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References

Aktuell

Fan 2016

Weiwei Fan & Ronald Evans, *The quest to burn fat, effortlessly and safely*. science **353** (2016), 749–750.

An enzyme steps up to BAT as a potential mitochondrial uncoupler.

Mammals develop brown adipose tissue (BAT) and beige adipose tissue that are specialized in thermogenesis by their high expression of uncoupling protein 1 (UCP1), an endogenous mitochondrial uncoupler. To discover new proteins that contribute to thermogenesis, Long et al. conducted a combinatorial genomic and proteomic study and identified PM20D1, whose expression is highly enriched in UCP1-positive adipocytes.

The findings of Long et al. open a door on a new class of endogenous mitochondrial uncouplers and present a new mechanism of adaptive thermogenesis via a secreted enzyme and its products. However, every open door reveals more questions than it answers, and follow-up studies are required. We are left to ponder the hope of a magic pill offering effortless and consequence-free fat burning.

Getzin 2016

Stephan Getzin et al., *Hexagonal patterns of Australian fairy circles develop without correlation to termitaria*, *Reply to Walsh et al.* PNAS **113** (2016), E5368–E5369.

Stephan Getzin, Hezi Yizhaq, Bronwyn Bell, Todd E. Erickson, Anthony C. Postle, Itzhak Katra, Omer Tzuk, Yuval R. Zelnik, Kerstin Wiegand, Thorsten Wiegand & Ehud Meron

We verified in the field thatmechanical crusts resulting from soil weathering were easily distinguishable from crusts potentially resulting from pavement mounds (8). Mechanical crusts are only a few millimeters to a few centimeters thick, and when they were removed, loose sand was found underneath them (Fig. 1 A and B).

Manrique 2016

Pilar Manrique, Benjamin Bolduc, Seth T. Walk, John van der Oost, Willem M. de Vos & Mark J. Young, *Healthy human gut phageome*. PNAS **113** (2016), 10400–10405.

The role of bacteriophages in influencing the structure and function of the healthy human gut microbiome is unknown. With few exceptions, previous studies have found a high level of heterogeneity in bacteriophages from healthy individuals. To better estimate and identify the shared phageome of humans, we analyzed a deep DNA sequence dataset of active bacteriophages and available metagenomic datasets of the gut bacteriophage community from healthy individuals. We found 23 shared bacteriophages in more than one-half of 64 healthy individuals from around the world. These shared bacteriophages were found in a significantly smaller percentage of individuals with gastrointestinal/irritable bowel disease. A network analysis identified 44 bacteriophage groups of which 9 (20 %) were shared in more than one-half of all 64 individuals. These results provide strong evidence of a healthy gut phageome (HGP) in humans. The bacteriophage community in the human gut is a mixture of three classes: a set of core bacteriophages shared

among more than one-half of all people, a common set of bacteriophages found in 20–50 % of individuals, and a set of bacteriophages that are either rarely shared or unique to a person. We propose that the core and common bacteriophage communities are globally distributed and comprise the HGP, which plays an important role in maintaining gut microbiome structure/function and thereby contributes significantly to human health.

Keywords: gut microbiome bacteriophage | human gut viral metagenome | shared microbiome viruses | gut microbiome viruses

Significance: Humans need a stable, balanced gut microbiome (GM) to be healthy. The GM is influenced by bacteriophages that infect bacterial hosts. In this work, bacteriophages associated with the GM of healthy individuals were analyzed, and a healthy gut phageome (HGP) was discovered. The HGP is composed of core and common bacteriophages common to healthy adult individuals and is likely globally distributed. We posit that the HGP plays a critical role in maintaining the proper function of a healthy GM. As expected, we found that the HGP is significantly decreased in individuals with gastrointestinal disease (ulcerative colitis and Crohn's disease). Together, these results reveal a large community of human gut bacteriophages that likely contribute to maintaining human health.

Naviaux 2016

Robert K. Naviaux et al., *Metabolic features of chronic fatigue syndrome*. PNAS **113** (2016), E5472–E5480.

Robert K. Naviaux, Jane C. Naviaux, Kefeng Li, A. Taylor Bright, William A. Alaynick, Lin Wang, Asha Baxter, Neil Nathan, Wayne Anderson & Eric Gordon

More than 2 million people in the United States have myalgic encephalomyelitis/chronic fatigue syndrome (ME/CFS). We performed targeted, broad-spectrum metabolomics to gain insights into the biology of CFS. We studied a total of 84 subjects using thesemethods. Forty-five subjects (n = 22 men and 23 women) met diagnostic criteria for ME/CFS by Institute of Medicine, Canadian, and Fukuda criteria. Thirty-nine subjects (n = 18 men and 21 women) were age- and sexmatched normal controls.Males with CFS were 53 (±2.8) y old (mean ± SEM; range, 21–67 y). Females were 52 (±2.5) y old (range, 20–67 y). The Karnofsky performance scores were 62 (±3.2) for males and 54 (±3.3) for females. We targeted 612 metabolites in plasma from 63 biochemical pathways by hydrophilic interaction liquid chromatography, electrospray ionization, and tandem mass spectrometry in a singleinjection method. Patients with CFS showed abnormalities in 20 metabolic pathways. Eighty percent of the diagnostic metabolites were decreased, consistent with a hypometabolic syndrome. Pathway abnormalities included sphingolipid, phospholipid, purine, cholesterol, microbiome, pyrroline-5-carboxylate, riboflavin, branch chain amino acid, peroxisomal, and mitochondrial metabolism. Area under the receiver operator characteristic curve analysis showed diagnostic accuracies of 94 % [95 % confidence interval (CI), 84–100 %] in males using eight metabolites and 96 % (95 % CI, 86–100 %) in females using 13 metabolites. Our data show that despite the heterogeneity of factors leading to CFS, the cellular metabolic response in patients was homogeneous, statistically robust, and chemically similar to the evolutionarily conserved persistence response to environmental stress known as dauer.

Keywords: chronic fatigue syndrome | metabolomics | mitochondria | dauer | cell danger response

Significance: Chronic fatigue syndrome is amultisystemdisease that causes longterm pain and disability. It is difficult to diagnose because of its protean symptoms and the lack of a diagnostic laboratory test. We report that targeted, broad-spectrum metabolomics of plasma not only revealed a characteristic chemical signature but also revealed an unexpected underlying biology. Metabolomics

showed that chronic fatigue syndrome is a highly concerted hypometabolic response to environmental stress that traces tomitochondria and was similar to the classically studied developmental state of dauer. This discovery opens a fresh path for the rational development of new therapeutics and identifies metabolomics as a powerful tool to identify the chemical differences that contribute to health and disease.

Singh 2016

Amar M. Singh, *Choosing the nontenure track*. science **353** (2016), 838.

I'm lucky to be in a supportive environment, where I will have the opportunity to write my own grants, do exciting research, and teach undergraduate courses. In some ways, I feel that my current position is better than starting out as a brand new tenure-track assistant professor, because I get to do the research I enjoy without the pressures of fully funding a lab.

Walsh 2016

Fiona J. Walsh, Ashley D. Sparrow, Peter Kendrick & Josef Schofield, *Fairy circles or ghosts of termitaria? Pavement termites as alternative causes of circular patterns in vegetation of desert Australia*. PNAS **113** (2016), E5365–E5367.

Alternative causal factors, including termites, were investigated but rejected. We have evidence that bare patches are subterranean termitaria, both active and inactive (abandoned). We have frequently observed bare circular areas that appear as "gaps" as defined by Getzin et al. but are actually pavement termitaria. Our preliminary excavations beneath circles at four locations (Table 1) revealed all gaps had termitaria typical of Drepanotermes harvester termites. Termite chambers occurred within 5 cm of the surface within a metastable matrix (Fig. 1 D and E). Gap-termite associations in Australian deserts are cryptic to the unfamiliar. Drepanotermes are leaf harvesters, surface-active only during cooler or humid conditions (4), and thus ecologically different from Namibian root eater and sand termite guilds.

Yuan 2016

Guoxiang Yuan et al., *H2S production by reactive oxygen species in the carotid body triggers hypertension in a rodent model of sleep apnea*. Science Signaling **9** (2016), ra80. DOI:10.1126/scisignal.aaf3204.

Guoxiang Yuan, Ying-Jie Peng, Shakil A. Khan, Jayasri Nanduri, Amritha Singh, Chirag Vasavda, Gregg L. Semenza, Ganesh K. Kumar, Solomon H. Snyder & Nanduri R. Prabhakar

Sleep apnea is a prevalent respiratory disease in which episodic cessation of breathing causes intermittent hypoxia. Patients with sleep apnea and rodents exposed to intermittent hypoxia exhibit hypertension. The carotid body senses changes in blood O2 concentrations, and an enhanced carotid body chemosensory reflex contributes to hypertension in sleep apnea patients. A rodent model of intermittent hypoxia that mimics blood O2 saturation profiles of patients with sleep apnea has shown that increased generation of reactive oxygen species (ROS) in the carotid body enhances the chemosensory reflex and triggers hypertension. CO generated by heme oxygenase-2 (HO-2) induces a signaling pathway that inhibits hydrogen sulfide (H2S) production by cystathionine g-lyase (CSE), leading to suppression of carotid body activity. We found that ROS inhibited CO generation by HO-2 in the carotid body and liver through a mechanism that required Cys265

in the heme regulatory motif of heterologously expressed HO-2. We showed that ROS induced by intermittent hypoxia inhibited CO production and increased H2S concentrations in the carotid body, which stimulated its neural activity. In rodents, blockade of H2S synthesis by CSE, by either pharmacologic or genetic approaches, inhibited carotid body activation and hypertension induced by intermittent hypoxia. Thus, our results indicate that oxidant-induced inactivation of HO-2, which leads to increased CSE-dependent H2S production in the carotid body, is a critical trigger of hypertension in rodents exposed to intermittent hypoxia.

Grabung

Smith 2009

Martin Smith & Megan Brickley, *People of the Long Barrows, Life, Death, and Burial in the Earlier Neolithic.* (Stroud 2009).

Zeeb-Lanz 2014

Andrea Zeeb-Lanz, *Was geschah vor 7000 Jahren in Herxheim? Ritueller Kannibalismus in der Pfalz.* Biologie in unserer Zeit **44** (2014), 172–180.

Hunderte zerstörter Prunkgefäße, etwa 75.000 Fragmente menschlicher Skelette, ca. 500 als Kalotten zugerichtete Schädel – das ist die Kurzbilanz der wichtigsten Funde aus einem jungsteinzeitlichen Erdwerk in Herxheim bei Landau (Pfalz). Was hier von Archäologen der Direktion Landesarchäo logie – Speyer aus dem Boden geborgen wurde, ist in vieler Hinsicht auch nach fast zehn Jahren Forschungsarbeit immer noch ein Rätsel für die Archäologie.

Extreme rituals including anthropophagy In a settlement of the early Neolithic in Herxheim (South Palatinate) the manipulated remains of more than 500 human individuals were detected during excavations in an enclosure surrounding the settlement of the earliest farmers in this region; the human skeleton elements date to the time around 5000 B.C. Meticulous examinations of the in most cases extremely smashed bones yielded cut marks in significant places, comparable to similar traces on butchered animals. This observation and further evidence on the bone material brought forth the interpretation of ritual cannibalism in the frame of an hitherto unknown ceremony – an inimitable situation for prehistory so far.

Luxury ceramic, precious stone tools and grinding stones – all of them intentionally destroyed – amplify the spectrum of findings, emphasizing the highly ritual character of the mysterious actions that took place in Herxheim 7000 years ago.

In einer jungsteinzeitlichen Siedlung in Herxheim (Südpfalz) wurden in einem Erdwerk der frühesten Ackerbauern unserer Breiten die manipulierten Überreste von mehr als 500 menschlichen Individuen entdeckt; sie stammen aus der Zeit um 5000 v. Chr. Im Rahmen eines bislang unbekannten Rituals wurde hier eine erhebliche Anzahl von Menschen getötet, getötet, zerlegt und dann möglicherweise rituell verspeist – ein für die europäische Prähistorie bis dato einmaliger Befund. Prunkkeramik, wertvolle Steingeräte und Mahlsteine – alle systematisch zerstört – gehören ebenfalls zum Fundspektrum von Herxheim und betonen den hochrituellen Charakter der hier vor 7000 Jahren durchgeführten Handlungen.

Keywords: Neolithikum | Linearbandkeramik | Ritual | Kannibalismus | Krise

Isotope

Smrčka 2005

Václav Smrčka et al., *Carbon, Nitrogen and Strontium Isotopes in the Set of Skeletons from the Neolithic Settlement at Vedrovice (Czech Republic)*. Anthropologie (Brünn) **43** (2005), 315–323.

Václav Smrčka, František Bůzek, Vojtěch Erban, Tomáš Berkovec, Marta Dočkalová, Kateřina Neumanová, Miriam Nŷvltová Fišáková

Isotopes C, N, Sr were employed in the study of eleven skeletons from the Neolithic settlements of the Linear Pottery Culture at Vedrovice. Samples of ribs were used for the analysis of 13C, 12C and 15N, 14N from organic part of the bone collagen. The scope of stable isotopes in the bone collagen is + 8.8 to 12 ‰ for d15N and between –20.5 and –21.9 ‰ for d13C in the skeletons. This indicates a population dependent on the inland plants of the type C3 of the photosynthetic cycle (wheat). The ratio of the isotopes of strontium 87Sr and 86Sr from the tooth tissue M1 and from compact bone of the middle part of the femur was used for distinction of the migrants. In the settlement at Vedrovice children in the grave 3/1966 (6–7 years) and in grave 4/1969 (child 7–8 years) most probably were from non-local population. Individuals from grave 5/1971 (child 5–6 years) and male in grave 10/1974 (40–50 years) may have moved more than once.

Keywords: Diet | Migration | Bone | Teeth | Geochemistry | Neolithic

Klima

Thual 2016

Sulian Thual, Andrew J. Majda, Nan Chen & Samuel N. Stechmann, *Simple stochastic model for El Niño with westerly wind bursts*. PNAS **113** (2016), 10245–10250.

Atmospheric wind bursts in the tropics play a key role in the dynamics of the El Niño Southern Oscillation (ENSO). A simple modeling framework is proposed that summarizes this relationship and captures major features of the observational record while remaining physically consistent and amenable to detailed analysis. Within this simple framework, wind burst activity evolves according to a stochastic two-state Markov switching–diffusion process that depends on the strength of the western Pacific warm pool, and is coupled to simple ocean–atmosphere processes that are otherwise deterministic, stable, and linear. A simple model with this parameterization and no additional nonlinearities reproduces a realistic ENSO cycle with intermittent El Niño and La Niña events of varying intensity and strength as well as realistic buildup and shutdown of wind burst activity in the western Pacific. The wind burst activity has a direct causal effect on the ENSO variability: in particular, it intermittently triggers regular El Niño or La Niña events, super El Niño events, or no events at all, which enables the model to capture observed ENSO statistics such as the probability density function and power spectrum of eastern Pacific sea surface temperatures. The present framework provides further theoretical and practical insight on the relationship between wind burst activity and the ENSO.

Keywords: tropical atmospheric wind bursts | state-dependent noise | two-state stochastic jump process

Significance: Understanding the role that atmospheric wind bursts play in the initiation and maintenance of the El Niño Southern Oscillation (ENSO) in the tropics is a crucial problem in ocean–atmosphere sciences. We provide insight into the problem by proposing a simple ENSO model, amenable to detailed analysis,

where wind burst activity is driven by a simple stochastic jump process that depends on the strength of the western Pacific warm pool. The model captures key features of the observational record, such as the probability density function and power spectrum of eastern Pacific sea surface temperatures. In addition, the varying intensity and strength of El Niño events from the model are also consistent with real observations including super El Niño episodes.

Mesolithikum

Cristiani 2016

Emanuela Cristiani, Anita Radini, Marija Edinborough & Dušan Borić, *Dental calculus reveals Mesolithic foragers in the Balkans consumed domesticated plant foods*. PNAS **113** (2016), 10298–10303.

Researchers agree that domesticated plants were introduced into southeast Europe from southwest Asia as a part of a Neolithic "package," which included domesticated animals and artifacts typical of farming communities. It is commonly believed that this package reached inland areas of the Balkans by ≈6200 calibrated (cal.) BC or later. Our analysis of the starch record entrapped in dental calculus of Mesolithic human teeth at the site of Vlasac in the Danube Gorges of the central Balkans provides direct evidence that already by ≈6600 cal. BC, if not earlier, Late Mesolithic foragers of this region consumed domestic cereals, such as Triticum monococcum, Triticum dicoccum, and Hordeum distichon, which were also the main crops found among Early Neolithic communities of southeast Europe. We infer that "exotic" Neolithic domesticated plants were introduced to southern Europe independently almost half a millennium earlier than previously thought, through networks that enabled exchanges between inland Mesolithic foragers and early farming groups found along the Aegean coast of Turkey.

Keywords: Mesolithic foragers | starch analysis | domesticated cereals | forager/farmer interaction | human dental calculus

Significance: The starch record entrapped in dental calculus of Mesolithic human teeth from the site of Vlasac in the central Balkans provides direct evidence that complex Late Mesolithic foragers of this region consumed domesticated cereal grains. Our results challenge the established view of the Neolithization in Europe that domestic cereals were introduced to the Balkans around ≈6200 calibrated (cal.) BC as a part of a "package" that also included domesticated animals and artifacts, which accompanied the arrival of Neolithic communities. We infer that Neolithic domesticated plants were transmitted independently from the rest of Neolithic novelties from ≈6600 cal. BC onwards, reaching inland foragers deep in the Balkan hinterland through established social networks that linked forager and farmer groups.

Religion

Evans 2016

Karla K. Evans, Tamara Miner Haygood, Julie Cooper, Anne-Marie Culpan & Jeremy M. Wolfe, *A half-second glimpse often lets radiologists identify breast cancer cases even when viewing the mammogram of the opposite breast*. PNAS **113** (2016), 10292–10297.

Humans are very adept at extracting the "gist" of a scene in a fraction of a second. We have found that radiologists can discriminate normal from abnormal mammograms at above-chance levels after a half-second viewing (d' ≈ 1) but are

at chance in localizing the abnormality. This pattern of results suggests that they are detecting a global signal of abnormality. What are the stimulus properties that might support this ability? We investigated the nature of the gist signal in four experiments by asking radiologists to make detection and localization responses about briefly presented mammograms in which the spatial frequency, symmetry, and/or size of the images was manipulated. We show that the signal is stronger in the higher spatial frequencies. Performance does not depend on detection of breaks in the normal symmetry of left and right breasts. Moreover, above-chance classification is possible using images from the normal breast of a patient with overt signs of cancer only in the other breast. Some signal is present in the portions of the parenchyma (breast tissue) that do not contain a lesion or that are in the contralateral breast. This signal does not appear to be a simple assessment of breast density but rather the detection of the abnormal gist may be based on a widely distributed image statistic, learned by experts. The finding that a global signal, related to disease, can be detected in parenchyma that does not contain a lesion has implications for improving breast cancer detection.

Keywords: gist processing | medical image perception | attention | mammography

Significance: Discovering characteristics of a signal that indicates to medical experts the presence of cancer in a noninvasive screening technique in a blink of an eye has implications for improving cancer detection. Here we report two surprising facts about this signal. First, it is much stronger in the high spatial frequencies (fine detail) than in the low frequencies. Second, it is widely distributed, with signal being present well away from the actual visible locus of disease even in the breast contralateral to visible signs of disease. Although this signal is not, in itself, definitive, it has the potential to be used in automated aids to medical screening and incorporated into training protocols for medical experts, speeding up and improving cancer detection.

Story or Book

SCHNIEDEWIND 2005

William M. Schniedewind, *Steps and missteps in the linguistic dating of Biblical Hebrew*. Hebrew Studies **46** (2005), 377–384.

A review of Biblical Hebrew: Studies in Chronology and Typology. Edited by Ian Young. JSOTSup 369. Pp. xii + 389. Edinburgh: T&T Clark, 2003. Cloth, $120.

It is somewhat disconcerting that a book collecting the state of the art of the diachronic study of the Hebrew language shows little interest in the broader academic disciplines of linguistics. A notable exception to this is the groundbreaking work of Frank Polak, which utilizes the sociolinguistic work of Wallace Chafe among others (p. 38). Awareness of linguistic theory is critical. Ehrensvärd, for example, discusses the late Biblical Hebrew tendency to use longer sentences (p. 168) without the awareness of the pivotal bearing of sociolinguistic studies employed by Polak.

This volume also persists with romantic ideas about language, namely that vernacular language and dialect diversity in the Levant would be accurately reflected in textual artifacts. Writing, and especially ancient writing, is a symbolic representation of language rather than being itself a language. The study of linguistics is built on the study of vernacular, not writing. Writing is a poor, and problematic, cousin of language. Not enough attention is given to the methodological problem of using writing to describe language, and certainly more attention needs to be given to the social structures that give us textual artifacts.