ported from the system and could be detected in nearby springs and rivers. Experiments were carried out to determine whether $NO_x$ can be utilized by aquifer microorganisms. Presumably, $NO_2^-$ is precipitated, during the formation of VHMS rocks, from circulating seawater, but origin from *in situ* $N_2$ fixation cannot be ruled out. This oxidant then becomes available to microbes upon weathering of the rocks. Analysis of modern sulfide chimney samples from mid-ocean ridges revealed that they contain similar concentrations of combined N. Thus, hydrothermal sulfide deposits in general may host complex biotic and abiotic nitrogen-cycling pathways. This may be an important factor in long-term habitability of deep subsurface ecosystems, and may provide a gaseous signal of certain ecosystems that could be detected by remote sensing.

## 456. Computer Modeling of Protocellular Functions: Peptide Insertion in Membranes

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Lipid vesicles became the precursors to protocells by acquiring the capabilities needed to survive and reproduce. These include transport of ions, nutrients and waste products across cell walls and capture of energy and its conversion into a chemically usable form. In modern organisms these functions are carried out by membrane-bound proteins (about 30% of the genome codes for this kind of proteins).

A number of properties of $\alpha$-helical peptides suggest that their associations are excellent candidates for protobiological precursors of proteins. In particular, some simple $\alpha$-helical peptides can aggregate spontaneously and form functional channels. This process can be described conceptually by a three-step thermodynamic cycle: 1) folding of helices at the water-membrane interface, 2) helix insertion into the lipid bilayer, and 3) specific interactions of these helices that result in functional tertiary structures.

Although a crucial step, helix insertion has not been adequately studied because of the insolubility and aggregation of hydrophobic peptides. In this work, we use computer simulation methods (Molecular Dynamics) to characterize the energetics of helix insertion and we discuss its importance in an evolutionary context. Specifically, helices could self-assemble only if their interactions were sufficiently strong to compensate the unfavorable Free Energy of insertion of individual helices into membranes, providing a selection mechanism for protobiological evolution.

## 466. Dust and Ices in the Scattered Light of Planet Forming Disks

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Studying the resolved disk structure of nearby young stars can hold clues to the chemistry and dynamics of planet formation. The abundance of water ice, for example, is important for efficient planet formation and delivery of water to terrestrial life bearing planets in young disks. Many Solar System objects, from comets to the surfaces of satellites show the presence of water ice, while some larger objects such as Pluto show the presence of methane ice. These materials should be present in young exo-solar disks and may have detectable features as a function of location in the scattered light of a resolved circumstellar disk. Even if ices are not detected, the albedo of a disk as a function of wavelength can provide insight into the properties of the dust seen in scattered light. We present observations from the Hubble Space Telescope's near infrared camera of two young stars with disks, HD 100546 and HR 4796A. HD 100546 is currently in the process of forming planets, while HR 4796A's disk is in a later stage of evolution and is in the process of clearing out planetesimals. We combine our results with observations in other wavelengths to create visible through near infrared spectra of each disk. We find that HR 4796A's disk has a red spectrum that flattens at longer wavelengths, while HD 100546's spectrum shows variation as a function of distance from the star. Both disks are compared to water ice, methane ice, silicate dust, and Solar System comet spectra.

## 481. Statistics of One: Applying Earth History to Life in the Universe

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Recent studies have attempted to extrapolate the abundance of life in the universe and the properties of such life from the history of life on Earth. A common "reasonable" assumption in such studies is that the history of life on earth is typical of life in the universe. I examine the question of whether life on Earth is likely to be typical of life in the universe. Given the the identical initial conditions to the pre-biotic Earth, what is the probability that a world inhabited by intelligent beings will result. In determining this we must consider that, as observers, we are biased by having only one example of life: the example that led to our evolution on a 4.5 billion year old Earth. This "anthropic principle," is more accurately described as an anthropic bias, which alters the relationship between mea-