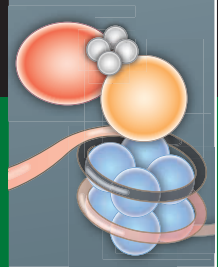

LETTERS

edited by Jennifer Sills

Physical Laws Shape Biology

IN THE PERSPECTIVE "A DYNAMICAL-SYSTEMS VIEW OF STEM CELL biology" (12 October 2012, p. 215), C. Furusawa and K. Kaneko discuss the relevance of dynamic systems biology approaches and the concept of "attractors" to understand cell differentiation and proliferation. We share their excitement in using computational models that apply physical laws to cell fate decision.

Because there are still naysayers who question whether simple physical laws operate in living systems, we want to emphasize the existence of numerous examples in which the laws of physics have been used to provide mechanistic insights on complex behaviors of living organisms. In the past two decades, numerous works in biology have integrated computational models with experimental verifications. Leibler and colleagues showed, using a simple mass-action model, that bacterial chemotaxis is highly robust to biochemical parameter variations (*1*, *2*). Complex pattern formation in seashells and zebrafish can be reproduced by Alan Turing's simple reaction-diffusion model (*3*). For immune-related Toll-like receptor signaling, a linear response model utilizing the physical law of mass conservation was sufficient to show the enhancement of an alternative TRIF-dependent pathway in MyD88 mutant murine macrophages (*4*, *5*). Similar biological flux redistribution in gain-of-function mutation was also observed for the energy metabolic pathways in *Escherichia coli* (*6*).

Laws of physics come to life. Patterns in zebrafish can be reproduced by Alan Turing's reaction-diffusion model.

With further integration of the latest experimental innovations, such as in vivo tracking of individual molecules in single cells, with computational models applying physical laws at different scales (quantum or classical), the future looks optimistic for a leap in understanding the origins of biological decisions. We hope schools and colleges will inspire students to learn multidisciplinary concepts.

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Biodiversity Despite Selective Logging

PRIMARY TROPICAL FORESTS ARE POWERhouses of biodiversity (*1*) but are rapidly declining in extent and are threatened even within some protected areas (*2*). As a result, non-primary forests, especially those that have been selectively logged, are becoming more important to conservation efforts.

In the tropics, logging is almost always selective, targeting only certain commercially valuable tree species above a minimum size and leaving other species unharvested. More than 400 million hectares of tropical forest are now in permanent timber estates (*3*), and at least 20% of all tropical forests were logged from 2000 to 2005 (*4*).

Biologists have often emphasized the deleterious impacts of selective logging for disturbance-sensitive wildlife [e.g., (*5*, *6*)], but recent evidence suggests that logged forests can have surprisingly high conservation values. In a meta-analysis across four tropical regions, selectively logged forests were by far the most biologically similar to primary forests, compared with agricultural and agroforestry systems (*1*). Even after repeated, intensive logging, the biodiversity of native forests in Borneo is roughly comparable to that after the first cut (*7*). Logged forests also store considerable carbon (*8*) and maintain most hydrological functions of primary forests. Hence, while they cannot replace primary forests, logged forests have great potential to enhance conservation at landscape and regional scales, act as buffer zones around protected areas, and help maintain forest connectivity for wildlife.

Unfortunately, logged forests are more likely than primary forests to be cleared or burned in some (*9*) but not all (*10*) nations. For this reason, we do not advocate an expansion of logging—although this will surely continue in many regions. Rather, we assert that logged forests are too vast, vulnerable,

Letters to the Editor

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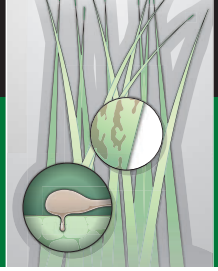
653



Sugar for flowers
659

and important to ignore, given their large conservation potential. We should strive to retain and better manage them.

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Legal Limits to Data Re-Identification

YANIV ERLICH AT THE WHITEHEAD INSTITUTE for Biomedical Research used his hacking skills to decipher the names of anonymous DNA donors ("Genealogy databases enable naming of anonymous DNA donors," J. Bohannon, News and Analysis, 18 January, p. 262). A little-known legal technicality in international data privacy laws could curb the privacy threats of reverse identification from genomes. "Personal information" is usually defined as any data relating to an individual whose identity is readily apparent from the data. The OECD Privacy Principles are enacted in over 80 countries worldwide (http://oecdprivacy.org). Privacy Principle No. 1 states: "There should be limits to the collection of personal data and any such data should be obtained by lawful and fair means and, where appropriate, with the knowledge or consent of the data subject." The principle is neutral regarding the manner of collection. Personal information may be collected directly from an individual or indirectly from third parties, or it may be synthesized from other sources, as with "data mining."

Computer scientists and engineers often don't know that recording a person's name against erstwhile anonymous data is technically an act of collection. Even if the consent form signed at the time of the original collection includes a disclaimer that absolute anonymity cannot be guaranteed, re-identifying the information later signifies a new collection. The new collection of personal information requires its own consent; the original disclaimer does not apply when third parties take data and process it beyond the original purpose for collection. Educating those with this capability about the legal meaning of collection should restrain the misuse of DNA data, at least in those jurisdictions that strive to enforce the OECD principles. It also implies that bioinformaticians working "with little more than the Internet" to attach names to samples may need ethics approval, just as they would if they were taking fresh samples from the people concerned. **STEPHEN WILSON**

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TECHNICAL COMMENT ABSTRACTS

Comment on "Large Volcanic Aerosol Load in the Stratosphere Linked to Asian Monsoon Transport"

Michael Fromm, Gerald Nedoluha, Zdenek Charvát

Bourassa *et al*. (Reports, 6 July 2012, p. 78) report on the 13 June 2011 eruption of the Nabro volcano and satellite observations of stratospheric aerosol that they attribute to troposphere to stratosphere ascent via the Asian monsoon. They claim (citing another source) that the 13 June top injection height was well below the tropopause. We will show that the 13 June Nabro eruption plume was clearly stratospheric and contained both volcanic gases and aerosols. Moreover, we will show height-resolved stratospheric sulfur dioxide and volcanic aerosol enhancements 1 to 3 days old, unaffected by the Asian monsoon, precisely connected to the volcano. The observed stratospheric aerosols and gases are fully explained by the 13 June eruption and do not require a monsoon vehicle.

Full text at http://dx.doi.org/10.1126/science.1228605

Comment on "Large Volcanic Aerosol Load in the Stratosphere Linked to Asian Monsoon Transport"

J.-P. Vernier, L. W. Thomason, T. D. Fairlie, P. Minnis, R. Palikonda, K. M. Bedka

Bourassa *et al*. (Reports, 6 July 2012, p. 78) have suggested that deep convection associated with the Asian monsoon played a critical role in transporting sulfur dioxide associated with the Nabro volcanic eruption (13 June 2011) from the upper troposphere (9 to 14 kilometers) into the lower stratosphere. An analysis of the CALIPSO lidar data indicates, however, that the main part of the Nabro volcanic plume was injected directly into the lower stratosphere during the initial eruption well before reaching the Asian monsoon deep convective region.

Full text at http://dx.doi.org/10.1126/science.1227817

Response to Comments on "Large Volcanic Aerosol Load in the Stratosphere Linked to Asian Monsoon Transport"

Adam E. Bourassa, Alan Robock, William J. Randel, Terry Deshler, Landon A. Rieger, Nicholas D. Lloyd, E. J. Llewellyn, Douglas A. Degenstein

Fromm *et al*. and Vernier *et al*. suggest that their analyses of satellite measurements indicate that the main part of the Nabro volcanic plume from the eruption on 13 June 2011 was directly injected into the stratosphere. We address these analyses and, in addition, show that both wind trajectories and height-resolved profiles of sulfur dioxide indicate that although the eruption column may have extended higher than the Smithsonian report we highlighted, it was overwhelmingly tropospheric. Additionally, the height-resolved sulfur dioxide profiles provide further convincing evidence for convective transport of volcanic gas to the stratosphere from deep convection associated with the Asian monsoon.

Full text at http://dx.doi.org/10.1126/science.1227961