

aborted fetal tissue and embryos originally created for fertility treatment (77 and 59%, respectively); however, 73% of respondents viewed creation of human embryos for research purposes as ethically unacceptable.

Thus, although the respondents are generally opposed to the creation of embryos for research, most appear to view the potential medical benefits as such that we should take advantage of the existence of unused embryos that would ultimately be discarded.

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References and Notes

1. The survey was part of a study sponsored by the Richard Lounsbery Foundation. A 12-page survey was sent to 3632 U.S. members of the American Society of Human Genetics, and 1236 surveys were returned, 1229 of which met all eligibility criteria. A copy of the group of questions from the survey relevant to this discussion are available from June Goldner, research consultant for the survey, at goldner@bestweb.net

Parasitic Plants Major Problem to Food Crops

IN THE PLANT PATHOLOGY SPECIAL ISSUE, THE News articles and Reviews discuss such seed plant pathogens as bacteria, fungi, viruses, nematodes, and insects (22 Jun., pp. 2269–2289). Strikingly absent from the discussion topics were parasitic angiosperms, plant pathogens that are plants themselves.

Such parasitic plants are present in most terrestrial ecosystems, but those feeding on food crops are particularly infamous (1). Species of the root parasitic genera *Striga* and *Orobanch* are notorious for the devastation they cause in less developed countries. *Striga* is estimated to infest more than two-thirds of the 73 million hectares in cereals and legumes in Sub-Saharan Africa, affecting the daily lives of some 300 million Africans in 25 countries (2). *Orobanch* destroys a broad spectrum of host crops, including legumes, vegetables, and sunflowers, in the Mediterranean and Middle East regions. Although developed countries have not escaped the ravages of parasitic plants—dwarf mistletoe (*Arceuthobium* spp.) destroy up to 3.2 billion board feet of lumber per year in western U.S. forests (3)—less developed



Orobanch crenata damages broad-beans in Syria.

countries are most affected.

The International Parasitic Plant Society (<http://www.ppws.vt.edu/IPPS/>) was inaugurated this year to promote the study of parasitic plants toward the aim of ultimately enhancing world food security. Funding research aimed at controlling parasitic weeds falls outside the agenda of most federal agencies, so it has largely been international agencies and foundations, notably the U.S. Agency for International Development and the Rockefeller Foundation, that pay for these studies. Their efforts have resulted in significant advances toward ameliorating the *Striga* problem, most notably through breeding efforts for developing host resistance.

With the emergence of genomic data from model species such as *Arabidopsis* and rice, novel approaches for controlling these pests can be envisioned. But the first step is bringing the problem to light.

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The Brain's Susceptibility to Amyloid Plaques

AMONG THE MOST CHALLENGING MYSTERIES of Alzheimer's disease is the identification of factors that render the brain particularly susceptible to the extracellular deposition of β -amyloid ($A\beta$). $A\beta$ peptides are thought to be toxic and are the central component of neuritic plaques, which are preferentially localized to brain regions that are critical for memory, cognition, emotional state, and personality.

Recent research has begun to provide new clues concerning the biological basis for the vulnerability of the brain to these abnormalities, and this information has relevance to developing therapies for Alzheimer's. $A\beta$ is generated from cleavages of the β -amyloid precursor protein (APP) by β site APP-cleaving enzyme 1 (BACE1) (1, 2) and by an enzyme activity termed γ -sec-

retase. In vivo, BACE1 has been found to be the principal β -secretase necessary to cleave APP to generate $A\beta$ (3). In contrast, APP can also be cleaved within the $A\beta$ sequence by putative " α -secretases" or by BACE2 to release the ectodomain (the amino-terminal soluble fragment) of APP (4); these cleavages within the $A\beta$ domain of APP preclude the formation of $A\beta$. In Alzheimer's, why is the brain but not any other organ (such as the pancreas, for example) particularly vulnerable to $A\beta$ deposition?

BACE1 and BACE2 are expressed ubiquitously, but levels of BACE1 messenger RNA (mRNA) are particularly high in brain and pancreas, whereas the levels of BACE2 mRNA are relatively low in all tissues, except in the brain, where it is nearly undetectable. Because BACE1 is the principal β -secretase in neurons and BACE2 limits the secretion of $A\beta$ peptides, we propose that BACE1 is a pro-amyloidogenic enzyme, whereas BACE2 is an anti-amyloidogenic enzyme.

In this scenario, the relative levels of BACE1 and BACE2, in concert with the abundance of APP in neurons, are major determinants of $A\beta$ formation. Under this model, the secretion of $A\beta$ peptides would be expected to be highest in neurons and brain, as compared with other cell types or organs, because neurons express high levels of BACE1 coupled with low expression of BACE2. If the ratio of the level of BACE1 to BACE2 is a critical factor that selectively predisposes the brain to the formation of $A\beta$, Alzheimer's disease would be predicted to involve the brain rather than heart or pancreas.

Seemingly inconsistent with this hypothesis is the observation that there are very high levels of BACE1 mRNA in the pancreas (1). It appears that some of this mRNA is alternatively spliced to generate a BACE1 isoform that is incapable of cleaving APP (5); thus, $A\beta$ is not deposited in the pancreas. Taken together with the observations that the pancreas has low levels of BACE1 protein (6), as well as low BACE1 enzymatic activity (2), these results are consistent with the view that a high ratio of BACE1 to BACE2 activity is a major determinant of selective vulnerability of the brain to formation of $A\beta$ plaques.

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Chiral Selection When Stirred, not Shaken

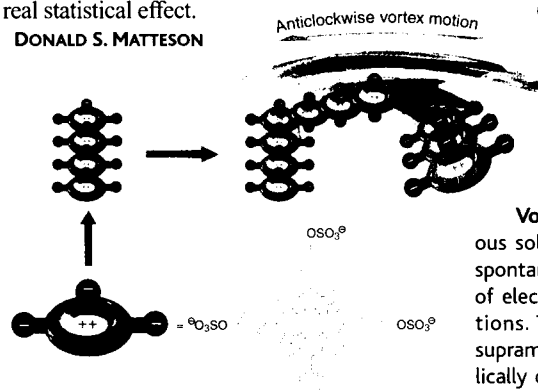
I AM PUZZLED BY THE REPORT THAT THE chirality of aggregates of certain porphyrin derivatives can be influenced by the direction of turning the solution in a rotary evaporator, put forward by J. M. Ribó and co-authors (Reports, "Chiral sign induction by vortices during the formation of mesophases in stirred solutions," 15 Jun., p. 2063). I have always worked under the assumption that the ordinary laws of thermodynamics and kinetics apply rigorously to the asymmetric selectivity of any process.

The results reported—a consistent 85% statistical bias in the chirality of porphyrin aggregates—would seem to require that one aggregation initiation step (essentially a crystal seeding) have about a 5-kilojoule-per-mole higher free energy than its opposite enantiomer. What could the source of such an

energy difference possibly be? The rotation frequency, about 10 hertz, or the maximum linear speed of the rotating solution, about 1 meter per second, is many orders of magnitude below the energy difference that is needed between the two chiralities of aggregates in the initiation step.

Chirality necessarily involves three dimensions. Surface effects could conceivably provide the energy bias needed in the third dimension. There has to be some mechanism to concentrate the exceedingly diffuse chiral bias energy of the entire system to a chemically significant level in a microscopic domain to produce any real statistical effect.

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Response

OUR RESULTS CANNOT BE INTERPRETED IN terms of a symmetry breaking exerted by an external polarization (such as asymmetric induction or asymmetric amplification). In this case—that is, in the typical context of organic chemistry reactions—the arguments raised by Matteson would be valid, and the asymmetric induction or chirality selection would be understood within the classical analysis of the coordinate reaction model.

Conversely, our scenario, by no means in contradiction with thermodynamics, corresponds to a spontaneous symmetry breaking process—a far-from-equilibrium cooperative phenomenon that takes place during an

Vortex motion as a chiral force. In aqueous solution, zwitterionic porphyrin molecules spontaneously assemble into stacks as a result of electrostatic and hydrogen-bonding interactions. These aggregates then assemble into supramolecular fiberlike structures that are helically oriented in the direction opposite to the vortex motion.

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