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Continuing human evolution

The question of whether natural selection continues to drive human evolution remains unsettled. By some accounts, humans ceased evolving around 40,000 years ago, but recent studies suggest that traits such as malaria resistance and high-altitude adaptation evolved relatively recently. Jonathan Beauchamp (pp. 7774–7779) used statistical methods to analyze links between relative lifetime reproductive success (rLRS), a proxy for evolutionary fitness that measures the lifetime number of an individual's



Continuing human evolution. Image courtesy of iStockphoto/00Mate00.

biological offspring, and gene variants previously tied to a handful of traits through genome-wide association studies. Focusing on people of European descent who were born between 1931 and 1953 and enrolled in the Health and Retirement Study, which tracks the health of around 20,000 Americans over the age of 50, the author found negative associations between rLRS and educational attainment. Thus, evolution might have been selecting against educational attainment in this cohort. However, the author cautions, the inferred rates of selection are small compared with the rapid changes wrought by cultural and environmental factors in recent generations, suggesting that the environment might have essentially overridden the observable effect of natural selection on educational attainment. Further, weak evidence suggests that selection may have favored a higher age at menarche for women in the cohort. Together, the findings make a case for the continuing but slow evolution of humans, according to the author. — P.N.

Household devices and air pollution in China

In recent years, the Chinese government has primarily sought to regulate modern air pollution sources such as power generation, transportation, and industry, but residential emissions have been largely overlooked. Focusing on the city of Beijing and the neighboring provinces of Beijing, Tianjin, and Hebei, Jun Liu et al. (pp. 7756–7761) used a mathematical model that simulates atmospheric chemistry and transport to recreate past heating seasons and evaluate the contribution of inefficient household heating and cooking devices to regional air pollution. The simulations revealed that eliminating residential emissions in Beijing in the winter of 2010 would have reduced the concentration of PM_{2.5}—a measure of suspended fine particles in air such as soot and smoke—by about 22% compared with a no-reduction scenario. Air quality further improved



Household chimney in Erhezhuang, outside Beijing, belches coal smoke. Image courtesy of Anna Zimmermann Jin (University of California, Berkeley, CA).

47 monoclonal antibodies derived from the B cells of dengue-infected individuals bound with high affinity to the Zika virus, and some of the antibodies were able to neutralize the virus. Moreover, the cross-reactive antibodies derived from the dengue patients were also capable of enhancing Zika virus infection in a human cell line. The findings suggest that preexisting dengue-induced antibodies have the potential to either protect against or enhance Zika virus infection and disease severity. According to the authors, analysis of cross-reactive immune responses against flaviviruses could inform the future design of broad-spectrum vaccines or antibody-based therapies. — J.W.

Anthrax toxin therapy for cancer

Anthrax toxins have attracted considerable attention as potential anticancer agents due to their ability to specifically target and kill tumor cells. However, the clinical development of these toxins has been limited because the mechanisms underlying their antitumor effects have been unclear, and because their

long-term use is precluded by the body's strong immune response against these foreign proteins. Shihui Liu et al. (pp. E4079–E4087) examined the antitumor effects of anthrax toxins, and found that combined treatment with immunosuppressive drugs enables multiple cycles of therapy and reduction in tumor growth. Using genetic mouse models, the authors found that anthrax toxins reduce tumor growth by binding to capillary morphogenesis protein-2 on tumor endothelial cells, thereby inhibiting the formation of new blood vessels. Moreover, the antitumor effects of anthrax toxins in mice with an aggressive form of lung cancer were enhanced by combined treatment with immunosuppressants called pentostatin and cyclophosphamide. These two clinically approved drugs selectively depleted B-cell populations and eliminated toxin-neutralizing antibodies, enabling five cycles of therapy over the course of 42 days. According to the authors, combined treatment with anthrax toxins and immunosuppressive drugs could lead to strong, long-term reductions in tumor growth and may warrant further investigation in clinical trials for a broad spectrum of cancers. — J.W.