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Pollution exposure and minority employment

Debates about industrial pollution regulations are often framed in terms of a trade-off between pollution exposure and employment opportunities. Racial and ethnic minorities in the United States are disproportionately exposed to industrial air pollution, but whether these groups experience corresponding employment gains is unclear. Michael Ash and James Boyce (pp. 10636–10641) combined US Environmental Protection Agency air pollution data with data on employment by race from the Equal Employment Opportunity Commission for more than 700 industrial facilities. The authors found that the share of exposure to pollution borne by black or Hispanic Americans generally exceeded that group's share of employment. On average, blacks bore 17.4% of the total pollution exposure while constituting 10.8% of employment. Hispanics bore 15% of pollution exposure while constituting 9.8% of employment. The disparity between pollution exposure and employment was larger for skilled and professional workers, less than 7% of whom were black or Hispanic. On a national level, the authors found no association between pollution exposure and the number of jobs. According to the authors, the findings suggest that strict environmental regulations may not necessarily take a toll on employment. — B.D.

Air pollution from smokestacks. Image courtesy of Wikimedia Commons/ Alfred T. Palmer.

Preventing chemotherapy-induced nerve damage

Certain chemotherapy drugs cause peripheral neuropathy, a condition marked by nerve damage that causes pain, numbness, tingling, swelling, or muscle weakness. An early feature of chemotherapy-induced peripheral neuropathy is axon degeneration, thought to be caused by the loss of the essential metabolite nicotinamide adenine dinucleotide (NAD^+). Hui-wen Liu et al. (pp. 10654–10659) provide evidence that a key determinant of axon protection is reduction in buildup of the direct NAD^+ precursor nicotinamide mononucleotide (NMN) rather than an increase in NAD^+ levels. The authors treated rat dorsal root ganglion neurons with the chemotherapy drug vincristine and a combination of compounds, namely FK866 and nicotinic acid riboside (NAR). Compared with vincristine alone, the combination treatment reduced NMN levels without significantly altering NAD^+ levels, which were substantially lower than in untreated neurons. Moreover, combined treatment with FK866 and NAR protected neurons against vincristine-induced axon degeneration as effectively as the bacterial enzyme NMN deamidase. According to the authors, the combination of FK866 and NAR may provide an effective strategy for preventing chemotherapy-induced peripheral neuropathy. — J.W.

Unraveling brain circuitry tied to reading

The ventral occipitotemporal cortex (vOTC) is a brain region crucial for recognizing visual patterns. Studying the function, structure, and connections of the vOTC is critical for understanding neural mechanisms that underlie reading. Garikoitz Lerma-Usabiaga et al. (pp. E9981–E9990) combined MRI and behavioral data collected from 66 Spanish-speaking individuals. The authors identified two distinct vOTC areas that play a role in visual word recognition. The posterior occipitotemporal sulcus (pOTS) is involved in

extracting visual features, responding more strongly as the participants viewed images of real words compared with checkerboards or scrambled words. The middle OTS (mOTS) is involved in processing lexical information, producing higher levels of activity in response to real words compared with pseudowords or consonant strings. Whereas the pOTS is structurally connected to the intraparietal sulcus, the mOTS is structurally connected to and integrates information with other language areas, namely the angular gyrus and inferior frontal gyrus. Increased activation in both the pOTS and mOTS was associated with shorter reaction times in a reading task that required subjects to discern between real words, pseudowords, and consonant strings. According to the authors, the findings reveal separate pathways involved in distinct processes that support reading. — J.W.

Early bird evolution

Early members of the Pygostylia, birds with short tails that end in a compound bone, are critical for understanding how the body plan of modern birds evolved. Min Wang et al. (pp. 10708–10713) describe a specimen of Pygostylia named *Jinguofortis perplexus* from the Early Cretaceous Period in China that forms, along with the bird *Chongmingia*, an evolutionary branch, or clade, named Jinguofortisidae, the second earliest known branch of Pygostylia. Jinguofortisids display a mosaic of characteristics, some reminiscent of nonavian theropod dinosaurs and others uniquely evolved in birds and specialized for flight, including a reduction in hand digits. Of note among the theropod-like features is a fused scapula and coracoid as part of the shoulder assembly. The authors report that the fusion of the scapulocoracoid may result from accelerated bone ossification, which may have helped the birds rapidly achieve maturity. With short, wide wings, *Jinguofortis* may have lived in dense forests. According to the authors, the structure of the shoulder girdle, when considered in context with the structures of other major four-footed animal groups, highlights the role of developmental plasticity in the early evolution of birds. — P.G.

A 127-million-year-old bird, *J. perplexus*.

Sexually transmitted nematode worms alter dung beetle microbiomes

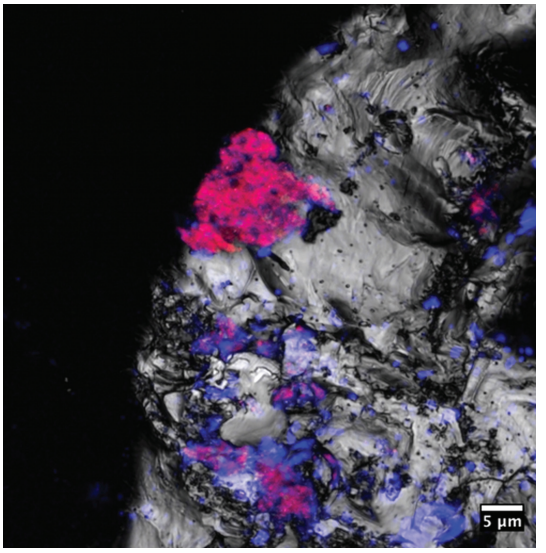
Dung beetles (*Onthophagus taurus*) transfer beneficial microbes to larval offspring in chambers called brood balls, which are composed of herbivore dung and consumed by larvae; the microbes help the larvae digest the tough plant tissues found in dung. Cristina Ledón-Rettig et al. (pp. 10696–10701) tested whether nematode worms, often found in close contact with dung beetles, are similarly transferred between partners during sex and from mothers to offspring. Through field observations and manipulations of artificial brood chambers in which beetle larvae develop, the authors found that the nematode *Diplogastrellus monhysteroides*, which accumulates in the beetles' genitals, is transmitted during copulation and from mothers to offspring. The nematodes alter the membership of bacterial and fungal communities in brood balls, boosting the abundance of plant-digesting bacteria such as *Dysgonomonas*, *Sphingobacterium*, and *Acinetobacter* and reducing the levels of harmful bacteria such as *Desulfovibrio*, which produces toxic hydrogen sulfide. The nematode's combined effects likely benefit the beetle

Horned beetle *O. taurus*.

larvae, enabling the larvae to derive nutrition from an otherwise inaccessible plant diet. In contrast to previous studies, the findings lend support to the notion that nematode worms are neither freeloading parasites nor cohabiting commensals of dung beetles. Instead, nematode worms add to the maternal endowment that enhances the fitness of both parents and offspring, according to the authors. — P.N.

Deep subsurface cyanobacteria

Cyanobacteria inhabit most environments, but their ecological range is thought to be limited to environments with at least some sunlight to facilitate photosynthesis. Fernando Puente-Sánchez et al. (pp. 10702–10707) report evidence of viable cyanobacteria in a 613-m-deep borehole from the Iberian Pyrite Belt in Spain, an analog for geochemical conditions on Mars. The authors characterized the cyanobacteria using microscopy, metagenomics analysis, and immunoassays. Because hydrogen abundance was negatively correlated with cyanobacterial abundance and because pathways for hydrogen use are present in the metagenomic data, the authors suggest that the cyanobacteria use hydrogen as an electron donor and potentially iron, manganese, nitric oxide, or other products of organic matter as electron acceptors. Several characteristics of cyanobacteria that developed in other environments, such as adaption to living within rocks and under severe nutritional and environmental stresses, may have facilitated life in the deep subsurface. According to the authors, cyanobacteria may serve as important primary producers in the deep subsurface. The findings suggest a need for the reevaluation of potential terrestrial and extraterrestrial cyanobacterial niches. — P.G.



Viable cyanobacterial cells (red fluorescent signals) attached to rock fragments retrieved from a depth of 607 m.