

References

Aktuell

BAHCALL 2015

Neta A. Bahcall, *Dark matter universe*. [PNAS 112 \(2015\), 12243–12245](#).

Most of the mass in the universe is in the form of dark matter—a new type of nonbaryonic particle not yet detected in the laboratory or in other detection experiments. The evidence for the existence of dark matter through its gravitational impact is clear in astronomical observations—from the early observations of the large motions of galaxies in clusters and the motions of stars and gas in galaxies, to observations of the large-scale structure in the universe, gravitational lensing, and the cosmic microwave background. The extensive data consistently show the dominance of dark matter and quantify its amount and distribution, assuming general relativity is valid. The data inform us that the dark matter is nonbaryonic, is “cold” (i.e., moves nonrelativistically in the early universe), and interacts only weakly with matter other than by gravity. The current Lambda cold dark matter cosmology—a simple (but strange) flat cold dark matter model dominated by a cosmological constant Lambda, with only six basic parameters (including the density of matter and of baryons, the initial mass fluctuations amplitude and its scale dependence, and the age of the universe and of the first stars)—fits remarkably well all the accumulated data. However, what is the dark matter? This is one of the most fundamental open questions in cosmology and particle physics. Its existence requires an extension of our current understanding of particle physics or otherwise point to a modification of gravity on cosmological scales. The exploration and ultimate detection of dark matter are led by experiments for direct and indirect detection of this yet mysterious particle.

FU 2015

Yongshuo H. Fu et al., *Declining global warming effects on the phenology of spring leaf unfolding*. [nature 526 \(2015\), 104–107](#).

[n526-0104-Supplement.pdf](#)

Yongshuo H. Fu, Hongfang Zhao, Shilong Piao, Marc Peaucelle, Shushi Peng, Guiyun Zhou, Philippe Ciais, Mengtian Huang, Annette Menzel, Josep Peñuelas, Yang Song, Yann Vitasse, Zhenzhong Zeng & Ivan A. Janssens

Earlier spring leaf unfolding is a frequently observed response of plants to climate warming. Many deciduous tree species require chilling for dormancy release, and warming-related reductions in chilling may counteract the advance of leaf unfolding in response to warming. Empirical evidence for this, however, is limited to saplings or twigs in climate-controlled chambers. Using long-term in situ observations of leaf unfolding for seven dominant European tree species at 1,245 sites, here we show that the apparent response of leaf unfolding to climate warming (ST, expressed in days advance of leaf unfolding per °C warming) has significantly decreased from 1980 to 2013 in all monitored tree species. Averaged across all species and sites, ST decreased by 40 % from 4.0 ± 1.8 days/°C during 1980–1994 to 2.3 ± 1.6 days/°C during 1999–2013. The declining ST was also simulated by chilling-based phenology models, albeit with a weaker decline (24–30 %) than observed in situ. The reduction in ST is likely to be partly attributable to reduced

chilling. Nonetheless, other mechanisms may also have a role, such as ‘photoperiod limitation’ mechanisms that may become ultimately limiting when leaf unfolding dates occur too early in the season. Our results provide empirical evidence for a declining ST, but also suggest that the predicted strong winter warming in the future may further reduce ST and therefore result in a slowdown in the advance of tree spring phenology.

FUNK 2015

Stefan Funk, *Indirect detection of dark matter with γ rays*. [PNAS 112 \(2015\), 12264–12271](#).

The details of what constitutes the majority of the mass that makes up dark matter in the Universe remains one of the prime puzzles of cosmology and particle physics today—80 y after the first observational indications. Today, it is widely accepted that dark matter exists and that it is very likely composed of elementary particles, which are weakly interacting and massive [weakly interacting massive particles (WIMPs)]. As important as dark matter is in our understanding of cosmology, the detection of these particles has thus far been elusive. Their primary properties such as mass and interaction cross sections are still unknown. Indirect detection searches for the products of WIMP annihilation or decay. This is generally done through observations of $\tilde{\alpha}$ -ray photons or cosmic rays. Instruments such as the Fermi large-area telescope, high-energy stereoscopic system, major atmospheric gamma-ray imaging Cherenkov, and very energetic radiation imaging telescope array, combined with the future Cherenkov telescope array, will provide important complementarity to other search techniques. Given the expected sensitivities of all search techniques, we are at a stage where the WIMP scenario is facing stringent tests, and it can be expected that WIMPs will be either be detected or the scenario will be so severely constrained that it will have to be rethought. In this sense, we are on the threshold of discovery. In this article, I will give a general overview of the current status and future expectations for indirect searches of dark matter (WIMP) particles.

Keywords: CTA | Fermi-LAT | H.E.S.S. | MAGIC | VERITAS

GINO 2015

Francesca Gino, Caroline Ashley Wilmuth & Alison Wood Brooks, *Compared to men, women view professional advancement as equally attainable, but less desirable*. [PNAS 112 \(2015\), 12354–12359](#).

Women are underrepresented in most high-level positions in organizations. Though a great deal of research has provided evidence that bias and discrimination give rise to and perpetuate this gender disparity, in the current research we explore another explanation: men and women view professional advancement differently, and their views affect their decisions to climb the corporate ladder (or not). In studies 1 and 2, when asked to list their core goals in life, women listed more life goals overall than men, and a smaller proportion of their goals related to achieving power at work. In studies 3 and 4, compared to men, women viewed highlevel positions as less desirable yet equally attainable. In studies 5–7, when faced with the possibility of receiving a promotion at their current place of employment or obtaining a high-power position after graduating from college, women and men anticipated similar levels of positive outcomes (e.g., prestige and money), but women anticipated more negative outcomes (e.g., conflict and tradeoffs). In these studies, women associated high-level positions with conflict, which explained the relationship between gender and the desirability of professional advancement. Finally, in studies 8 and 9, men and women alike rated power as one of the main

consequences of professional advancement. Our findings reveal that men and women have different perceptions of what the experience of holding a high-level position will be like, with meaningful implications for the perpetuation of the gender disparity that exists at the top of organizational hierarchies.

Keywords: gender | professional advancement | goals | power | achievement

Significance: We identify a profound and consistent gender gap in people's core life goals. Across nine studies using diverse sample populations (executives in high-power positions, recent graduates of a top MBA program, undergraduate students, and online panels of working adults) and over 4,000 participants, we find that, compared to men, women have a higher number of life goals, place less importance on power-related goals, associate more negative outcomes (e.g., time constraints and tradeoffs) with high-power positions, perceive power as less desirable, and are less likely to take advantage of opportunities for professional advancement. Women view high-level positions as equally attainable as men do, but less desirable. Our findings advance the science of gender, goals, organizational behavior, and decision making.

KEENAN 2015

Trevor F. Keenan, *Spring greening in a warming world*. [nature](#) **526** (2015), 48–49.

Warmer temperatures have been associated with an earlier emergence of spring leaves each year. New data, however, suggest that leaf emergence is becoming less sensitive to temperature as global temperatures rise.

VAN DER LEE 2015

Romy van der Lee & Naomi Ellemers, *Gender contributes to personal research funding success in The Netherlands*. [PNAS](#) **112** (2015), 12349–12353.

We examined the application and review materials of three calls ($n = 2,823$) of a prestigious grant for personal research funding in a national full population of early career scientists awarded by the Netherlands Organization for Scientific Research (NWO). Results showed evidence of gender bias in application evaluations and success rates, as well as in language use in instructions and evaluation sheets. Male applicants received significantly more competitive “quality of researcher” evaluations (but not “quality of proposal” evaluations) and had significantly higher application success rates than female applicants. Gender disparities were most prevalent in scientific disciplines with the highest number of applications and with equal gender distribution among the applicants (i.e., life sciences and social sciences). Moreover, content analyses of the instructional and evaluation materials revealed the use of gendered language favoring male applicants. Overall, our data reveal a 4% “loss” of women during the grant review procedure, and illustrate the perpetuation of the funding gap, which contributes to the underrepresentation of women in academia.

Keywords: gender bias | research funding | success rates | academia | STEM

Significance: Women remain underrepresented in academia as they continue to face a leadership gap, salary gap, and funding gap. Closing the funding gap is of particular importance, because this may directly retain women in academia and foster the closing of other gaps. In this study, we examined the grant funding rates of a national full population of early career scientists. Our results reveal gender bias favoring male applicants over female applicants in the prioritization of their “quality of researcher” (but not “quality of proposal”) evaluations and success rates, as well as in the language use in instructional and evaluation materials. This

work illuminates how and when the funding gap and the subsequent underrepresentation of women in academia are perpetuated.

MANN 2015

Adam Mann, *Reionizing the universe*, *News Feature*. [PNAS 112 \(2015\), 12225–12227](#).

A slew of current and planned space projects should help scientists better understand the mysterious star- and galaxy-forming epoch that followed the Big Bang.

PEEBLES 2015

P. James E. Peebles¹, *Dark matter*. [PNAS 112 \(2015\), 12246–12248](#).

The evidence for the dark matter (DM) of the hot big bang cosmology is about as good as it gets in natural science. The exploration of its nature is now led by direct and indirect detection experiments, to be complemented by advances in the full range of cosmological tests, including judicious consideration of the rich phenomenology of galaxies. The results may confirm ideas about DM already under discussion. If we are lucky, we also will be surprised once again.

Keywords: cosmic structure | dark energy

Amerika

HALFFMAN 2015

Carrin M. Halffman et al., *Early human use of anadromous salmon in North America at 11,500 y ago*. [PNAS 112 \(2015\), 12344–12348](#).

Carrin M. Halffman, Ben A. Potter, Holly J. McKinney, Bruce P. Finney, Antonia T. Rodrigues, Dongya Y. Yang & Brian M. Kemp

Salmon represented a critical resource for prehistoric foragers along the North Pacific Rim, and continue to be economically and culturally important; however, the origins of salmon exploitation remain unresolved. Here we report 11,500-y-old salmon associated with a cooking hearth and human burials from the Upward Sun River Site, near the modern extreme edge of salmon habitat in central Alaska. This represents the earliest known human use of salmon in North America. Ancient DNA analyses establish the species as *Oncorhynchus keta* (chum salmon), and stable isotope analyses indicate anadromy, suggesting that salmon runs were established by at least the terminal Pleistocene. The early use of this resource has important implications for Paleoindian land use, economy, and expansions into northwest North America.

Keywords: salmon | Paleoindians | Beringia | ancient DNA | stable isotopes

Significance: Fish bones from the 11,500-y-old Upward Sun River site in interior Alaska represent the oldest evidence for salmon fishing in North America. We used ancient DNA analysis to identify the fish specimens as chum salmon (*Oncorhynchus keta*), and stable isotope analysis to confirm that the salmon were anadromous (searun). The exploitation of salmon at this early date is noteworthy because Paleoindians are traditionally portrayed as big-game hunting specialists. Furthermore, the presence of salmon at Upward Sun River over 1,400 km upriver from the coast shows that spawning runs had been established by the end of the last Ice Age. The early availability and use of anadromous salmon has important implications for understanding Paleoindian economies and expansion into North America.

Anthropologie

CONSORTIUM 2015

The 1000 Genomes Project Consortium, *A global reference for human genetic variation*. *nature* **526** (2015), 68–74.

n526-0068-Supplement.pdf

The 1000 Genomes Project set out to provide a comprehensive description of common human genetic variation by applying whole-genome sequencing to a diverse set of individuals from multiple populations. Here we report completion of the project, having reconstructed the genomes of 2,504 individuals from 26 populations using a combination of low-coverage whole-genome sequencing, deep exome sequencing, and dense microarray genotyping. We characterized a broad spectrum of genetic variation, in total over 88 million variants (84.7 million single nucleotide polymorphisms (SNPs), 3.6 million short insertions/deletions (indels), and 60,000 structural variants), all phased onto high-quality haplotypes. This resource includes >99% of SNP variants with a frequency of >1% for a variety of ancestries. We describe the distribution of genetic variation across the global sample, and discuss the implications for common disease studies.

LEVIN 2015

Naomi E. Levin, Yohannes Haile-Selassie, Stephen R. Frost & Beverly Z. Saylor, *Dietary change among hominins and cercopithecids in Ethiopia during the early Pliocene*. *PNAS* **112** (2015), 12304–12309.

pnas112-12304-Supplement.zip

The incorporation of C4 resources into hominin diet signifies increased dietary breadth within hominins and divergence from the dietary patterns of other great apes. Morphological evidence indicates that hominin diet became increasingly diverse by 4.2 million years ago but may not have included large proportions of C4 foods until 800 thousand years later, given the available isotopic evidence. Here we use carbon isotope data from early to mid Pliocene hominin and cercopithecoid fossils from Woranso-Mille (central Afar, Ethiopia) to constrain the timing of this dietary change and its ecological context. We show that both hominins and some papionins expanded their diets to include C4 resources as early as 3.76 Ma. Among hominins, this dietary expansion postdates the major dentognathic morphological changes that distinguish *Australopithecus* from *Ardipithecus*, but it occurs amid a continuum of adaptations to diets of tougher, harder foods and to committed terrestrial bipedality. In contrast, carbon isotope data from cercopithecids indicate that C4-dominated diets of the earliest members of the *Theropithecus oswaldi* lineage preceded the dental specialization for grazing but occurred after they were fully terrestrial. The combined data indicate that the inclusion of C4 foods in hominin diet occurred as part of broader ecological changes in African primate communities.

Keywords: hominins | Woranso-Mille | *Theropithecus* | carbon isotopes | paleodiet

Significance: Dietary change among hominins is a critical aspect of human evolution. Here we use carbon isotope data from fossil teeth of hominins, monkeys, and other mammals from Ethiopia to document C4 food consumption by both hominins and the baboon, *Theropithecus oswaldi*, during the early Pliocene. The expansion of hominin diet and the appearance of the *Theropithecus oswaldi* lineage as early as 3.76 Ma mark a major ecological change within African primate communities. The ability to eat a range of C3 and C4 foods indicates that early Pliocene hominins were likely generalists who could thrive in different and perhaps varying environments.

Bibel

FAUST 2007

Avraham Faust, *Settlement Dynamics and Demographic Fluctuations in Judah from the Late Iron Age to the Hellenistic Period and the Archaeology of Persian-Period Yehud*. In: YIGAL LEVIN (Hrsg.), *A Time of Change, Judah and its Neighbours in the Persian and Early Hellenistic Period*. Library of Second Temple studies 65 (London 2007), 23–51.

An examination of the various data regarding demographic and settlement trends during the late Iron Age through the Hellenistic-period era shows that the relative prosperity of the seventh century was followed by a major decline, and then a gradual recovery. While there are several theoretical scenarios that can outline such demographic ups and downs, we have seen that the only plausible reconstruction is that of a sharp and abrupt decline immediately after the Iron Age, and then a gradual recovery that lasted during the Persian period and matured only during the (late) Hellenistic period.

The demographic and settlement peak of the Persian period was (at most) about one-third of those of the late Iron Age and Hellenistic periods. The nadir of the Persian period, however, was much lower. It seems as if the lowest demographic point (probably in the sixth century BCE) was probably around 10% of the late Iron Age (20% would be a highly exaggerated figure).

The collapse of Judahite society in the sixth century BCE had long-term results. The entire Persian period should be viewed as one of postcollapse. All of Judean/Jewish society of the Persian period existed in the shadow of this collapse.

YOUNG 2013

Ian Young, *What Do We Actually Know about Ancient Hebrew*. *Australian Journal of Jewish Studies* 27 (2013), 11–31.

Every book of the Hebrew Bible, in whatever manuscript we have it, is therefore a linguistically composite text reflecting language from different layers of composition, redaction and transmission. No detail or collection of linguistic details in our biblical manuscripts is likely to represent the language of the “original author” or earliest stage of composition, except in very large-scale and exceptional circumstances, such as the overall peculiarity of Qoheleth’s language, or perhaps the stylistic openness to variety of the five so-called “late” books. So we are left with a lot of linguistic evidence in the Hebrew Bible, but we are often unable to work out what to do with it. For example, we will not be able to unravel any linguistic chronology out of the Hebrew Bible (i.e. what is early and late) until we have sufficient dated extra-biblical sources to independently establish such a chronology. The inscriptions I discussed are important and provide some datable and localised samples of language. However, all told, the corpus of inscriptions is not quite 2% of the size of the Hebrew Bible (Clines 2011: 9–10). So it turns out that the answer to the question of what we actually know about ancient Hebrew is: Quite a lot, but perhaps a lot less for certain than we previously thought.

Metallzeiten

GORDON 1992

Robert B. Gordon & David J. Killick, *The Metallurgy of the American Bloomery Process*. *Archeomaterials* 6 (1992), 141–167.

During the nineteenth century, Americans in New Jersey and the Adirondack region of New York brought the ancient bloomery process for the direct reduction of iron to a high state of technological development. Using this process, they were able to make iron as good as the best Swedish grades. Rich magnetite ore was used; low fuel consumption was achieved by preheating the air blast, and labor productivity was maximized by ore preparation and hearth design that speeded the reduction process. Magnetite grains were reduced to particles of sponge iron in the upper part of the hearth, fell with liquid slag, and agglomerated on rims of iron formed around pieces of charcoal to nucleate the bloom. The hearth was manipulated to form a pool of liquid slag on top of the bloom that served as a trap for descending sponge-iron particles. The iron in the bloom was often partially carburized by entrapped charcoal particles. Although dismissed by some historians as “primitive,” the American bloomery process was a sophisticated adaptation of an ancient technology to local resources and economic conditions and was capable of producing grades of iron for special applications not easily made in other ways.

HAWASS 2010

Zahi Hawass et al., *Ancestry and Pathology in King Tutankhamun's Family*. [Journal of the American Medical Association](#) **303** (2010), 638–647.

JAMA303-0638-Supplement.pdf

Zahi Hawass, Yehia Z. Gad, Somaia Ismail, Rabab Khairat, Dina Fathalla, Naglaa Hasan, Amal Ahmed, Hisham Elleithy, Markus Ball, Fawzi Gaballah, Sally Wasef, Mohamed Fateen, Hany Amer, Paul Gostner, Ashraf Selim, Albert Zink, Carsten M. Pusch

Context The New Kingdom in ancient Egypt, comprising the 18th, 19th, and 20th dynasties, spanned the mid-16th to the early 11th centuries BC. The late 18th dynasty, which included the reigns of pharaohs Akhenaten and Tutankhamun, was an extraordinary time. The identification of a number of royal mummies from this era, the exact relationships between some members of the royal family, and possible illnesses and causes of death have been matters of debate.

Objectives To introduce a new approach to molecular and medical Egyptology, to determine familial relationships among 11 royal mummies of the New Kingdom, and to search for pathological features attributable to possible murder, consanguinity, inherited disorders, and infectious diseases.

Design From September 2007 to October 2009, royal mummies underwent detailed anthropological, radiological, and genetic studies as part of the King Tutankhamun Family Project. Mummies distinct from Tutankhamun's immediate lineage served as the genetic and morphological reference. To authenticate DNA results, analytical steps were repeated and independently replicated in a second ancient DNA laboratory staffed by a separate group of personnel. Eleven royal mummies dating from circa 1410-1324 BC and suspected of being kindred of Tutankhamun and 5 royal mummies dating to an earlier period, circa 1550-1479 BC, were examined.

Main Outcome Measures Microsatellite-based haplotypes in the mummies, generational segregation of alleles within possible pedigree variants, and correlation of identified diseases with individual age, archeological evidence, and the written historical record.

Results Genetic fingerprinting allowed the construction of a 5-generation pedigree of Tutankhamun's immediate lineage. The KV55 mummy and KV35YL were identified as the parents of Tutankhamun. No signs of gynecomastia and craniosynostoses (eg, Antley-Bixler syndrome) or Marfan syndrome were found, but an accumulation of malformations in Tutankhamun's family was evident. Several

pathologies including Köhler disease II were diagnosed in Tutankhamun; none alone would have caused death. Genetic testing for STEVOR, AMA1, or MSP1 genes specific for *Plasmodium falciparum* revealed indications of malaria tropica in 4 mummies, including Tutankhamun's. These results suggest avascular bone necrosis in conjunction with the malarial infection as the most likely cause of death in Tutankhamun. Walking impairment and malarial disease sustained by Tutankhamun is supported by the discovery of canes and an afterlife pharmacy in his tomb.

Conclusion Using a multidisciplinary scientific approach, we showed the feasibility of gathering data on Pharaonic kinship and diseases and speculated about individual causes of death.

Politik

EXTANCE 2015

Andy Extance, *Bitcoin and Beyond*. [nature 526 \(2015\), 21–23](#).

The digital currency has caused any number of headaches for law enforcement. Now entrepreneurs and academics are scrambling to build a better version.

Nakamoto's central challenge with this wideopen system was the need to make sure that no one could find a way to rewrite the ledger and spend the same bitcoins twice — in effect, stealing bitcoins. His solution was to turn the addition of new transactions to the ledger into a competition: an activity that has come to be known as mining (see 'The Bitcoin game').

Mining starts with incoming Bitcoin transactions, which are continuously broadcast to every computer on the network. These are collected by 'miners' — the groups or individuals who choose to participate — who start competing for the right to bundle transactions into a new block. The winner is the first to broadcast a 'proof of work' — a solution showing that he or she has solved an otherwise meaningless mathematical puzzle that involves encrypted data from the previous block, and lots of computerized trial and error. The winning block is broadcast through the Bitcoin network and added to the block chain, with the proof of work providing an all but unbreakable link. The block chain is currently almost 400,000 blocks long.

In principle, this competition keeps the block chain secure because the puzzle is too hard for any one miner to solve every time. This means that no one will ever gain access to the encrypted links in the block chain and the ability to rewrite the ledger.

Mining is also a way to steadily increase the bitcoin supply: the miner who wins each block gets a reward, currently 25 new bitcoins. That is worth almost \$6,000 at today's prices. Nakamoto's design controls the supply increase by automatically adjusting the difficulty of the puzzle so that a new block is added roughly every ten minutes. In addition, the reward for creating a block decreases by half roughly every four years. The goal is to limit the supply to a maximum of 21 million bitcoins.