly affected after the burning of the Leuven library during the city’s occupation by German forces.

This singular event damaged Germany’s national reputation and thereby laid the groundwork for a significant politicization of library work all the way to the Second World War.

The library of Leuven was destroyed in the very first month of the war during a ruthless sacking of the city by the German army. The neo-Renaissance building was shelled and caught fire during the German occupation of the city, resulting in the destruction of most of its 300,000 holdings.

That the destruction of Leuven’s library was construed as an injury to Belgium and a threat to European culture at large had to do with the status of libraries in European cultural history.

This library was a kind of memory palace of European civilization. Decorated with busts of great men, it entered the cultural memory of the First World War alongside the human casualties of Belgium.

With this incident, Germany could be exposed as the new barbarian or ‘Hun’, with the destruction being compared to the supposed fate of the library of Alexandria in antiquity.

Alongside the charge of illegitimate attacks on civilians, the burned library cast a long shadow over Germany’s carefully cultivated self-image as the proud purveyor of cosmopolitan knowledge.

Cohen, P.A., et al (2023) **Presence and quantity of botanical ingredients with purported performance-enhancing properties in sports supplements.** JAMA NETWORK OPEN 6:doi.org/10.1001/jamanetworkopen.2023.23879 (available as a free pdf)

Authors’ extracts: *Of the 63 products purchased, 6 did not list 1 of the 5 ingredients on the label; therefore, 57 products were analyzed (13 listing R vomitoria; 21, methylliberine; 8, turkesterone; 7, halostachine; and 8, octopamine).*

Twenty-three of 57 products (40%) did not contain a detectable amount of the labeled ingredient. Of the products that contained detectable amounts of the listed ingredient, the actual quantity ranged from 0.02%to 334%of the labeled quantity.

Six of 57 products (11%) contained a quantity of the ingredient within 10% of the labeled quantity. Seven of 57 products (12%) were found to contain at least 1 FDA-prohibited ingredient.

Five different FDA-prohibited compounds were found, including 4 synthetic simulants, 1,4-dimethylamylamine, deterenol, octodrine, oxilofrine, and omberacetam. Six products contained 1 of these prohibited ingredients, and 1 product contained 4 different prohibited ingredients.

Eighty-nine percent of dietary supplement labels did not accurately declare the ingredients found in the products, and 12%of products contained FDA-prohibited ingredients.

Darimont, C.T., et al (2023) **Humanity’s diverse predatory niche and its ecological consequences.** COMMUNICATIONS BIOLOGY 6:https://doi.org/10.1038/s42003-023-04940-w (available as a free pdf)

Authors’ abstract: *Although humans have long been predators with enduring nutritive and cultural relationships with their prey, seldom have conservation ecologists considered the divergent predatory behavior of contemporary, industrialized humans.*

Recognizing that the number, strength and diversity of predator-prey relationships can profoundly influence biodiversity, here we analyze humanity’s

modern day predatory interactions with vertebrates and estimate their ecological consequences. Analysing IUCN ‘use and trade’ data for ~47,000 species, we show that fishers, hunters and other animal collectors prey on more than a third (~15,000 species) of Earth’s vertebrates.

Assessed over equivalent ranges, humans exploit up to 300 times more species than comparable non-human predators. Exploitation for the pet trade, medicine, and other uses now affects almost as many species as those targeted for food consumption, and almost 40% of exploited species are threatened by human use.

Trait space analyses show that birds and mammals threatened by exploitation occupy a disproportionally large and unique region of ecological trait space, now at risk of loss.

These patterns suggest far more species are subject to human-imposed ecological (e.g., landscapes of fear) and evolutionary (e.g., harvest selection) processes than previously considered. Moreover, continued overexploitation will likely bear profound consequences for biodiversity and ecosystem function.

Nepomuceno, A., et al (2023) **Impact of major awards on the subsequent work of their recipients.** ROYAL SOCIETY OPEN SCIENCE 10:doi.org/10.1098/rsos.230549

Authors’ abstract: To characterize the impact of major research awards on recipients’ subsequent work, we studied Nobel Prize winners in Chemistry, Physiology or Medicine, and Physics and MacArthur Fellows working in scientific fields.

Using a case crossover design, we compared scientists’ citations, publications and citations-per-publication from work published in a 3-year pre-award period to their work published in a 3-year post-award period.

Nobel Laureates and MacArthur Fellows received fewer citations for post- than for pre-award work. This was driven mostly by Nobel Laureates. Median decrease was 80.5 citations among Nobel Laureates and 2 among MacArthur Fellows.

Mid-career (42 to 57 years) and senior (greater than 57 years) researchers tended to earn fewer citations for post-award work. Early career researchers (less than 42 years, typically MacArthur Fellows) tended to earn more, but the difference was non-significant.

MacArthur Fellows but not Nobel Laureates had significantly more post-award publications. Both populations had significantly fewer post-award citations per paper. If major research awards indeed fail to increase (and even decrease) recipients’ impact, one may need to reassess the purposes, criteria, and impacts of awards to improve the scientific enterprise.

Technology.

Nyhan, B., et al (2023) **Like-minded sources on Facebook are prevalent but not polarizing.** NATURE 620:doi.org/10.1038/s41586-023-06297-w (available as a free pdf)

Authors’ abstract: Many critics raise concerns about the prevalence of ‘echo chambers’ on social media and their potential role in increasing political polarization. However, the lack of available data and the challenges of conducting large-scale field experiments have made it difficult to assess the scope of the problem.

Here we present data from 2020 for the entire population of active adult Facebook users in the USA showing that content from ‘like-minded’ sources constitutes the majority of what people see on the platform, although political information and news represent only a small fraction of these exposures.

To evaluate a potential response to concerns about the effects of echo chambers, we conducted a multi-wave field experiment on Facebook among 23,377 users for whom we reduced exposure to content from like-minded sources during the 2020 US presidential election by about one-third.

We found that the intervention increased their exposure to content from cross-cutting sources and decreased exposure to uncivil language, but had no measurable effects on eight preregistered attitudinal measures such as affective polarization, ideological extremity, candidate evaluations and belief in false claims.

These precisely estimated results suggest that although exposure to content from like-minded sources on social media is common, reducing its prevalence during the 2020 US presidential election did not correspondingly reduce polarization in beliefs or attitudes.

Increased partisan polarization and hostility are often blamed on online echo chambers on social media, a concern that has grown since the 2016 US presidential election.

Platforms such as Facebook are thought to fuel extremity by repeatedly showing people congenial content from like-minded sources and limiting exposure to counterarguments that could promote moderation and tolerance.

Similarly, identity-reinforcing communication on social media could strengthen negative attitudes toward outgroups and bolster attachments to ingroups.

Ospina, J., et al (2023) **The relation between authoritarian leadership and belief in fake news.** SCIENTIFIC REPORTS 13:doi.org/10.1038/s41598-023-39807-x (available as a free pdf)

Authors' abstract: *Individual factors such as cognitive capacities matter when one is requested to spot fake news. We suggest, however, that social influence, specifically as exercised by an authoritarian leader, might matter more if one is expected to agree with the fake news.*

We developed a single-item prototype measure of leadership styles and recruited participants from four Western democratic countries (Australia, Canada, United Kingdom, United States, N = 501) who identified their immediate boss as an autonomous, paternalistic, or authoritarian leader.

Then they were asked to evaluate the accuracy of several fake news articles and their expectations to agree with their boss when asked about these articles.

People with authoritarian bosses were less accurate in spotting fake news compared to employees with autonomous bosses. The bigger effect, however, was that they would agree with their boss about the fake news article when it was shared by their authoritarian boss compared to employees with autonomous or paternalistic bosses.

We argue that in addition to effects on the perceived accuracy of information, social influence, conformity, and obedience are crucial and unacknowledged factors of how misinformation may be maintained and propagated by authoritarian leaders.

Kauffman, S.A., and A. Roli (2023) **What is consciousness? Artificial intelligence, real intelligence, quantum mind and qualia.** BIOLOGICAL JOURNAL OF THE LINNEAN SOCIETY 139:530-538 (available as a free pdf)

Authors' abstract: *We approach the question 'What is consciousness?' in a new way, not as Descartes' 'systematic doubt', but as how organisms find their way in their world. Finding one's way involves finding possible uses of features of the world that might be beneficial or avoiding those that might be harmful.*

'Possible uses of X to accomplish Y' are 'affordances'. The number of uses of X is indefinite (or unknown), the different uses are unordered, are not listable, and are not deducible from one another.

All biological adaptations are either affordances seized by heritable variation and selection or, far faster, by the organism acting in its world finding uses of X to accomplish Y.

Based on this, we reach rather astonishing conclusions:
1. Artificial general intelligence based on universal Turing machines (UTMs) is not possible, since UTMs cannot 'find' novel affordances.

2. Brain-mind is not purely classical physics for no classical physics system can be an analogue computer whose dynamical behaviour can be isomorphic to 'possible uses'.

3. Brain-mind must be partly quantum-supported by increasing evidence at 6.0 to 7.3 sigma.

4. Based on Heisenberg's interpretation of the quantum state as 'potentia' converted to 'actuals' by measurement, where this interpretation is not a substance dualism, a natural hypothesis is that mind actualizes potentia.

This is supported at 5.2 sigma. Then mind’s actualizations of entangled brain-mind-world states are experienced as qualia and allow ‘seeing’ or ‘perceiving’ of uses of X to accomplish Y. We can and do jury-rig. Computers cannot.

5. Beyond familiar quantum computers, we discuss the potentialities of trans-Turing systems.

Karata, M., and K.M. Cutright (2023) **Thinking about God increases acceptance of artificial intelligence in decision-making.** PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES USA 120:doi.org/10.1073/pnas.2218961120

Authors’ abstract: *Thinking about God promotes greater acceptance of Artificial intelligence (AI)-based recommendations. Eight preregistered experiments (n = 2,462) reveal that when God is salient, people are more willing to consider AI-based recommendations than when God is not salient.*

Studies 1 and 2a to 2d demonstrate across a wide variety of contexts, from choosing entertainment and food to mutual funds and dental procedures, that God salience reduces reliance on human recommenders and heightens willingness to consider AI recommendations.

Studies 3 and 4 demonstrate that the reduced reliance on humans is driven by a heightened feeling of smallness when God is salient, followed by a recognition of human fallibility. Study 5 addresses the similarity in mysteriousness between God and AI as an alternative, but unsupported, explanation.

Finally, study 6 (n = 53,563) corroborates the experimental results with data from 21 countries on the usage of robo-advisors in financial decision-making.

FREE STUFF ONLINE

You will have noticed that I provide sources for the pdfs and mp3s reviewed in this zine. Here is a summary of some good resources, all of which are free.

In particular, the “Seen In The Literature” column cites only peer-reviewed papers. For topics such as climate change or social media effects, more people should be reading these papers instead of blogs where commentators confuse their opinions as being facts.

For scientific papers for which free pdfs are available, the easiest method is to Google either the title of the paper or its digital object identifier, the phrase beginning with doi.org.

Many papers are behind a paywall, so unless you have access to a university library computer, you can only get the abstract. However, the abstract is often enough to understand the gist of the article.

Every scientific periodical has free email notifications of each new issue’s table of contents. I subscribe to dozens of notification services, in case you were wondering how I manage to keep up with the literature.

For zines, www.efanzines.com provides current pdf zines as well as some older ones. A club called Fanac at www.fanac.org does the reverse; they provide thousands of old zines from the 1930s to date, with a few current zines. Both sites have a free email notification service you can subscribe to.

The Old Time Radio Researchers have thousands of old-time radio shows (1930s to 1950s) covering all the genres, such as comedy, science fiction, fantasy, and mystery. Visit www.otrr.org/OTRRLibrary.

They also publish a free bulletin OLD RADIO TIMES, available at www.otrr.org/?c=times, with an email notification service. Don’t pay money for audio books and listen to a droning voice when you can listen for free to full-cast shows such as Jack Benny or Inner Sanctum from the OTRR.

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