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In This Issue

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APPLIED MATHEMATICS

Structure of ideas in classic writings

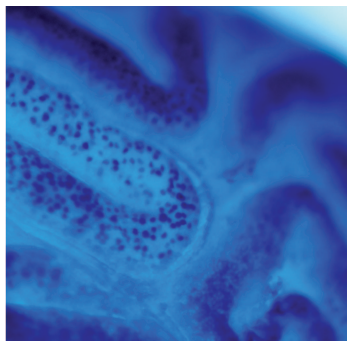
Structural commonalities may run through the writings of Einstein, Plato, Shakespeare, and Kafka, based on a mathematical approach that may explain how a reader's memory is used to bring out the full meaning of a given text. The discovery of long-range correlations between small bits of text may help elucidate how complicated, multidimensional ideas can be collapsed down and represented in linear one-dimensional texts. Enric Alvarez-Lacalle *et al*. studied 12 famous fiction and nonfiction texts, including Einstein's writings on relativity, Mark Twain's *Tom Sawyer*, and William S. Burroughs's *Naked Lunch*. The researchers analyzed the texts in batches of ≈100 words, termed "windows of attention." By analyzing the matrix of word co-occurrences in these and subsequent batches, Alvarez-Lacalle *et al.* tracked how the window of attention on a subject moved throughout the texts, tracing its trajectory in what they called a "concept space." The subject in a concept space was found to persist over long spans with correlations defined by a simple power-law relationship, which usually hints at an underlying hierarchical network. The long lifetimes of these different concepts were explained by the existence of hierarchical structures similar to volumes, chapters, and paragraphs. Alvarez-Lacalle *et al.* say that the long-range correlations between the concepts are built up in the reader's mind and serve to replicate the author's multidimensional ideas. — P.D.

"Hierarchical structures induce long-range dynamical correlations in written texts" by E. Alvarez-Lacalle, B. Dorow, J.-P. Eckmann, and E. Moses (see pages 7956–7961)

APPLIED BIOLOGICAL SCIENCES

Generating knockout mice with gonadal stem cells

Stem cells possess a number of properties that make them attractive targets for cell and gene therapies, including self-renewal potential, relative tolerance to cytotoxic damage, and the ability to regenerate entire tissues. Of the different stem cell types, spermatogonial stem cells, which can create permanent changes in the germ line of animals, have proved difficult to manipulate. In a potential advance, however, Mito Kanatsu-Shinohara *et al.* report the generation of knockout mice by using spermatogonial stem cells. The authors mutagenized cultured spermatogonial germ-line stem (GS) cells to incorporate a knockout vector for the *occludin* gene. Occludin encodes a tight junction protein expressed in a variety of organs and was used in the study to track GS cell uptake. To confirm the germ-line potential of the manipulated GS cells, the cells were microinjected into infertile male mice. The recipient mice were able to produce offspring with wild-type females as early as 77 days after GS cell transplantation, and the mice were shown to transmit the transgene. Next-generation animals homozygous for the knockout displayed phenotypes of occludin deficiency and lacked occludin mRNA and protein. — F.A.



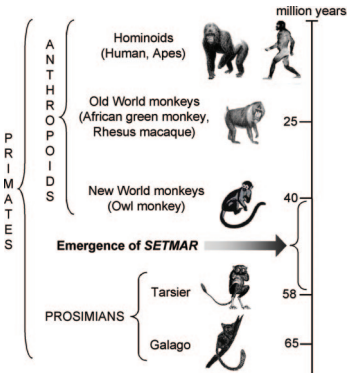
Creating knockout animals via spermatogonial stem cells.

"Production of knockout mice by random or targeted mutagenesis in spermatogonial stem cells" by Mito Kanatsu-Shinohara, Masahito Ikawa, Masanori Takehashi, Narumi Ogonuki, Hiromi Miki, Kimiko Inoue, Yasuhiro Kazuki, Jiyoung Lee, Shinya Toyokuni, Mitsuo Oshimura, Atsuo Ogura, and Takashi Shinohara (see pages 8018–8023)

EVOLUTION

Mobile element fused in primate gene

The emergence of new genes is a critical step in the evolution of a species. Genetic innovation through gene duplication has been extensively investigated, but less well understood is the creation of new genes by recycling coding material from selfish mobile genetic elements such as transposons. Richard Cordaux *et al.* have reconstructed the evolutionary history of *SETMAR*, a newly identified primate gene that resulted from the fusion of a



Tarsier primate lineage lacks the *SETMAR* gene.

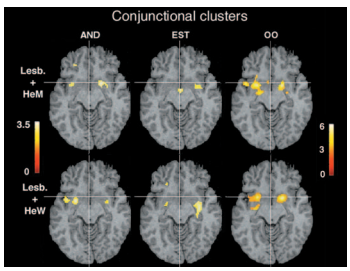
SET histone methyltransferase gene to the transposase gene of a mobile element, *Hsmar1*. The authors found that the *SET* region of *SETMAR* preexisted in the ancestral primate genome and that the *MAR* region was added downstream of the *SET* region during evolution. *MAR*'s insertion was made possible by the conversion of previously noncoding sequence into exonic sequence, removing the stop codon of *SET*. Cordaux *et al.* identified hundreds of putative *MAR* binding sites in the human genome and suggest that their domestication in the genome may provide a mechanism for rapidly establishing complex regulatory networks. — F.A.

"Birth of a chimeric primate gene by capture of the transposase gene from a mobile element" by Richard Cordaux, Swalpa Udit, Mark A. Batzer, and Cédric Feschotte (see pages 8101–8106)

MICROBIOLOGY

Combination vaccines against avian viruses

Newcastle disease, an economically important viral disease of poultry, is controlled by routine vaccination, and recent reports have suggested that the Newcastle disease virus (NDV) might be amenable to the insertion of avian influenza genes to provide a combination vaccine strain that could potentially protect against both diseases. In this issue of PNAS, two separate research groups report the development of combination vaccines that combat both avian influenza and Newcastle disease, suggesting an efficient and cost-effective strategy for limiting avian influenza in poultry and preventing its spread to humans. Using reverse genetic strategies, Jutta Veits *et al.* constructed a recombinant virus by inserting the hemagglutinin gene from the highly pathogenic H5N2 avian influenza strain into the NDV genome. The resulting recombinant virus (NDVH5m) induced the production of antibodies against both NDV and avian influenza and protected chickens against these diseases after exposure to lethal doses of both viruses. Man-Seong Park *et al.* also used reverse genetics to generate a chimeric influenza virus expressing antigens from both viruses. In addition, Park *et al.* inserted an avian hemagglutinin gene from the H7N7 strain into a weakened NDV strain. A single dose of this dual vaccine protected 90% of chickens against the H7N7 avian influenza strain and offered complete protection against Newcastle disease. The antibody responses from both engineered virus strains could be differentiated from naturally occurring avian influenza virus by antibody tests, making disease surveillance possible. Because Newcastle disease vaccinations are typically administered by spray or in drinking water, these studies demonstrate the possibility of designing affordable and effective vaccines against multiple poultry diseases. Furthermore, this combination vaccine strategy may provide a method for controlling the growing public health threat of avian influenza. — M.M.



Pheromone-mediated neural activation in lesbian women.

"Newcastle disease virus expressing H5 hemagglutinin gene protects chickens against Newcastle disease and avian influenza" by Jutta Veits, Dorothee Wiesner, Walter Fuchs, Bernd Hoffmann, Harald Granzow, Elke Starick, Egbert Mundt, Horst Schirrmeier, Teshome Mebatsion, Thomas C. Mettenleiter, and Angela Römer-Oberdörfer (see pages 8197–8202)

and

"Engineered viral vaccine constructs with dual specificity: Avian influenza and Newcastle disease" by Man-Seong Park, John Steel, Adolfo García-Sastre, David Swayne, and Peter Palese (see pages 8203–8208)

NEUROSCIENCE

Neural pheromone responses in lesbian women

Certain steroid compounds have been shown to stimulate the anterior hypothalamus, a brain region associated with sexual behavior, in a manner consistent with sexual orientation. Previous research by Hans Berglund *et al.* demonstrated these effects in homosexual men with a progesterone derivative found in men and an estrogen-like steroid found in women. Herein, Berglund *et al.* report the expansion of these studies in lesbian women, with findings that highlight the variation between male and female homosexuality. In neural imaging studies, lesbian subjects did not activate the anterior hypothalamus in response to the progesterone derivative, which their heterosexual counterparts did, and instead processed this steroid through olfactory regions of the brain. Lesbian women also activated their olfactory regions in response to the estrogen-like steroid, but they showed some anterior hypothalamus activation that overlapped with heterosexual men. However, the difference was not as high as that observed between homosexual men and heterosexual women. Therefore, these findings may strengthen the ideas that the progesterone derivative and estrogen-like steroid act as human pheromones and that sexual preference is linked to the hypothalamic neuronal circuitry. Also, the authors note, the lack of a differentiated hormonal response in lesbian women reinforces the fact that female homosexuality is markedly different from male homosexuality. — N.Z.

"Brain response to putative pheromones in lesbian women" by Hans Berglund, Per Lindström, and Ivanka Savic (see pages 8269–8274)