

OPUNTIA 582



Middle September 2024

Opuntia is published by Dale Speirs, Calgary, Alberta. It is posted on www.efanzines.com and www.fanac.org. There is also an cumulative subject index to all issues available at those sites.

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 2024-09-02

One of my neighbours planted their boulevard to sunflowers.

NOR ANY DROP TO DRINK
photo by Dale Speirs

On June 4, the City of Calgary suffered a catastrophic water main break that cut off 60% of the city’s drinking water to 1.4 million inhabitants. See OPUNTIA #575 for details.

That break was eventually fixed but during the summer inspections revealed more potential breaks in the 50-year-old line. Accordingly, scheduled repairs were undertaken in September at multiple points.

This necessitated a return to Stage 4 emergency, the highest level on the disaster response scale. Water rationing will last until September 23. This time even the buses were used to spread the message.



LITTLE FREE LIBRARIES: PART 9

photos by Dale Speirs

[Parts 1 to 8 appeared in OPUNTIA #378, 427, 466, 482, 489, 502, 523, and 542.]

Just cleaning out my files of photos accumulated over the past year or so. Little Free Libraries are popular in Calgary. The plain ones I won't bother to show but many of them have nice designs. Since there are no secondhand bookstores left in Calgary, I have been weeding out my library and distributing books into LFLs in my neighbourhood.

Below is a townhouse LFL on Garrison Blvd SW, formerly a military base and now an upscale neighbourhood where a starter home is \$900,000.



Not far away in the Marda Loop is this LFL along 34 Avenue SW.



Below and top right: The City of Calgary uses pseudo-LFLs for its publicity campaigns. They are moved about from community to community. This one was in the Banff Trail district in 2023 but who knows where it is now.



At near left: Seen on 26 Avenue SW in the Killarney district. Veddy British.

On Kensington Road NW in the Hillhurst district.



LICENCED TO DRIVE: PART 10

photos by Dale Speirs

[Parts 1 to 9 appeared in OPUNTIA #476, 482, 489, 497, 503, 513, 528, 539, and 567.]



CRY UNCLE AND LET SLIP THE DOGS OF WAR: PART 8

by Dale Speirs

[Parts 1 to 7 appeared in OPUNTIAAs #361 to 364, 462, 556, and 570.]

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 Magazines.

"The Genghis Khan Affair" (1967 August, TMFUM) opened in Hong Kong, where a Nationalist Chinese (Taiwan) scientist named Dr Li Po Shue apparently defected to Red China. There was a fracas at the border as Napoleon Solo and Illya Kuryakin tracked Li, which ended in a diplomatic kerfuffle.

At UNCLE operations in Hong Kong, things got messier. The real Dr Li, an expert in electronics and guided missiles, was dead. Solo and Kuryakin had been chasing an imposter from THRUSH.

The question was what THRUSH was planning and why they wanted to infiltrate China. Their impersonator could not have bluffed his way through as a missile expert. Eventually Solo and Kuryakin infiltrated China in various guises.

As they learned, the Russians were sending two IRBM missiles through China to North Vietnam to help them pacify South Vietnam. THRUSH intended to hijack the missiles and launch them at India.

Here the handwaving was very blurry but apparently THRUSH thought they could replace Chairman Mao with their own man and eradicate the Red Guards. The attack on India, which was feuding with China at the time, would distract the nations of Southeast Asia. The Russians wouldn't be happy either.

All the contestants wound up in Mongolia. The nomads didn't like any of them. From there the proceedings adjourned to fake Dr Li's missile base. Once more Kuryakin snuck in, removed a few bolts from the rockets, and departed. The missiles blew up on the launch pads. Works every time.

"The Man From Yesterday Affair" (1967 September, TMFUM) began badly for Napoleon Solo and Illya Kuryakin in the jungles of the Amazon. UNCLE had a laboratory there on the Isle de Mal. The work was on tropical diseases but one of the researchers, Dantez Edmonds, found a new virulent plague.

He escaped with an infected monkey, leading UNCLE on a worldwide chase. Edmonds accepted an offer from THRUSH and began supplying them with diseased monkeys to be let loose to spread the plague. As he told Kuryakin: "*A plague on the house of UNCLE*".

The boss Alexander Waverly was bitten by an infected monkey but there was no suspense about him dying since he was a continuing character. Edmonds was bitten as well but since he was the villain of a single novella, he died. The UNCLE technicians came up with an antidote, thus stopping the plague before it got started. Everyone was happy to be vaccinated, not like what happened 55 years later.

The Man From Paperbacks.

THE RADIOACTIVE CAMEL AFFAIR (1966) by Peter Leslie was a straightforward MacGuffin hunt. The MacGuffin was stolen uranium 235, being taken by camel caravan to Sudan or thereabouts.

Napoleon Solo and Illya Kuryakin were on the case. There being no African nation capable or willing to build thermonuclear bombs, the conclusion was that THRUSH were up to their usual rubbish.

The grand finale was in darkest Africa where THRUSH had almost completed a fission reactor. They never did once Solo and Kuryakin arrived and put the kibosh on them.

The 8th MFUP was THE MONSTER WHEEL AFFAIR, which I reviewed in issue #362 of this zine.

THE DIVING DAMES AFFAIR (1967) by Peter Leslie took Napoleon Solo and Illya Kuryakin to Brazil. The initial response was to determine the identities of two American women killed in a single vehicle crash.

All that was known about them was they had claimed to be working for DAMES, the Daughters of America Missionary Emergency Service. The organization supposedly provided disaster relief, except that Brazil had no disasters recently.

Fingerprints showed the women had criminal records. A vague possibility existed that the women were connected with a dirty bird using a power project for some intended evil. Solo and Kuryakin traveled about Brazil trying to discover what THRUSH was up to now.

Even for THRUSH, their plan was ridiculously elaborate. Their project was a giant hydroelectric facility, to be used as a cover for their real plan. Not just figuratively either. They excavated a secret base underneath the reservoir, accessible only by a tunnel.

But wait, the plan got better. The secret base was used to assemble a nuclear-powered missile submarine. This was deep in the heart of the Brazilian jungle. The submarine would fire atomic missiles and obliterate the principal cities of South America.

From a land-locked reservoir, that is. Apparently THRUSH feared the navies of the world would track down their submarine out in the ocean. No one would think of looking for a submarine in a reservoir. Not a bad idea, actually.

Solo and Kuryakin survived many alarms and reached the underwater base. They jury-rigged a torpedo and sank the submarine as it left its pen. Ta!

THE ASSASSINATION AFFAIR (1967) by J. Hunter Holly (pseudonym of Joan Carol Holly, who lived her entire life in Michigan) was the tenth paperback in the series. The alarms were numerous attempts to kill Napoleon Solo. Since the reader knows that Solo was a continuing character, there was no suspense in the action, only tedium.

There was a mad scientist named Dr Abel Cain Adams. He was probably mad because of the names his parents gave him. No doubt that as a boy the other kids in Sunday school must have teased him.

Abel had a niece Mada working inside UNCLE and feeding him information. He had previously worked for THRUSH but they refused to recognize his genius, so he was trying to destroy both organizations.

In the meantime THRUSH was testing its latest weapon in Michigan farm fields, a chemical that rendered soil barren in days and killed crops. They had the antidote with which to rule the world once they had starved everyone into submission.

The denouement was in a barnyard. There was a three-way battle between THRUSH, UNCLE, and assorted fanatics. Since Michigan is still fresh and green today, the end result was self-evident.

WHEN WORDS COLLIDE 2025

Calgary's annual readercon When Words Collide has a membership limit of 1,000 plus volunteers and guests. The event always sells out a few months before. Reports of previous WWC conventions appeared in OPUNTIA's #71, 253, 266, 282, 318, 350, 387, 421, 452, 481, 507, 532, 555, and 580.

The 2025 WWC will be held August 15 to 17 at the Delta Southland Drive Hotel. The Alexandra Writers Centre in Calgary are the organizers. They did a good job in 2024 and will no doubt do so again in 2025. Details from www.whenwordscollide.org

Numerous authors, editors, and publishers will be in attendance. The dealer bourse is restricted to books. The average customer buys in armloads or tote bags full.

LITERA SCRIPTA BIBLIOTHECA: PART 4

by Dale Speirs

[Parts 1 to 3 appeared in OPUNTIA #512, 526, and 542.]

Cozies.

DEATH IN THE MARGINS (2022) by Victoria Gilbert (pseudonym of Vicki Lemp Weavil) was a novel in a cozy series about Amy Webber of Taylorsford, Virginia. She worked at the Blue Ridge Library but life as a librarian was dull, so she helped her husband Richard with his dance troupe.

Their production was based on the folklore and music of the Blue Ridge hills. Amy researched the source materials at the library. The choreographer Meredith Fox was a disputatious woman and, to add fuel to the flames, was Richard's ex-fiancée.

The scripting, choreography, and rehearsals were noisy. Someone, not necessarily with the troupe, couldn't stand Fox and eliminated her from the gene pool. Amy went Marpleing, dredging up all sorts of back stories and suspects. She was kind enough to share information with the sheriff's department, who felt they had precedence.

The rush was on to find the killer before the premiere. What annoyed Amy was having to report for work at the library. They had, after all, hired her to look after collections and users, not collect evidence and accuse. The murderer found Amy and Richard first and held them for an extended confrontation. Fox had been a blackmailer, a class of people who seldom live to collect their pensions.

DEATH BY BEACH READ (2022) by Eva Gates (pseudonym of Vicki Delany) was a novel in a cozy series about Lucy Richardson of the Outer Banks of North Carolina. She worked as a librarian at the Bodie Island Lighthouse Library.

Lucy and her fiancé Connor McNeil were househunting and found a fixer-upper on Nags Head Beach. She had previously lived in a room above the library with Charles the library cat. Both now commuted between the house and the library.

The library hosted the Classic Novel Reading Club, which was now working its way through Nathaniel Hawthorne's novel THE HOUSE OF SEVEN GABLES. The book served as a counterpoint to Lucy and Connor in their house, which

seemed to have intruders. Not ghosts, which don't leave footprints in the renovation sawdust. Nor the man's corpse which appeared in the newly finished kitchen. Lucy researched in the attic and the library to learn the history of the house. Rum running, a teenaged girl who fled and never came back, and family feuds, but no ghosts.

Lucy got some blowback from other library staff who remembered her previous escapades as a murder magnet and erstwhile Jessica Fletcher. One of them had killed the man to frighten Lucy and Connor out of the house.

The culprit was arrested, opening a vacancy at the library. Any takers? Remember that you would be working with a woman whose acquaintances had dramatically shortened lifespans.

Gone To Hell.

A.J. Hackwith had a series about Hell's library and Claire Hadley, sent there, well, because. I reviewed the first novel THE LIBRARY OF THE UNWRITTEN in issue #505 of this zine. Claire had been the librarian of the Unwritten Books wing.

The sequel was THE ARCHIVE OF THE FORGOTTEN (2020). When last we left the library, it had narrowly escaped destruction but not without some serious damage. Trashed unwritten books began leaking ink, and thereby came the plot.

Claire was transferred to the Arcane Wing, which held artifacts that had concluded stories. A dusty archive but she would soon fix that. The new librarian of the Unwritten Books was a muse named Brevity. She and Claire did not get along.

They had to after the ink escaped from the damaged books and began looking for new homes. The ink favoured human skin, while the humans were still in their skins. The ink had powers which too soon attracted the attention of other denizens in Hell. The alarums multiplied amongst the books and ink, not to mention infighting library staff.

The theme of this novel was summarized in the denouement: *Stories were made of soul stuff, fragmented and spurned from their human authors. Humans could create because they could birth little pieces of their souls to do it. Books existed*

in the afterlife because the afterlife was a place of immutable things, including souls.

THE GOD OF LOST WORDS (2021) carried on the struggle for control of the library. The strange ink was made of fragments of souls. Its sudden appearance caught the attention of demons outside the library.

A military commander Gen. Malphas appeared and demanded an inventory of the library. This was obviously the first step to a grab. Also attracted by the fuss were those from Elysium. They were determined to save souls whether or not the souls wanted to be saved.

The Unwritten Library annoyed both sides. The Unsaid Wing and the Dust Wing became part of the battleground. Not thud and blunder, just ambiguous talk to pad out the novel. No character ever walked from one room to another in a single paragraph when two pages would suffice.

All ended in a hallelujah chorus. Claire was elevated to godhood, with a halo of ink droplets. The author's afterword said this was the final volume of a trilogy. I suspect that, depending on sales of course, the trilogy will be stretched to ten volumes like so many other fantasy series.

Rare Books.

THE DEPARTMENT OF RARE BOOKS AND SPECIAL COLLECTIONS (2022) by Eva Jurczyk was about Liesl Weiss, a university librarian whose boss had a serious stroke, leaving her in charge.

The problem was that he was the only one who knew the combination of the safe within which the most valuable acquisitions were stored. Liesl's efforts to solve the problem uncovered skullduggery among the stacks of rare manuscripts.

Another librarian went missing. Liesl found back stories not in the books but in her colleagues' lives. The university bureaucracy was a conspiracy in itself, as the established staff tried to keep everything as it was. Campus politics were just as vicious as any federal election campaign.

Liesl eventually emerged triumphant with a promotion. She had an incentive to modernize the library, such as getting rid of the typewriters.

FREE STUFF ONLINE

I provide sources for the scientific pdfs and old-time radio 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 I cite 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 90,000+ 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.

For pulp fiction magazines from all genres, visit www.archive.org/details/pulpmagazinearchive?&sort=-downloads&page=2
Books in the public domain are free from <https://gutenberg.org>

LETTERS TO THE EDITOR

[Editor's remarks in square brackets. Please include your name and town when sending a comment. Email to opuntia57@hotmail.com]

FROM: Garth Spencer
Vancouver, British Columbia

2024-09-01

[Re: OPUNTIA #580]: I was really amused by your cover photo, and the Grain Growers' Guide instructions on "How to Open a Book." I guess there are people who really need the directions.

Your coverage of the latest When Words Collide conference was informative. I hadn't realized there were such things as "live action slush readings." Great idea!

Moving to your continuing series on fiction set at conventions, I see I really must go to the fanzine archives and read your earlier instalments. The stories you review sound like a hoot, but as you point out, the murder mysteries depart frequently from credible settings and police procedure.

Perhaps that is inevitable. In the real world, if a fatality at a convention turned out to be a murder, I would expect the event to be shut down, hard. I might expect the alarmed and irate members to find that not only is there nothing to do or see anymore, they're restricted to the hotel until the police have eliminated them all as suspects. In fact, I think I've come up with a story idea ...

FROM: Lloyd Penney
Etobicoke, Ontario

2024-09-03

OPUNTIA #579: Good to see Teddy Harvia/David Thayer providing even more great cartoons on the cover.

The Olympics are done, and Canada has come away with 27 medals. Now, the Paralympics are on, and we may have a record haul there, too. The CBC does this right, in my humble opinion.

Farmers' markets are great ways to spend your morning. It also reminds you that as soon as you are awake in the morning, odds are the farmers are already set up

at the market. My thanks for you getting the AMAZING STORIES BEST OF 2023. Sales figures from Amazon are outstanding.

With the NASFiC done, we will be going to the World Fantasy Convention in Niagara Falls, NY in October, and Loscon 50 in Los Angeles in late November. We have already presented Susan Manchester with Mike Glicksohn's award. Just lunch at one of Mike's favourite pubs, A Dark Horse. Nice little place, and I can see why he liked it.

Re: Seen in the Literature: I rarely comment on what's in here, but I liked the abstract on warp drives and warp bubbles. We have a talent of explaining logically some of SF's greatest fictional ideas. The Alcubierre Drive sounds like it's just years away from realization. Ah, if only...

[Sort of like the old joke about fusion reactors, always predicted to be supplying energy too cheap to be metered within ten years. But alas, the authors of the warp drive article mentioned that even in theory there is no way to sustain a warp bubble.]

OPUNTIA #580: I still have When Words Collide in mind, but seeing that Yvonne is our only driver, I might ask her if she'd be willing to drive me to Can*Con in 2025. I intend to ask them if there would be anything there for an editor still looking for any discussions or lessons on how to do the job better.

World Fantasy Convention parallels When Word Collide with only books in the dealers' room.

I had thought to join Editors Canada. I was a member many years ago when it was the Freelance Editors Association of Canada. I got very little for my membership money, but I am told it is much better now. I would join, if only I could afford it. A quick look reminds me that an annual membership is now \$310.

[Quite frankly I don't see the point unless they had some type of practical assistance such as legal or tax advice. SFWA and RWA are imploding south of the border. What authors and editors need is help in blocking copyright theft websites or useful ways of stopping AI fraud.]

SEEN IN THE LITERATURE

Galaxies.

Estrada-Carpenter, V., et al (2024) **When, where, and how star formation happens in a galaxy pair at cosmic noon using CANUCS JWST /NIRISS grism spectroscopy.** MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY 532:doi.org/10.1093/mnras/stae1368 (available as a free pdf)

[The universe is about 13.8 gigayears old. Cosmic Noon is the period 11 to 10 gigayears ago when star and black hole formation was at its maximum.]

Authors' abstract: *Spatially resolved studies are key to understanding when, where, and how stars form within galaxies.*

Using slitless grism spectra and broad-band imaging from the CANadian NIRISS Unbiased Cluster Survey (CANUCS), we study the spatially resolved properties of a strongly lensed $z = 0.8718$ galaxy pair consisting of a blue face-on galaxy with multiple star-forming clumps and a dusty red edge-on galaxy.

We produce accurate H alpha maps from JWST /NIRISS grism data using a new methodology that accurately models spatially varying continuum and emission line strengths.

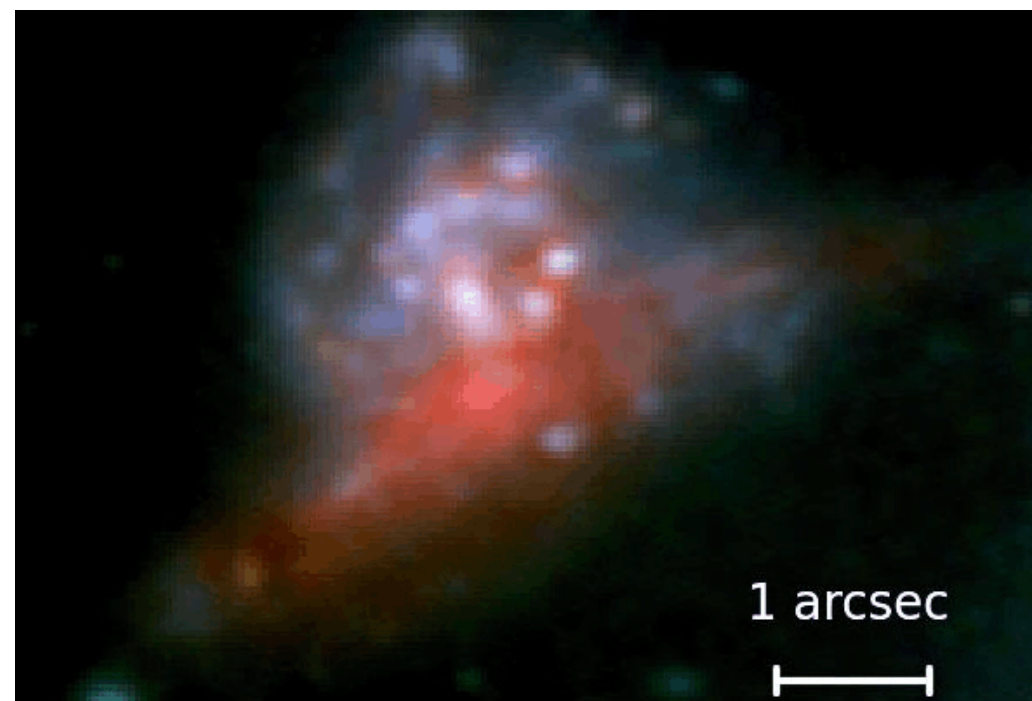
With spatially resolved indicators, we probe star formation on time-scales of ~ 10 Myr and ~ 100 Myr. ... We find that in the face-on galaxy both H and broad-band star formation rates (SFRs) drop at large galactocentric radii by a factor of ~ 4.7 and 3.8, respectively, while SFR over the last ~ 100 Myrs has increased by a factor of 1.6.

Additionally, of the 20 clumps identified in the galaxy pair we find that 7 are experiencing bursty star formation, while 10 clumps are quenching, and 3 are in equilibrium (either being in a state of steady star formation or post-burst).

Our analysis reveals that the blue face-on galaxy disc is predominantly in a quenching or equilibrium phase. However, the most intense quenching within the galaxy is seen in the quenching clumps. This pilot study demonstrates what

JWST /NIRISS data can reveal about spatially varying star formation in galaxies at Cosmic Noon.

[Image from this paper shows the two galaxies colliding at right angles to each other, one blue-shifted and the other with red dust.]



Stars.

Heaton, T.J., et al (2024) **Extreme solar storms and the quest for exact dating with radiocarbon.** NATURE 633:doi.org/10.1038/s41586-024-07679-4 (available as a free pdf)

Authors' abstract: *Radiocarbon (^{14}C) is essential for creating chronologies to study the timings and drivers of pivotal events in human history and the Earth system over the past 55,000 years. It is also a fundamental proxy for investigating solar processes, including the potential of the Sun for extreme activity.*

Until now, fluctuations in past atmospheric ^{14}C levels have limited the dating precision possible using radiocarbon. However, the discovery of solar super-storms known as extreme solar particle events (ESPEs) has driven a series of advances with the potential to transform the calendar-age precision of radiocarbon dating.

Organic materials containing unique ^{14}C ESPE signatures can now be dated to annual precision. In parallel, the search for further storms using high precision annual ^{14}C measurements has revealed fine-scaled variations that can be used to improve calendar-age precision, even in periods that lack ESPEs.

Furthermore, the newly identified ^{14}C fluctuations provide unprecedented insight into solar variability and the carbon cycle. Since its existence was confirmed in 1940, radiocarbon has been both a cornerstone for dating the past 55,000 years and a fundamental tracer of Earth system processes. ...

We discuss how the discovery of so-called Miyake events caused by ESPEs has created opportunities for more-precise radiocarbon calibration and stimulated research programmes to measure past ^{14}C levels at annual resolution.

The approximately 5,700-year half-life of the radioactive ^{14}C isotope of carbon (radiocarbon) and the ubiquitous nature of carbon in the biogeosphere make it extremely useful as a scientific tool to study the past 55,000 years.

Radiocarbon dating is based on the principle that while an organism is alive, it exchanges carbon with its surroundings, so it will have a ratio of ^{14}C to stable carbon that is in equilibrium with that of its local environment; a similar situation also arises for some geological processes, such as the growth of speleothems.

Once this exchange ceases, for example when an organism dies, the stable carbon incorporated into well-preserved chemical components will remain constant, but the amount of ^{14}C will halve roughly every 5,700 years. Beyond ten half-lives (around 60,000 years), insufficient ^{14}C remains to be measured reliably using current methods.

If the ^{14}C concentration (the ratio of ^{14}C to stable carbon) in the various reservoirs of the carbon cycle had been constant over time, obtaining a precise calendar age from radiocarbon dating would be straightforward.

However, the ^{14}C concentration has varied considerably over time and differs according to the carbon reservoir (for example, the atmosphere or ocean) being studied. These past fluctuations mean that all radiocarbon age measurements need to be adjusted to account for the ^{14}C concentration when the sample stopped carbon exchange.

This adjustment is known as radiocarbon calibration. Calibrating a ^{14}C measurement into an accurate calendar date requires comparison with reference material of known calendar age (for example, tree rings dated by dendrochronology) or with other independently dated ^{14}C records (such as stalagmites, corals and lacustrine and marine sediments).

Planets.

Speedie, J., et al (2024) **Gravitational instability in a planet-forming disk.** NATURE 633:doi.org/10.1038/s41586-024-07877-0 (available as a free pdf)

Authors' abstract: *The canonical theory for planet formation in circumstellar disks proposes that planets are grown from initially much smaller seeds. The long-considered alternative theory proposes that giant protoplanets can be formed directly from collapsing fragments of vast spiral arms induced by gravitational instability if the disk is gravitationally unstable.*

For this to be possible, the disk must be massive compared with the central star: a disk-to-star mass ratio of 1:10 is widely held as the rough threshold for triggering gravitational instability, inciting substantial non-Keplerian dynamics and generating prominent spiral arms.

Although estimating disk masses has historically been challenging, the motion of the gas can reveal the presence of gravitational instability through its effect on the disk-velocity structure. Here we present kinematic evidence of gravitational instability in the disk around AB Aurigae, using deep observations of ^{13}CO and C^{18}O line emission with the Atacama Large Millimeter/submillimeter Array.

The observed kinematic signals strongly resemble predictions from simulations and analytic modelling. From quantitative comparisons, we infer a disk mass of up to a third of the stellar mass enclosed within 1" to 5" on the sky.

Boley, K.M., et al (2024) **The first evidence of a host star metallicity cutoff in the formation of super-earth planets.** ASTRONOMICAL JOURNAL 168:doi.org/10.3847/1538-3881/ad6570 (available as a free pdf)

Authors' abstract: Planet formation is expected to be severely limited in disks of low metallicity, owing to both the small solid mass reservoir and the low-opacity accelerating the disk gas dissipation.

While previous studies have found a weak correlation between the occurrence rates of small planets and stellar metallicity, so far no studies have probed below the metallicity limit beyond which planet formation is predicted to be suppressed.

Here, we constructed a large catalog of ~110,000 metal-poor stars observed by the TESS mission with spectroscopically derived metallicities, and systematically probed planet formation within the metal-poor regime for the first time.

Extrapolating known higher-metallicity trends for small, short-period planets predicts the discovery of ~68 super-Earths around these stars (~85,000 stars) after accounting for survey completeness; however, we detect none.

As a result, we have placed the most stringent upper limit on super-Earth occurrence rates around metal-poor stars to date, about 1.67%, a statistically significant deviation from the prediction of metallicity trends derived with Kepler and K2.

We find a clear host star metallicity cliff for super-Earths that could indicate the threshold below which planets are unable to grow beyond an Earth mass at short orbital periods.

Satellites.

Hirata, Naoyuki (2024) **Giant impact on early Ganymede and its subsequent reorientation.** SCIENTIFIC REPORTS 14:doi.org/10.1038/s41598-024-69914-2 (available as a free pdf)

Authors' abstract: Ganymede has an ancient impact structure called a furrow system. The furrow system is the largest impact structure in the outer solar

system, and the impact should have significantly affected Ganymede's early history; however, its effects are poorly understood.

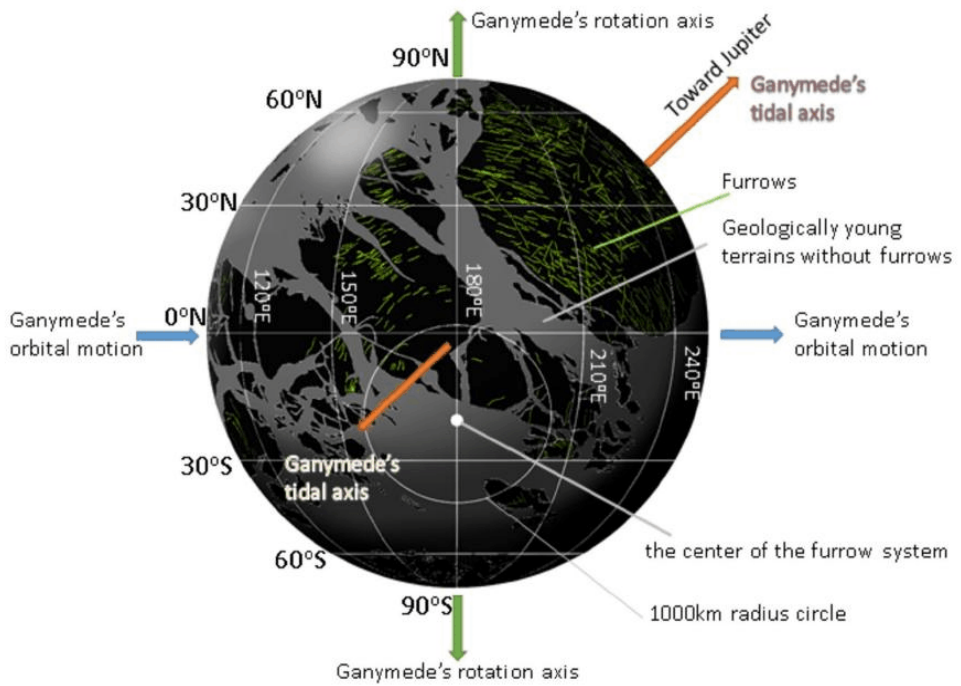
No attention has been given to the center of the furrow system coinciding with Ganymede's tidal axis, indicating that mass redistribution induced by the furrow-forming impact caused a reorientation (true polar wander) of Ganymede.

We propose that the impact ejecta created a mass anomaly that reoriented the impact site toward the tidal axis. We found that an impactor with a radius of 150 km and an incidence angle between 60° and 90° most accurately reproduces the current location of the furrow system.

We predict that future explorations would reveal remnant topographic profiles or gravity anomalies associated with the furrow-forming impact and reorientation.

Additionally, various possible explanations for the reorientation of Ganymede, such as an impactor-origin mascon beneath the basin or a thickness variation in the lithosphere, should be studied.

[Image is from this paper.]



Origin Of Life.

Moody, E.R.R., et al (2024) **The nature of the last universal common ancestor and its impact on the early Earth system.** NATURE ECOLOGY AND EVOLUTION 8:doi.org/10.1038/s41559-024-02461-1 (available as a free pdf)

Authors' abstract: *The nature of the last universal common ancestor (LUCA), its age and its impact on the Earth system have been the subject of vigorous debate across diverse disciplines, often based on disparate data and methods. Age estimates for LUCA are usually based on the fossil record, varying with every reinterpretation.*

The nature of LUCA's metabolism has proven equally contentious, with some attributing all core metabolisms to LUCA, whereas others reconstruct a simpler life form dependent on geochemistry. Here we infer that LUCA lived ~4.2 gigayears ago through divergence time analysis of pre-LUCA gene duplicates, calibrated using microbial fossils and isotope records under a new cross-bracing implementation.

Phylogenetic reconciliation suggests that LUCA had a genome of at least 2.5 megabases, encoding around 2,600 proteins, comparable to modern prokaryotes. Our results suggest LUCA was a prokaryote-grade anaerobic acetogen that possessed an early immune system.

Although LUCA is sometimes perceived as living in isolation, we infer LUCA to have been part of an established ecological system. The metabolism of LUCA would have provided a niche for other microbial community members and hydrogen recycling by atmospheric photochemistry could have supported a modestly productive early ecosystem.

The common ancestry of all extant cellular life is evidenced by the universal genetic code, machinery for protein synthesis, shared chirality of the almost-universal set of 20 amino acids and use of ATP as a common energy currency.

The last universal common ancestor is the node on the tree of life from which the fundamental prokaryotic domains (Archaea and Bacteria) diverge. As such, our understanding of LUCA impacts our understanding of the early evolution of life on Earth.

Vosseberg, J., et al (2024) **The emerging view on the origin and early evolution of eukaryotic cells.** NATURE 633:doi.org/10.1038/s41586-024-07677-6 (available as a free pdf)

[Eukaryotes are cells with nuclei and organelles such as mitochondria, which respire oxygen and keep the cell alive. Prokaryotes are the primitive cells where everything floats freely inside with no nucleus.]

Authors' abstract: *The origin of the eukaryotic cell, with its compartmentalized nature and generally large size compared with bacterial and archaeal cells, represents a cornerstone event in the evolution of complex life on Earth.*

In a process referred to as eukaryogenesis, the eukaryotic cell is believed to have evolved between approximately 1.8 and 2.7 billion years ago from its archaeal ancestors, with a symbiosis with a bacterial (proto-mitochondrial) partner being a key event.

In the tree of life, the branch separating the first from the last common ancestor of all eukaryotes is long and lacks evolutionary intermediates. As a result, the timing and driving forces of the emergence of complex eukaryotic features remain poorly understood.

Here we outline our current understanding of the key players and events underlying the emergence of cellular complexity during the prokaryote-to-eukaryote transition and discuss potential avenues of future research that might provide new insights into the enigmatic origin of the eukaryotic cell.

Eukaryotic cells display multiple characteristics that distinguish them from cells of prokaryotes, including a nucleus, the feature that gives eukaryotes their name, other membrane-bound organelles, an elaborate trafficking system and a dynamic cytoskeleton.

This, in addition to their comparatively large cell size and large gene content, has resulted in the view that eukaryotes represent more complex life forms compared to prokaryotes.

The seminal work of Carl Woese and colleagues during the last quarter of the previous century unveiled two distinct prokaryotic domains: Bacteria and Archaea.

Biochemical and genetic studies of some of the few archaeal lineages that could be cultured revealed that archaea and eukaryotes share components of information-processing machineries, such as those responsible for transcription and genome replication.

Eukaryotes are now widely believed to have originated from both the archaeal and bacterial domain. This has resulted in the view that only the prokaryotic domains, Archaea and Bacteria, should be regarded as primary domains of life.

Eukaryotes, rather, evolved from an archaea-related host cell and a bacteria-related endosymbiont, whose descendants are still present in modern eukaryotic cells in the form of mitochondria.

The evolutionary transition from prokaryote to eukaryote, the process referred to as eukaryogenesis, is inferred to have taken place mostly in the Paleoproterozoic era. Recent estimates from molecular dating analyses suggest that this transition took hundreds of millions of years between 2.7 and 1.8 billion years ago, although such estimates are under debate.

The study of this transition is complicated by the extinction of intermediate lineages, which has contributed to the long branch of the eukaryotic clade, its stem, in the tree of life.

The fossil and biomarker record of proposed stem eukaryotes is limited, and its interpretation is debated. This, combined with the fact that the cellular complexity of the last eukaryotic common ancestor (LECA) has been inferred to resemble that of modern eukaryotes and that the eukaryotic cell evolved only once, makes eukaryogenesis an evolutionary conundrum.

Because the eukaryotic features that would define a stem eukaryote as a eukaryote-grade organism remain contentious, here we use the taxonomic definition of eukaryotes and define eukaryogenesis as the period between the first eukaryotic common ancestor (FECA) and LECA, spanning the entire eukaryotic stem lineage.

Different definitions of FECA have been used in the literature. Here we use the original definition of FECA as the first stem eukaryote after the separation between the eukaryotic lineage and its closest archaeal sister group.

FECA was therefore not unlike its archaeal relatives and, merely owing to historical contingency, only had eukaryotes as extant descendants. Similar to the archaea-related FECA, the mitochondrial stem lineage starts with the first mitochondrial common ancestor (FMCA).

It is important to realize that FECA and FMCA are entities based on inferences of genomic data and that their nature and phylogenetic position in the tree of life can change upon the discovery of even closer sister groups of eukaryotes and mitochondria.

The same would apply to LECA in case new deep-branching eukaryotic lineages were to be identified. The inferred nature of LECA illustrates the fundamental gap in cellular complexity between prokaryotes and eukaryotes that was bridged during eukaryogenesis.

Paleobiology.

Smith, M.R., et al (2024) **Organ systems of a Cambrian euarthropod larva.** NATURE 633:doi.org/10.1038/s41586-024-07756-8 (available as a free pdf)

[Arthropods (crustaceans, insects, millipedes) are the most successful group of animals on Earth, about 80% of all animals.]

Authors' abstract: The Cambrian radiation of euarthropods can be attributed to an adaptable body plan. Sophisticated brains and specialized feeding appendages, which are elaborations of serially repeated organ systems and jointed appendages, underpin the dominance of Euarthropoda in a broad suite of ecological settings.

The origin of the euarthropod body plan from a grade of vermiform taxa with hydrostatic lobopodous appendages ('lobopodian worms') is founded on data from Burgess Shale-type fossils. However, the compaction associated with such preservation obscures internal anatomy.

Phosphatized microfossils provide a complementary three-dimensional perspective on early crown group euarthropods, but few lobopodians. Here we describe the internal and external anatomy of a three-dimensionally preserved euarthropod larva with lobopods, midgut glands and a sophisticated head.

The architecture of the nervous system informs the early configuration of the euarthropod brain and its associated appendages and sensory organs, clarifying homologies across Panarthropoda.

*The deep evolutionary position of *Youti yuanshi* gen. et sp. nov. informs the sequence of character acquisition during arthropod evolution, demonstrating a deep origin of sophisticated haemolymph circulatory systems, and illuminating the internal anatomical changes that propelled the rise and diversification of this enduringly successful group.*

Sun, Y., et al (2024) **Mega El Niño instigated the end-Permian mass extinction.** SCIENCE 385:doi.org/10.1126/science.ado2030

[The greatest mass extinction ever was the end-Permian of 251 megayears ago, when flood lavas overheated Earth. 97% of all life died out.]

Authors' abstract: The ultimate driver of the end-Permian mass extinction is a topic of much debate. Here, we used a multiproxy and paleoclimate modeling approach to establish a unifying theory elucidating the heightened susceptibility of the Pangean world to the prolonged and intensified El Niño events leading to an extinction state.

As atmospheric partial pressure of carbon dioxide doubled from about 410 to about 860 ppm (parts per million) in the latest Permian, the meridional overturning circulation collapsed, the Hadley cell contracted, and El Niños intensified.

The resultant deforestation, reef demise, and plankton crisis marked the start of a cascading environmental disaster. Reduced carbon sequestration initiated positive feedback, producing a warmer hothouse and, consequently, stronger El Niños.

The compounding effects of elevated climate variability and mean state warming led to catastrophic but diachronous terrestrial and marine losses.

Sosa-Montes de Oca, C., et al (2024) **Intense changes in the main source of organic carbon to the Gulf Coastal Plain following the Cretaceous-Paleogene boundary.** PALEOCEANOGRAPHY AND PALEOCLIMATOLOGY 39:doi.org/10.1029/2024PA004887 (available as a free pdf)

Authors' abstract To explore both environmental change and the response of non-fossilizing phytoplankton across the Cretaceous-Paleogene (K-Pg) boundary mass extinction event, we determined changes in organic matter (OM) sources using a range of apolar (n-alkanes, acyclic isoprenoids, steranes, and hopanes) and polar (BIT index) biomarkers.

We analyzed two K-Pg proximal sections, located in the Mississippi Embayment, Gulf Coastal Plain (USA), covering ~300 kiloyears prior to and ~3 megayears after the K-Pg event. The OM abundance and composition changed dramatically across the boundary.

The post-impact ejecta layer and burrowed unit are characterized by an increase in the mass accumulation rate (MAR) of plant and soil biomarkers, including high molecular weight n-alkanes and C29 steranes as well as the BIT index, related to an erosive period which transported terrestrial OM to the ocean in the aftermath of the impact event.

At the same time, MARs of putative aquatic biomarkers decrease (low molecular weight n-alkanes, C27 steranes and pristane and phytane), which suggests a collapse of the marine phytoplankton community.

The increase of terrestrial OM to the ocean, during the first 280 kyrs after the Chicxulub impact event, is a combination of reworked kerogen, soil and some plant material.

Crucially, within the latter part of this erosion period, only ~160 kyrs after the K-Pg do biomarkers return to distributions similar to those in the upper Cretaceous, although not to pre-impact MARs.

Thus, our results suggest a long-term interval for the full sedimentary and ecological recovery of the non-fossilizing phytoplankton community after this event.

Authors' abstract: "*Pegasus*" *volans* is a highly unusual fossil teleost fish from the celebrated Eocene Bolca Lagerstätte. The fossil, known on the basis of two specimens, has been historically assigned to seamoths (*Pegasidae*), then to oarfish and relatives (*Lampriformes*).

We describe its enigmatic skeletal anatomy in detail, and provide a new genus name. "*Pegasus*" *volans* is an extremely elongate and slender animal, with long anal and dorsal fins and a very well-developed first dorsal-fin ray reminiscent to the vexillum of some modern teleost larvae.

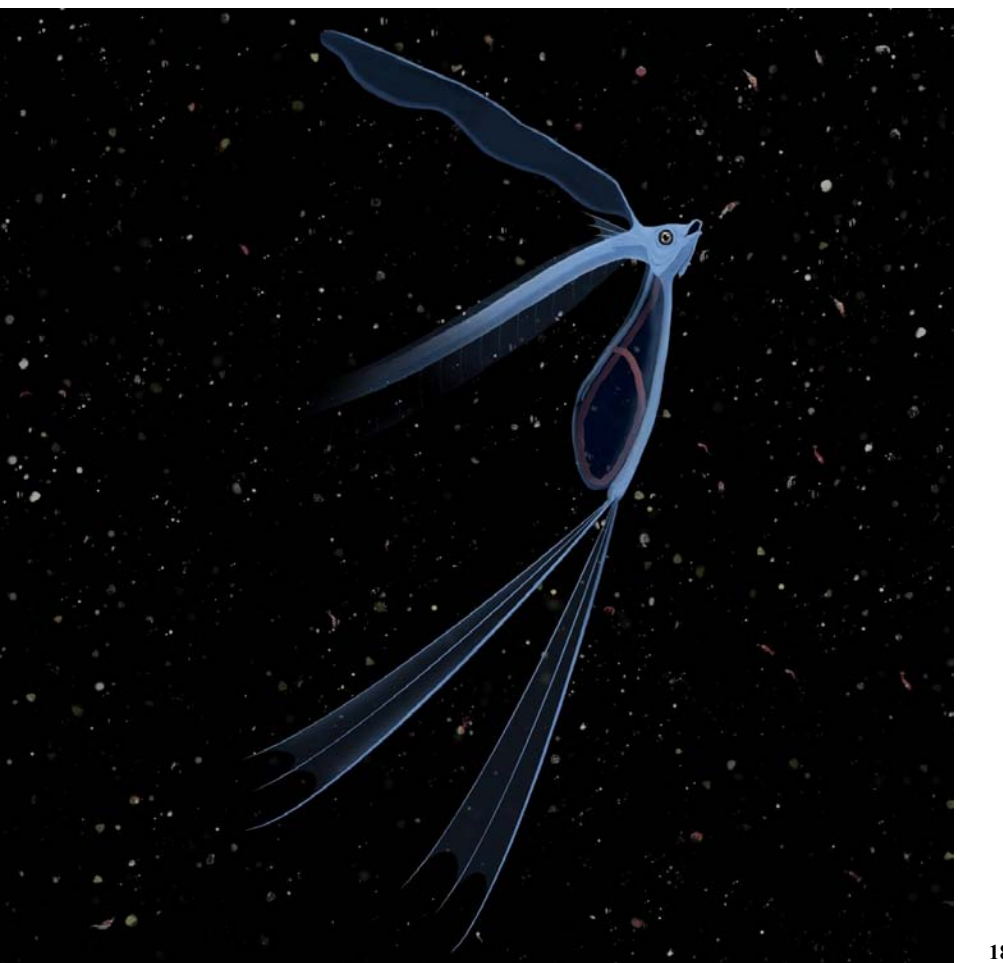
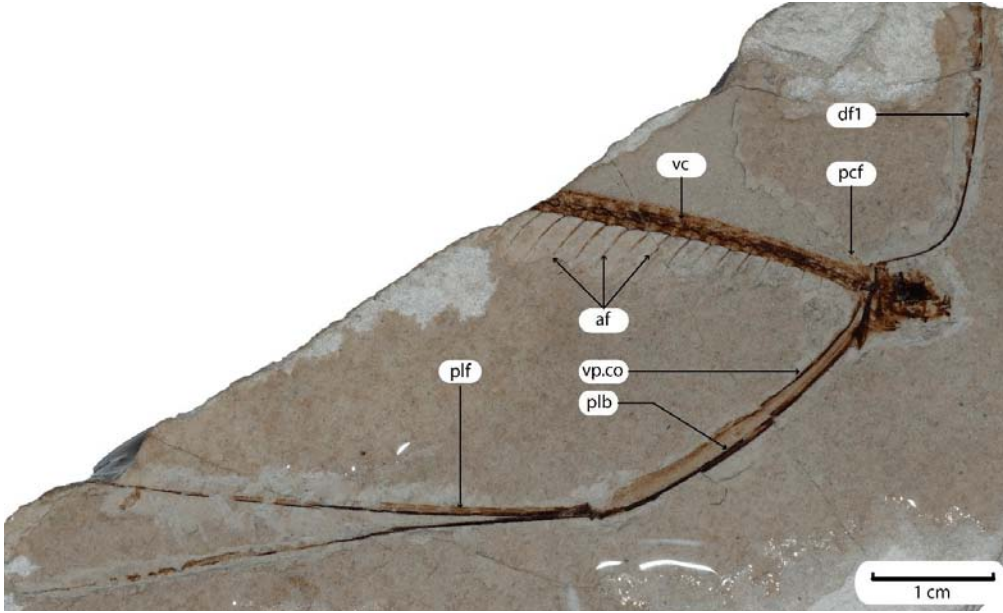
Most striking is its extreme ventral projection of the pelvic girdle (*basipterygium*), associated with an element of the pectoral girdle (a long process of the coracoid) and developed pelvic-fin rays.

The strongly reduced abdominal region suggests that "*Pegasus*" *volans* had an external gut, once again reminiscent of those of certain larval teleosts.

The unique character state combination displayed by "*Pegasus*" *volans* make it impossible to assign it to a specific subclade within perch-like spiny-rayed fishes (*Percomorpha*).

Nevertheless, it offers a valuable perspective on the diversity of morphologies and ecological niches occupied by teleost fishes of the early Eocene Bolca fauna.

[Images are from this paper, showing the fossil and a reconstruction.]



Dinosaurs.

Reisz, R.R., et al (2024) **Parental feeding in the dinosaur *Lufengosaurus* revealed through multidisciplinary comparisons with altricial and precocious birds.** SCIENTIFIC REPORTS 14:doi.org/10.1038/s41598-024-70981-8 (available as a free pdf)

Authors' abstract: *Previous studies arguing for parental care in dinosaurs have been primarily based on fossil accumulations of adults and hatchlings, perinatal and post-hatchlings in nests and nest areas, and evidence of brooding, the majority of which date to the Late Cretaceous.*

*Similarly, the general body proportions of preserved embryonic skeletons of the much older Early Jurassic *Massospondylus* have been used to suggest that hatchlings were unable to forage for themselves.*

*Here, we approach the question of parental care in dinosaurs by using a combined morphological, chemical, and biomechanical approach to compare early embryonic and hatchling bones of the Early Jurassic sauropodomorph *Lufengosaurus* with those of extant avian taxa with known levels of parental care.*

*We compare femora, the main weight-bearing limb bone, at various embryonic and post-embryonic stages in a precocious and an altricial extant avian dinosaur with those of embryonic and hatchling *Lufengosaurus*, and find that the rate and degree of bone development in *Lufengosaurus* is closer to that of the highly altricial *Columba* (pigeon) than the precocious *Gallus* (chicken), providing strong support for the hypothesis that *Lufengosaurus* was fully altricial.*

*We suggest that the limb bones of *Lufengosaurus* hatchlings were not strong enough to forage for themselves and would likely need parental feeding.*

Rosenbach, K.L., et al (2024) **New pterosaur remains from the Late Cretaceous of Afro-Arabia provide insight into flight capacity of large pterosaurs.** JOURNAL OF VERTEBRATE PALEONTOLOGY 43:doi.org/10.1080/02724634.2024.2385068 (available as a free pdf)

Authors' abstract: *Pterosaurs were the earliest and largest vertebrates to evolve powered flight, but they are the only major volant group that has gone extinct. Attempts to understand pterosaur flight mechanics have relied on aerodynamic principles and analogy with extant birds and bats.*

Both lines of inquiry rely on the size, three-dimensional shape, and internal structure of flight bones, which in pterosaurs are surprisingly rare. Remarkably, two new large-bodied pterosaur individuals with three-dimensionally preserved wing elements were recently recovered from Upper Cretaceous (Maastrichtian) horizons of Jordan.

*Both specimens represent azhdarchoid pterosaurs; one is referable to the giant species *Arambourgiania philadelphiae* (ca. 10 metre wingspan) and the second to a new, smaller species *Inabtanin alarabia* gen. et sp. nov. (ca. 5 metre wingspan).*

In this study, we describe these new specimens and use high-resolution micro-computed tomography scans to reconstruct and compare the internal osteology of the humeri of these two differently sized species to that of extant birds, for which internal bone structure can be correlated with flight behavior.

*The humerus of *Arambourgiania* exhibits a series of helical ridges formed along the cortical bone, whereas *Inabtanin* exhibits a denser pattern of hollow struts. Variation in internal structure for these individuals likely reflects responses to mechanical forces applied on the wings of pterosaurs.*

*Results indicate that *Inabtanin* has internal bone morphology similar to that of flapping birds, whereas the internal morphology of *Arambourgiania* is most similar to that of soaring birds.*

Zoology.

LeBlanc, A.R.H., et al 92024) **Iron-coated Komodo dragon teeth and the complex dental enamel of carnivorous reptiles.** NATURE ECOLOGY AND EVOLUTION 8:doi.org/10.1038/s41559-024-02477-7 (available as a free pdf)

Authors' abstract: *Komodo dragons (Varanus komodoensis) are the largest extant predatory lizards and their ziphodont (serrated, curved and blade-shaped) teeth make them valuable analogues for studying tooth structure, function and comparing with extinct ziphodont taxa, such as theropod dinosaurs.*

Like other ziphodont reptiles, V. komodoensis teeth possess only a thin coating of enamel that is nevertheless able to cope with the demands of their puncture-pull feeding.

Using advanced chemical and structural imaging, we reveal that V. komodoensis teeth possess a unique adaptation for maintaining their cutting edges: orange, iron-enriched coatings on their tooth serrations and tips.

Comparisons with other extant varanids and crocodylians revealed that iron sequestration is probably widespread in reptile enamels but it is most striking in V. komodoensis and closely related ziphodont species, suggesting a crucial role in supporting serrated teeth.

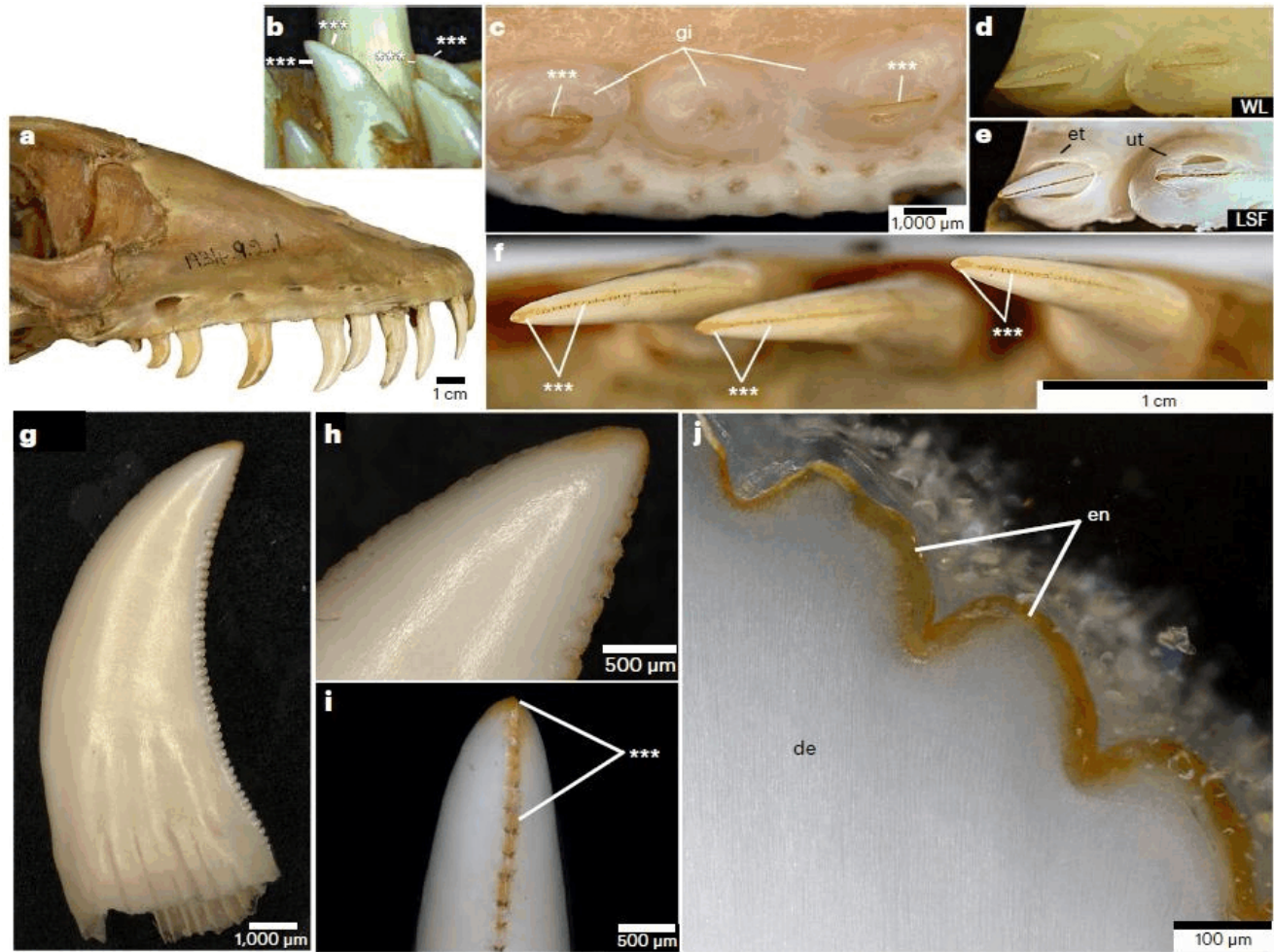
Unfortunately, fossilization confounds our ability to consistently detect similar iron coatings in fossil teeth, including those of ziphodont dinosaurs. However, unlike V. komodoensis, some theropods possessed specialized enamel along their tooth serrations, resembling the wavy enamel found in herbivorous hadrosaurid dinosaurs.

Ziphodont teeth evolved convergently in several extinct apex predators, including the 'pelycosaur' Dimetrodon and theropod dinosaurs. These teeth have serrated cutting edges composed of dentine-cored serrations (denticles) capped with a thin veneer of hard enamel.

The slenderness of the hard enamel cap is most striking in extinct ziphodont species, where even the largest predatory dinosaurs have only 10 to 20% of the absolute enamel thickness of a human tooth and lack the structural complexity of mammalian enamel.

Despite having thin, structurally simpler enamel, amniotes repeatedly evolved ziphodont teeth, suggesting that this tooth morphology is linked to the success of many extinct carnivores. This also suggests that there may be common specializations hidden in ziphodont enamel which enable these teeth to effectively cut and tear into animal tissue.

[Images are from this paper and show the iron-edged teeth.]



Hasegawa, Y., et al (2024) **How Japanese eels escape from the stomach of a predatory fish.** CURRENT BIOLOGY 34:R795-R815 (available as a free pdf)

Authors' extracts: *Predation shapes diversity in the defensive tactics of prey. One specialized defensive tactic is to escape the digestive system of the predator after capture.*

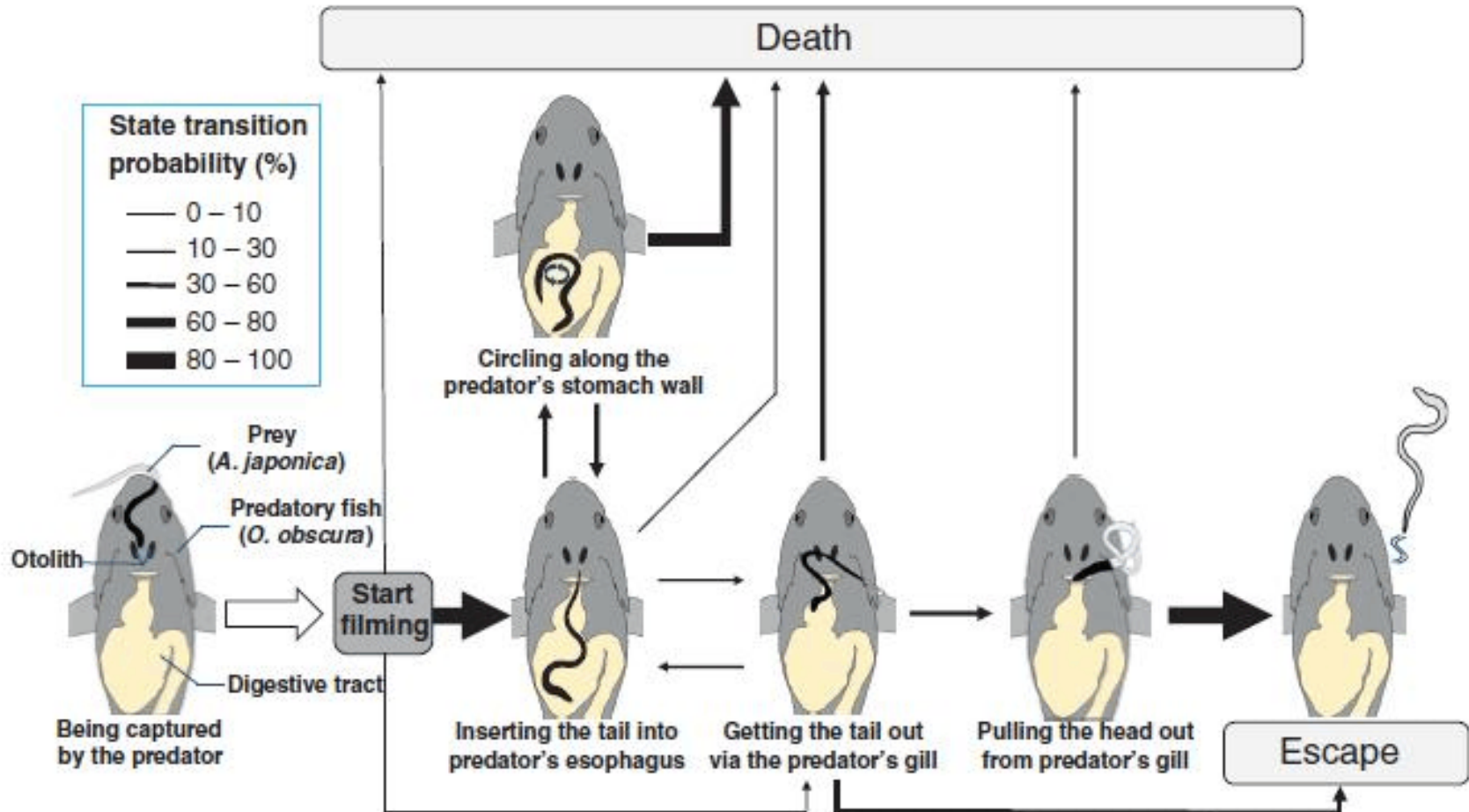
While most of these defensive tactics involve passive ejection alive from predators' mouths and vents, active escape from the digestive tracts of predators has recently been observed in certain invertebrate species and fish.

Here, we report the sequential escape processes of the Japanese eel Anguilla japonica from capture to escape via the gills of predatory fish Odontobutis obscura using an X-ray video system. All captured eels had at least one portion of their bodies swallowed into the stomach of the predator.

Surprisingly, after being swallowed, most individuals attempted to escape by going back up the digestive tract towards the esophagus and gill, and some of them succeeded in escaping via the predator's gill.

Some eels, whose entire bodies were completely inside the stomach, exhibited circling behavior along the stomach, seemingly searching for possible escape routes. An electro-anesthetization experiment revealed that eels utilize various escape routes through gill clefts, rather than just one.

[Images are from this paper.]



Kobayashi, T, et al (2024) **Cleaner fish with mirror self-recognition capacity precisely realize their body size based on their mental image.** SCIENTIFIC REPORTS 14:doi.org/10.1038/s41598-024-70138-7 (available as a free pdf)

Authors' abstract: *Animals exhibiting mirror self-recognition (MSR) are considered self-aware; however, studies on their level of self-awareness remain inconclusive. Recent research has indicated the potential for cleaner fish (Labroides dimidiatus) to possess a sophisticated level of private self-awareness.*

Here, we show that cleaner fish, having attained MSR, construct a mental image of their bodies by investigating their ability to recall body size. A size-based hierarchy governs the outcomes of their confrontations.

The mirror-naïve fish behaved aggressively when presented with photographs of two unfamiliar conspecifics that were 10% larger and 10% smaller than their body sizes.

After passing the MSR test, they refrained from aggression toward the larger photographs but still behaved aggressively toward the smaller ones without re-examining their mirror images. These findings suggest that cleaner fish accurately recognize their body size based on mental images of their bodies formed through MSR.

Additionally, mirror-experienced fish frequently revisited the mirror when presented with an intimidating larger photograph, implying the potential use of mirrors for assessing body size. Our study established cleaner fish as the first non-human animal to be demonstrated to possess private self-awareness.

Geology.

Svennevig, K., et al (2024) **A rockslide-generated tsunami in a Greenland fjord rang Earth for 9 days** SCIENCE 385:doi.org/10.1126/science.adm9247

[A seiche is when large volumes of water slosh back and forth in a lake or fjord.]

Authors' abstract: *Climate change is increasingly predisposing polar regions to large landslides. Tsunamigenic landslides have occurred recently in Greenland (Kalaallit Nunaat), but none have been reported from the eastern fjords.*

In September 2023, we detected the start of a 9-day-long, global 10.88-millihertz (92-second) monochromatic very-long-period seismic signal, originating from East Greenland.

In this study, we demonstrate how this event started with a glacial thinning-induced rock-ice avalanche of 25×10 cubic meters plunging into Dickson Fjord, triggering a 200-meter-high tsunami.

Simulations show that the tsunami stabilized into a 7-meter-high long-duration seiche with a frequency (11.45 millihertz) and slow amplitude decay that were nearly identical to the seismic signal.

An oscillating, fjord-transverse single force with a maximum amplitude of 5×10 newtons reproduced the seismic amplitudes and their radiation pattern relative to the fjord, demonstrating how a seiche directly caused the 9-day-long seismic signal.

Environmental Science.

Frank, E.G. (2024) **The economic impacts of ecosystem disruptions: Costs from substituting biological pest control.** SCIENCE 385:doi.org/10.1126/science.adg0344 (available as a free pdf)

Authors' abstract: *Ecologists have documented both the importance of bats as natural predators of insects as well as their population declines after the emergence of a wildlife disease, resulting in a potential decline in biological pest control.*

In this work, I study how species interactions can extend beyond an ecosystem and affect agriculture and human health. I find that farmers compensated for bat decline by increasing their insecticide use by 31.1%.

The compensatory increase in insecticide use by farmers adversely affected health-human infant mortality increased by 7.9% in the counties that experienced bat die-offs. These findings provide empirical validation to previous theoretical predictions about how ecosystem disruptions can have meaningful social costs.

Human Prehistory.

Wood, B.M., et al (2024) **Beyond the here and now: hunter-gatherer socio-spatial complexity and the evolution of language.** PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY OF LONDON 379B:doi.org/10.1098/rstb.2022.0521 (available as a free pdf)

Authors' abstract: *In this paper, we review data and evolutionary models suggesting that major changes in socio-spatial behaviour accompanied the evolution of language.*

*To illustrate and explore these issues, we present a comparison of GPS measures of the socio-spatial behaviour of Hadza hunter-gatherers of northern Tanzania to those of olive baboons (*Papio anubis*), a comparatively small-brained primate that is also savanna-adapted.*

While standard spatial metrics show modest differences, measures of spatial diversity, landscape exploration and spatiotemporal displacement between

individuals differ markedly. Groups of Hadza foragers rapidly accumulate a vast, diverse knowledge pool about places and things over the horizon, contrasting with the baboon's narrower and more homogeneous pool of ecological information.

The larger and more complex socio-spatial world illustrated by the Hadza is one where heightened cognitive abilities for spatial and episodic memory, navigation, perspective taking and communication about things beyond the here and now all have clear value.

Slimak, L., et al (2024) **Long genetic and social isolation in Neanderthals before their extinction.** CELL GENOMICS 4:doi.org/10.1016/j.xgen.2024.100593 (available as a free pdf)

Authors' abstract: *Neanderthal genomes have been recovered from sites across Eurasia, painting an increasingly complex picture of their populations' structure that mostly indicates that late European Neanderthals belonged to a single metapopulation with no significant evidence of population structure.*

Here, we report the discovery of a late Neanderthal individual, nicknamed 'Thorin', from Grotte Mandrin in Mediterranean France, and his genome.

These dentognathic fossils, including a rare example of distomolars, are associated with a rich archeological record of Neanderthal final technological traditions in this region 50 to 42 thousand years ago. Thorin's genome reveals a relatively early divergence of 105 ka with other late Neanderthals.

Thorin belonged to a population with a small group size that showed no genetic introgression with other known late European Neanderthals, revealing some 50 kiloyears of genetic isolation of his lineage despite them living in neighboring regions.

Bolognini, D., et al (2024) **Recurrent evolution and selection shape structural diversity at the amylase locus.** NATURE 633:doi.org/10.1038/s41586-024-07911-1 (available as a free pdf)

Authors' abstract: *The adoption of agriculture triggered a rapid shift towards starch-rich diets in human populations. Amylase genes facilitate starch*

digestion, and increased amylase copy number has been observed in some modern human populations with high-starch intake, although evidence of recent selection is lacking.

Here, using 94 long-read haplotype-resolved assemblies and short-read data from approximately 5,600 contemporary and ancient humans, we resolve the diversity and evolutionary history of structural variation at the amylase locus.

We find that amylase genes have higher copy numbers in agricultural populations than in fishing, hunting and pastoral populations.

We identify 28 distinct amylase structural architectures and demonstrate that nearly identical structures have arisen recurrently on different haplotype backgrounds throughout recent human history. *AMY1* and *AMY2A* genes each underwent multiple duplication/deletion events with mutation rates up to more than 10,000-fold the single-nucleotide polymorphism mutation rate, whereas *AMY2B* gene duplications share a single origin.

Using a pangenome-based approach, we infer structural haplotypes across thousands of humans identifying extensively duplicated haplotypes at higher frequency in modern agricultural populations. Leveraging 533 ancient human genomes, we find that duplication-containing haplotypes (with more gene copies than the ancestral haplotype) have rapidly increased in frequency over the past 12,000 years in West Eurasians, suggestive of positive selection.

Together, our study highlights the potential effects of the agricultural revolution on human genomes and the importance of structural variation in human adaptation. Dietary changes have had a major role in human adaptation and evolution, impacting phenotypes such as lactase persistence and polyunsaturated fatty acid metabolism.

One of the most substantial recent changes to the human diet is the shift from hunter-gatherer societies to agriculture-based subsistence. The earliest instance of crop domestication can be traced to the Fertile Crescent of southwestern Asia approximately 12 thousand years before present (kyr bp), laying the foundation for the Neolithic revolution.

Agriculture subsequently spread rapidly westward into Europe by way of Anatolia by approximately 8.5 kyr bp and eastward into the Indian subcontinent.

However, the transition to agriculture-based subsistence has happened independently several other times throughout human history, and today, the overwhelming majority of carbohydrates consumed by humans are derived from agriculture.

Plant-based diets are rich in starches, which are broken down into simple sugars by α -amylase enzymes in mammals. Human genomes contain three different amylase genes located proximally to one another at a single locus: *AMY1*, which is expressed exclusively in salivary glands, and *AMY2A* and *AMY2B*, which are expressed exclusively in the pancreas.

Costa, F.M., et al (2024) **Archaeological findings show the extent of primitive characteristics of maize in South America.** SCIENCE ADVANCES 10:10.1126/sciadv.adn1466 (available as a free pdf)

[Corn, or maize as it is known outside Canada and the USA, is a man-made species that does not exist in nature. About 9,000 years ago Mexican farmers discovered a mutant of the grass teosinte that did not have hard shells on its seeds and did not drop them at maturity. They then bred them into modern-day corn.]

Authors' abstract: *Scientific research has suggested that maize spread from Mexico and arrived in lowland South America in a state of partial domestication. However, archaeological samples with primitive morphological characteristics that corroborate this finding have not been recorded in the region thus far.*

Unexpectedly, many samples were identified in the Peruaçu Valley with characteristics never previously observed in South America.

These archaeological samples with primitive characteristics, which are the focus of this work, represent the furthest records from the center of origin of the species and the longest duration of the maintenance of such characteristics (between 1010 and 570 years before present).

The findings of this study, including archaeological samples, native races, and samples of teosinte, attest to a long history of maize diversification in lowland South America.

Moreno-Mayar, J.V., et al (2024) **Ancient Rapanui genomes reveal resilience and pre-European contact with the Americas.** NATURE 633:doi.org/10.1038/s41586-024-07881-4 (available as a free pdf)

Authors' abstract: *Rapa Nui (also known as Easter Island) is one of the most isolated inhabited places in the world. It has captured the imagination of many owing to its archaeological record, which includes iconic megalithic statues called moai.*

Two prominent contentions have arisen from the extensive study of Rapa Nui. First, the history of the Rapanui has been presented as a warning tale of resource overexploitation that would have culminated in a major population collapse, the 'ecocide' theory.

Second, the possibility of trans-Pacific voyages to the Americas pre-dating European contact is still debated. Here, to address these questions, we reconstructed the genomic history of the Rapanui on the basis of 15 ancient Rapanui individuals that we radiocarbon dated (1670 to 1950 CE) and whole-genome sequenced.

We find that these individuals are Polynesian in origin and most closely related to present-day Rapanui, a finding that will contribute to repatriation efforts. Through effective population size reconstructions and extensive population genetics simulations, we reject a scenario involving a severe population bottleneck during the 1600s, as proposed by the ecocide theory.

Furthermore, the ancient and present-day Rapanui carry similar proportions of Native American admixture (about 10%). Using a Bayesian approach integrating genetic and radiocarbon dates, we estimate that this admixture event occurred about 1250 to 1430 CE.

Rapa Nui, also known as Te Pito o Te Henua ('the navel of the world'), is one of the most isolated inhabited places in the world. Located in the Pacific, on the easternmost tip of the Polynesian Triangle, it lies 3,700 km west of South America and more than 1,900 km east of the closest inhabited island.

Despite the remoteness of Rapa Nui, archaeological and genetic evidence shows that Polynesian peoples from the west had already reached the island about 1250 CE. The following five centuries saw the Rapanui, the inhabitants of Rapa Nui, develop a culture characterized by iconic giant stone statues (moai)

and monumental stone platforms (ahu). Owing to the isolation of Rapa Nui, Europeans reached the island only in 1722 CE.

Over the years, European visitors had a devastating impact on the Rapanui as they killed local inhabitants and introduced deadly pathogens that the islanders had not been exposed to before.

Furthermore, in the 1860s, Peruvian slave raiders kidnapped a third of the population, and only a few were repatriated after international condemnation of the slaving practices. Subsequently, a smallpox outbreak decimated the Rapanui population and it fell to an estimated 110 individuals.

Crist, W., and R. Abdullayev (2024) **Herding with the hounds: The game of fifty-eight holes in the Abseron Peninsula.** EUROPEAN JOURNAL OF ARCHAEOLOGY 27:doi.org/10.1017/eea.2024.24 (available as a free pdf)

Authors' abstract: *The game of fifty-eight holes is one of the longest recognized games of antiquity, but also one of the least understood.*

New evidence from the Caspian littoral points to an early adoption of the game by Middle Bronze Age seasonally pastoral cattle herders in the late third millennium and early second millennium BC. Six boards bearing this game's distinct pattern were found at sites on the Abseron Peninsula and Gobustan Reserve in Azerbaijan.

Their presence there not only indicates that the region was connected to societies to the south, but also demonstrates the game's popularity across cultures and socioeconomic groups. Its supposed first appearance in Egypt is questioned in favour of a south-western Asian origin.

The game of fifty-eight holes, sometimes known as 'hounds and jackals' (so named because the first gaming pieces found feature either a jackal's or a hound's head), was played for more than a millennium from the Middle Bronze Age into the Iron Age.

*Its ancient name is lost, though Finkel suggests that it could have been the *isb* from the Middle Kingdom Egyptian Tomb of Khety or the *patti-abzu* mentioned in a letter from Tushratta to Amenhotep III.*

Boards have been found in a broad region covering Egypt, the Levant, Mesopotamia, Iran, and Anatolia. Recently, patterns of shallow depressions identified on stone outcrops and portable stone objects indicate that this game was also played during that period in the southern Caucasus.

[Image from this paper shows the game board. No one knows how it was played. Cribbage anyone?]



Modern Humans.

Fannin, L.D., et al (2024) **Commemorating the monkey bars, catalyst of debate at the intersection of human evolutionary biology and public health.** EVOLUTION, MEDICINE, AND PUBLIC HEALTH 12:doi.org/10.1093/emph/eoae017/7735986 (available as a free pdf)

Authors' abstract: *Play is an essential part of childhood, and growing attention has focused on the potential health benefits of risky or thrill-seeking play. Such play behavior is readily observed on any playground, where it can sometimes lead to injuries, most often from fall impacts, that require medical attention.*

Monkey bars account for ~7% of childhood arm fractures in the United States, an alarming statistic that raises difficult questions over its costs and benefits.

Many authors view monkey bars as a public health hazard, but it is plausible that our childhood impulse toward thrill-seeking play is a result of selective pressures throughout our primate evolutionary history.

Indeed, emerging evidence suggests that the developmental benefits of thrill-seeking play extend into adulthood, outweighing the occasional costs of injury.

Disparate and consequential, these dueling perspectives have fueled debate among health professionals and policymakers, but with little attention to the work of biological anthropologists.

Here we call attention to the hominin fossil record and play behaviors of non-human primates, providing a novel perspective that bolsters arguments for the adaptive significance of thrill-seeking play.

The moment for such a review is timely, for it commemorates the centennial anniversaries of two playground icons: the jungle gym and monkey bars.

Speirs: When I was a young lad and it were all green fields around here, every playground had monkey bars and merry-go-rounds. We had great fun but the next generations never knew them. They were a hazard, although no one ever banned automobiles just because the occasional child was run over on the way home.

Technology.

Hofmann, V., et al (2024) **AI generates covertly racist decisions about people based on their dialect.** NATURE 633:doi.org/10.1038/s41586-024-07856-5 (available as a free pdf)

Authors' abstract: *Hundreds of millions of people now interact with language models, with uses ranging from help with writing to informing hiring decisions.*

However, these language models are known to perpetuate systematic racial prejudices, making their judgements biased in problematic ways about groups such as African Americans.

Although previous research has focused on overt racism in language models, social scientists have argued that racism with a more subtle character has developed over time, particularly in the United States after the civil rights movement. It is unknown whether this covert racism manifests in language models.

Here, we demonstrate that language models embody covert racism in the form of dialect prejudice, exhibiting raciolinguistic stereotypes about speakers of African American English (AAE) that are more negative than any human stereotypes about African Americans ever experimentally recorded.

By contrast, the language models' overt stereotypes about African Americans are more positive. Dialect prejudice has the potential for harmful consequences. Language models are more likely to suggest that speakers of AAE be assigned less-prestigious jobs, be convicted of crimes and be sentenced to death.

Finally, we show that current practices of alleviating racial bias in language models, such as human preference alignment, exacerbate the discrepancy between covert and overt stereotypes, by superficially obscuring the racism that language models maintain on a deeper level.

Crespi, S., et al (2024) **Sensorimotor control of robots mediated by electrophysiological measurements of fungal mycelia.** SCIENCE ROBOTICS 9:doi.org/10.1126/scirobotics.adk8019

Authors' abstract: *Living tissues are still far from being used as practical components in biohybrid robots because of limitations in life span, sensitivity to environmental factors, and stringent culture procedures.*

Here, we introduce fungal mycelia as an easy-to-use and robust living component in biohybrid robots. We constructed two biohybrid robots that use the electrophysiological activity of living mycelia to control their artificial actuators.

The mycelia sense their environment and issue action potential-like spiking voltages as control signals to the motors and valves of the robots that we designed and built.

The paper highlights two key innovations: first, a vibration- and electromagnetic interference-shielded mycelium electrical interface that allows for stable, long-term electrophysiological bioelectric recordings during untethered, mobile operation;

second, a control architecture for robots inspired by neural central pattern generators, incorporating rhythmic patterns of positive and negative spikes from the living mycelia.

We used these signals to control a walking soft robot as well as a wheeled hard one. We also demonstrated the use of mycelia to respond to environmental cues by using ultraviolet light stimulation to augment the robots' gaits.