Ling's son is if Hsing-Hsing had been the father. Chia-Chia is excluded by both loci. The genotypes of the four other loci are also consistent with this explanation.

These results are reassuring insofar as they confirm the virility and fertility of Hsing-Hsing and add another breeding male to the very small population of captive male giant pandas.

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4. Abbreviations are as follows: ACP1, erythrocyte acid phosphatase; ACP2, tissue acid phosphatase; ADA, adenosine deaminase; ESA, esterase-A; ESD, esterase-D; FUCA, α-L-fucosidase; GALA, galactosidase-A; GALB, galactose-B; GOT1, glutamate oxaloacetate transaminase-1; GOT2, glutamate oxaloacetate transaminase-2; G6PD, glucose-6-phosphate dehydrogenase; GPI, glucose phosphate isomerase; GSR, glutathione reductase; GLO, glyoxalase-1; HK1, hexokinase-1; HK2, hexokinase-2; IDH1, isocitrate dehydrogenase-1 (soluble); MDH1, malate dehydrogenase-1 (soluble); ME1, malic enzyme 1 (soluble); PEPA, peptidase-A; PEPB, peptidase-B; PEPC, peptidase-C; PEPD, peptidase-D; PGD, 6-phosphogluconate dehydrogenase; PGM1, phosphoglucomutase-1; PGM3, phosphoglucomutase-3; PP, pyrophosphatase, inorganic; SOD1, superoxide dismutase-1; and MPI, mannose phosphate isomerase.
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Ediacaran Fossils

In his article "Alien beings here on Earth" (Research News, 6 Jan., p. 39), Roger Lewin reports on the views of Adolf Seilacher of Tübingen University with respect to fossils occurring in the Late Precambrian Ediacaran beds of South Australia. Seilacher is said to believe that these fossils have a completely different architecture and physiology from Phanerozoic (Cambrian-Recent) organisms. It is reported to be his view that these body fossil organisms of some 670 million years ago died without descendants.

Many of the Ediacaran body fossils have already been described and attributed without exception to extant phyla of marine organisms but, according to Seilacher, one can question these attributions for two reasons. He says that the Ediacaran sediments are coarser than those which, in the Phanerozoic, contain preserved evidence of the groups involved. This is especially so in the case of soft-bodied organisms, as most of the described Ediacaran fauna are. He thinks the Proterozoic organisms were invested with a tougher integument than later organisms (and hence were better preserved in coarse sediments) and had primordial flattish and "quilted" surface, elsewhere unknown. Because he found no evidence of a mouth in some of the organisms heretofore attributed to Vermes, Seilacher concludes they were mouthless (and presumably gutless) and that their seeming metamerism is an illusion; he speculates that they were possibly acellular and carried on their physiologic processes directly by transfusion through their thick integumental wall. It should be pointed out, however, that it is unusual indeed to find the mouth area preserved in rare fossil worms which, by their segmented nature, invite disassociation after death; and pray how, other than flattened, would one expect to find a worm preserved? Or any other essentially soft-bodied creature?

Mine is the traditional view that the Ediacaran fauna is a backward projection of the Cambrian shallow benthos requiring no exceptional explanations of any sort. In the more than 130 million years between the Ediacaran time and the earliest Cambrian, hard parts (calcium phosphate, calcium carbonate, chitin), which may have been incipient in the Ediacaran organisms, were widely developed by invertebrate creatures. This made their basal Phanerozoic preservation not only abundant, but so much so by way of contrast as to seem to some paleontologists to have been the result of essentially instantaneous "explosive" evolution. In contrast to Seilacher's attribution of the known Ediacaran fauna to a "world apart," most of it seems to me to fit comfortably into extant phyla.

In the earliest Cambrian, many of the organisms seem to have been at that time "living fossils" which necessarily had had a long antecedent, but undiscovered, evolutionary history. Current work on primitive arthropods (trilobites and nontrilobites) furnishes considerable evidence of this nature. The presence also in the Early Cambrian of the remains of several higher arthropod lineages, some of which became extinct in the Phanerozoic, others of which are extant, also indicates a long antecedent evolutionary history before their first appearances as fossils. The same kind of evidence exists for the early Echinodermata.

When one considers the vastness of Precambrian time, during which life existed in oceanic waters, and the undoubtedly gradual change of the nature of those waters, it would be indeed strange if there were not a multitude of these ancients yet to be discovered as fossils; moreover, it would be surprising if some of these lineages were not unique to the Precambrian; thus an open mind is required in testing the oldest organisms with respect to their relevancy to the Phanerozoic biota. But arguments for such novelties should be well grounded.

We can only wish Seilacher success in his further study of the Ediacaran trace fossils and hope that this will encourage others to undertake similar studies of Precambrian deposits for organic remains. Such quests are of immense importance to an understanding of organic evolution.

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Caster misses the point when he seeks to imply that Seilacher is unaware that when soft-bodied marine organisms are fossilized they are typically flattened. What is of interest is that the evident quilted structure of many of the Ediacaran fauna indicates that these organisms were also of a generally flattened appearance in life. Hence, at least in part, Seilacher's inference of the unusual diffusional mode of nutrient and metabolite transport.—ROGER LEWIN

Acetylene on Titan

The ocean of ethane on Titan proposed by Lunine, Stevenson, and Yung (Reports, 16 Dec., p. 1229) is a fascinating idea to an organic chemist, but the suggested layer of solid acetylene (C_2H_2) 100 to 200 meters thick lining the bottom is utterly fantastic. "Don't liquefy acetylene, but whatever you do, don't freeze it!" is the advice I remember from my days at E. I. du Pont. The legendary explosive character of the liquid or solid is attested in the older literature (*1*). The unfavorable heat of formation from the elements, 227 kilojoules per mole, is more than twice the energy of explosion of an equal weight of TNT (*2*). Thus, the estimated instability of Titan is approximately 200 to 400 megatons per square kilometer of the planet's surface (*3*). Fantasies of the first space probe's triggering a spectacular detonation of the whole planet are dampened by the knowledge that meteorites have been there first, and prosaic chemical reactions such as polymerization probably never allowed the explosive solid to accumulate in the first place.

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2. *International Critical Tables*, E. W. Washburn, Ed. (McGraw-Hill, New York, 1929), vol. 5, p. 181; *ibid.*, vol. 7, p. 490.
3. A megaton of TNT occupies a cube approximately 100 meters on a side.

We acknowledge the rather explosive properties of pure, solid acetylene, as noted by Matteson. However, we envision the composition of the solid material underlying the ethane-methane ocean to be considerably more complicated than pure acetylene, as we suggest briefly in our report. The dissociation of methane and consequent production of hydrocarbons in the Titan stratosphere from methane must produce not only C_2 and C_3 hydrocarbons but also much heavier long-chain polymers (incorporating nitrogen), at the expense, in part, of acetylene (*1*). This material has been inferred by a number of authors (*2*) to be the source of haze layers visible in Voyager images. The base of the ocean must therefore be a collection of complex polymers, solid acetylene, and intermediate photochemical products stable as solids under the ambient conditions. The final proportions of the various products after descent through the atmosphere and the intimacy of the mixture on the ocean floor are at present difficult to quantify but of interest, since the presence of impurities can slow further polymerization of acetylene. The possibility of meteorite impacts inducing further reactions of hydrocarbons both *in* the ocean and at its base is a fascinating one; the frequency of impacts by objects sufficiently large to reach the ocean and affect the base is 10^7 to 10^8 years.

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