

# JOSEPH SHEEPDREAM

life organ become a nerve cell? how does a single somatic cell become a whole plant? how does earth's interior work? are we alone in the universe? how and where did life on earth arise? what determines species diversity? what genetic changes made us uniquely human? how are memories stored and retrieved? how did cooperative behavior evolve? how will big pictures emerge from a sea of biological data? how far can we push chemical self-assembly? what are the limits of conventional computing? can we selectively shut off immune responses? do deeper principles underlie quantum uncertainty and nonlocality? is an effective hiv vaccine feasible? how hot will the greenhouse world be? What can replace cheap oil and when? will malthus continue to be wrong? is ours the only universe? what drove cosmic inflation? when and how did the first stars and galaxies form? Where do ultrahigh energy cosmic rays come from? what powers quasars? what is the nature of black holes? why is there more matter than antimatter? does the proton decay? What is the nature of gravity? why is time different from other dimensions? are there smaller building blocks than quarks? are neutrinos their own antiparticles? is there a unified theory explaining all correlated electron systems? what is the most powerful laser researchers can build? can researchers make a perfect optical lens? is it possible to create magnetic semi conductors that work at room temperature? what is the pairing mechanism behind high-temperature superconductivity? can we develop a general theory of the dynamics of turbulent flows and the motion of granular materials? are there stable high-atomic-number elements? is superfluidity possible in a solid? if so, how? what is the structure of water? what is the nature of the glassy state? are there limits to rational chemical synthesis? What is the ultimate efficiency of photovoltaic cells? will fusion always be the energy source of the future? what drives the solar magnetic cycle? how do planets form? what causes ice ages? what causes reversals in earth's magnetic field? are there earthquake precursors that can lead to useful predictions? is there or was there life elsewhere in the solar system? what is the origin of homochirality in nature? can we predict how proteins will fold? how many proteins are there in humans? how do proteins find their partners? how many forms of cell death are there? what keeps intracellular traffic running smoothly? what enables cellular components to copy themselves independent of dna? what roles do different forms of rna play in genome function? what role do telomeres and centromeres play in genome function? why are some genomes really big and others quite compact? what is all that "junk" doing in our genomes? how much will new technologies lower the cost of sequencing? how do organs and whole organisms know when to stop growing? how can genome changes other than mutations be inherited? how is asymmetry determined in the embryo? how do limbs, fins, and faces develop and evolve? what triggers puberty? are stem cells at the heart of all cancers? is cancer susceptible to immune control? can cancers be controlled rather than cured? is inflammation a major factor in all chronic diseases? how do prion diseases work? how much do vertebrates depend on the innate immune system to fight infection? does immunologic memory require chronic exposure to antigens? why doesn't a pregnant woman reject her fetus? what synchronizes an organism's circadian clocks? how do migrating organisms find their way? why do we sleep? why do we dream? why are there critical periods for language learning? do pheromones influence human behavior? how do general anesthetics work? what causes schizophrenia? what causes autism? to what extent can we stave off alzheimer's? what is the biological basis of addiction? is morality hardwired into the brain? what are the limits of learning by machines? how much of personality is genetic? what is the biological root of sexual orientation? will there ever be a tree of life that systematists can agree on? how many species are there on earth? what is a species? why does lateral transfer occur in so many species and how? who was luca the last universal common ancestor? how did flowers evolve? how do plants make cell walls? how is plant growth controlled? why aren't all plants immune to all diseases? what is the basis of variation in stress tolerance in plants? what caused mass extinctions? can we prevent extinction? why were some dinosaurs so large? how will ecosystems respond to global warming? how many kinds of humans coexisted in the recent past and how did they relate? what gave rise to modern human behavior? what are the roots of human culture? what are the evolutionary roots of language and music? what are human races, and how did they develop? why do some countries grow and others stagnate? what impact do large government deficits have on a country's interest rates and economic growth rate? are political and economic freedom closely tied? why has poverty increased and life expectancy declined in sub sahanan africa? is there a simple test for determining whether an elliptic curve has an infinite number of rational solutions? can a hodge cycle be written as a sum of algebraic cycles? will mathematicians unleash the power of the navier-stokes equations? does poincaré's test identify spheres in four-dimensional space? do mathematically interesting zero-value solutions of the riemann zeta function all have the form  $a + bi$ ? does the particle physics  $\blacksquare$   $\blacksquare$  rest on solid mathematical foundations?  $\blacksquare$   $\blacksquare$