TO BE OR NOT TO BE : WHERE IS SELF-PRESERVATION IN EVOLUTIONARY THEORY? PAMELA LYON pdf

1: The Littlest Genome and the Question of Life | Lenses of Perception

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The concept of cognitive biology is exemplified by this seminar description: These include perceiving, remembering and learning, evaluating and deciding, planning actions, etc. But humans are not the only organisms that engage in these activities. Indeed, virtually all organisms need to be able to procure information both about their own condition and their environment and regulate their activities in ways appropriate to this information. In some cases species have developed distinctive ways of performing cognitive tasks. But in many cases these mechanisms have been conserved and modified in other species. This course will focus on a variety of organisms not usually considered in cognitive science such as bacteria, planaria, leeches, fruit flies, bees, birds and various rodents, asking about the sorts of cognitive activities these organisms perform, the mechanisms they employ to perform them, and what lessons about cognition more generally we might acquire from studying them. As such, it makes sense to approach cognition like other biological phenomena. This means first assuming a meaningful degree of continuity among different types of organismsâ€"an assumption borne out more and more by comparative biology , especially genomics â€"studying simple model systems e. This comparative approach is expected to yield simple cognitive concepts common to all organisms. There is a continuous line of meaningful descent. There in the Faculty of Natural Sciences, the Bratislava Biocenter is presented as a consortium of research teams working in biomedical sciences. Their website lists the Center for Cognitive Biology in the Department of Biochemistry at the top of the page, followed by five lab groups, each at a separate department of bioscience. His perspective is briefly discussed below. The category of cognitive biology has no fixed content but, rather, the content varies with the user. If the content can only be recruited from cognitive science , then cognitive biology would seem limited to a selection of items in the main set of sciences included by the interdisciplinary conceptâ€" cognitive psychology , artificial intelligence , linguistics , philosophy , neuroscience , and cognitive anthropology. As it gained momentum, the growth of cognitive science in subsequent decades seemed to offer a big tent to a variety of researchers. Others appropriated the keyword, as for example Donald Griffin in , when he advocated the establishment of cognitive ethology. Categorical assignments were problematic. For example, the decision to append cognitive to a body of biological research on neurons, e. No less difficult a decision needs be madeâ€"between the computational and constructivist [43] approach to cognition, and the concomitant issue of simulated v. One solution is to consider cognitive biology only as a subset of cognitive science. One of which is described thus: Linked through that list of topics, upon its selection the Cognitive Biology page offers a selection of reviews and articles with biological content ranging from cognitive ethology [46] through evolutionary epistemology ; cognition and art; evo-devo and cognitive science; animal learning ; genes and cognition; cognition and animal welfare; etc. The papers were listed under four headings, each representing a different domain of requisite cognitive ability: Dealing with Information from Bacteria to Minds. After discussing the differences between the cognitive and biological sciences, as well as the value of one to the other, the author concludes:

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6 To Be or Not To Be: Where Is Self-Preservation in Evolutionary Theory? Pamela Lyon Cooperation, it is commonly said, is a puzzle for evolutionary biology because of the in-trinsic selfishness of.

The study of cognition as a biological function may be unique in the life sciences in the extent to which findings ultimately are calibrated against a single species, Homo sapiens Shettleworth, The study of respiration and other biological functions, for example, are not so calibrated, although scientific investigation doubtless began with concern for the human case. We stop breathing, we die â€" so what is breath? Rather, evidence is followed wherever it leads, and it can lead to unexpected places. We know now that the oxidation of nicotinamid dinucleotide NADH , the molecular substrate of cellular respiration, is a process universally shared, and in animals is relevantly similar across phyla. By contrast, prokaryotic memory was discovered more than four decades ago Macnab and Koshland, , yet is far from being accepted â€" even by microbiologists â€" as anything relevantly like memory in complex vertebrates, to say nothing of humans. Cognitive scientists might be similarly dismissive were they to give it any thought at all. Memory, needless to say, is critical to cognition. Without memory, present circumstances have no context; the detection of change is impossible. Without the ability to detect change, the decision to alter behavior can only be random, haphazard. Without memory, learning of any kind is impossible. While cognitive scientists now accept that discoveries concerning the molecular basis of memory in the marine invertebrate Aplysia are relevant to the study of human memory Kandel, , they to say nothing of microbiologists have yet to connect the dots with memory processes in prokaryotes. Nevertheless, similar ST mechanisms appear to be at work, albeit with different leading biochemical actors and different degrees of regulatory complexity. Does it have a prokaryotic homologue? To my knowledge, no one is looking. Behavior generation lies at the heart of all cognitive inquiry, and while unicellular organisms are simpler than metazoans in structure, they are not always behaviorally less complex. The well-described social predation style, rippling behavior and fruiting body formation of Myxococcus xanthus arguably are more complex than the activities of most Porifera and even some worms with simple nervous systems. This may explain why, for the past several decades, microbial researchers increasingly have helped themselves to cognitive terminology i. In the following pages I hope to show that such linguistic usage is not wholly metaphorical. Because we are not concerned with the special capacities of a single mammalian species i. Shettleworth , p. These include perception, learning, memory, and decision making. Although this definition can be applied to phyla Shettleworth may not have had in mind, e. Others concerned with the specifically biological manifestation of cognitive function â€" which historically includes William James, H. With this in mind, I extend the definition as follows: Biological cognition is the complex of sensory and other information-processing mechanisms an organism has for becoming familiar with, valuing, and [interacting with] its environment in order to meet existential goals, the most basic of which are survival, [growth or thriving], and reproduction. Lyon, , p. Bacteria possess processes for breaking down and transforming nutrients into usable forms of energy for self-production or generating behavior, storing energy in molecules that can be catabolized when needed, and eliminating molecular waste generated during these processes. In the case of well-studied bacterial species e. Valence The capacity of an organism to assign a value to the summary of information about its surroundings at a given moment, relative to its own current state. Behavior The capacity of an organism to adapt via changing its spatial, structural or functional relation to its external or internal milieu. Memory The capacity to retain information about the immediate and possibly distant past, and to calibrate the sensorium to take account of this information, for example, via signal amplification. Learning The capacity to adapt behavior according to past experience, enabling a faster response time. Anticipation The capacity to predict what is likely to happen next based on an early stimulus. Signal integration decision making The capacity to combine information from multiple sources, because all organisms appear to sense more than one thing, and some bacterial species are equipped to sense dozens of different states of affairs. Open in a separate window Like all organisms, bacteria adapt to changes in their environment by modifying their metabolism and behavior. The traditional view is that this process depends on a limited number of highly canalized, inflexible mechanisms, which bear little resemblance to their behavioral counterparts in animals with nervous systems. Such mechanisms are characterized by non-linear responsivity, integration of multiple information channels, and in the case of CT receptors, at least habituation and adaptation phenomena. These structural and dynamical features are among the defining features of neuronal sensory processing in animals, including humans. Keep in mind that a great deal of complexity will be obscured in the simplifications that follow. In each cell of E. The behavioral output for a single cell is thus hugely complex, and much more refined tumbles, twiddles, etc. When we simplify to get just two outputs, run and tumble, and then bundle behaviors to get population averages, a lot of the cognitive output is likely to be occluded. Consider an example with humans: The Bacterial Cognitive Toolkit As do animals and plants, bacteria monitor the biotic and abiotic features of their surrounding milieu using a wide variety of sensory systems, and adapt their behavior and physiology in response to what they perceive in order to stay alive and reproduce. While the ecological niche of some bacteria is fairly stable, if sometimes extreme, many inhabit highly mutable environments and conduct highly complex lifestyles within them, which present considerable challenges, some of which are capable of being anticipated and others not. Like all organisms, bacteria do not gather information in a vacuum, but are able to assess the significance of the signals they receive relative to their own functioning, their internal milieuâ€"although it is worth noting that the power spectrum of signals remains unknown for any bacterium 3. Valence refers to the attractiveness, acceptability or tolerability of a stimulus Lyon, Aversive conditioning depends on the capacity of previously neutral or even positive stimuli to become negative for an organism under particular circumstances. Thus, all sensory signals have a context-dependent valenceâ€"positive, negative or neutralâ€"which influences the available response. This involves brain structures such as the amygdala and the orbitofrontal cortex. Although bacteria lack such specialized organs, the valence of a signal is implicit in the processes that coordinate, say, the rotation bias of flagellar motors or the complex developmental sequence of signaling, genetic transcription and protein expression that leads to sporulation. One of the most resilient obstacles to thinking about microbes as potentially cognitive organisms is the lack of specialized sensory and information-processing systems that exist in vertebrates and especially mammals. Signal transduction systems in bacteria come in several basic forms that perform a wide range of behavioral and physiological roles Ulrich and Zhulin, Thought to be evolutionarily older, 1CSs monitor the level of intracellular metabolites or respond to concentrations of membrane-permeable extracellular ligands Galperin, ; Ulrich et al. Table 2 Genome size and signal transduction, by millions of base pairs Mbp and type of system.

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This is why scientists who focus on the origin of life often study complexity. They try to find ways that intricate patterns can emerge from simple algorithms. They hope that this will give us clues on how cellular life evolved. This is a fallacy. The mistake comes from confusing complexity, in general, with the specific kind of intricacies we find in living things. There is so much vague thinking about this subject that many scientists think that generating any kind of complexity can help solve the mystery of life. Countless hours have been wasted on this pursuit. Professor Sharon Glotzer talks with some engineering students. Photo from University of Michigan. A recent article raises this issue again. Glotzer uses computer simulations to study emergence â€" the phenomenon whereby simple objects give rise to surprising collective behaviors. For example, if you have a room full of spheres, all the same size, they will naturally assemble into a simple lattice pattern. You only need to shake them gently and they will fall into this simple repeating pattern. What Glotzer discovered is that if you start with other shapes, such as pyramids, made from triangles on all sides, they produce quasi-crystalline patterns that never repeat. Simple shapes can produce surprisingly complex patterns. Glotzer sees this as a potential new insight into the origin of life. Most scientists think that to have order you need chemical bonds â€" you need interactions. This insight about the patterns created by different shapes is valuable for the work that Glotzer does: This simple mistake happens far too often. It is time to kill this fallacy. We naturally compare it to things that we know. That is why scientists keep trying to see if mechanical reactions can explain life. Once you see this, you will realize why all of the games with computer algorithms, looking for ways to create complexity, are a waste of time. So, what is a complex thing? How should we recognize it? In what sense is it true to say that a watch or an airliner or an earwig or a person is complex, but the moon is simple? For example, the moon is simple because it is one homogeneous thing, like a bowl of milk or the endless sands in the Sahara desert. Dawkins suggests that we need a system with many different elements. That is the kind of complication we are looking for. A mountain, like Mont Blanc, is made up of many different types of rocks. And every area of Mont Blanc is truly unique and distinct from every other, making it far from simple. Mont Blanc, the highest mountain in the Alps. He then asks if we can get closer to the mystery of life by looking at probabilities. What if we say something is complex only if it has an arrangement of many different elements in a way that is highly improbable? There are billions of possible ways of putting together the bits of an airliner, and only one, or very few, of them would actually be an airliner. There are even more ways of putting together the scrambled parts of a human. This approach to a definition of complexity is promising, but something more is still needed. There are billions of ways of throwing together the bits of Mont Blanc, it might be said, and only one of them is Mont Blanc. So what is it that makes the airliner and the human complicated, if Mont Blanc is simple? We need to see something more than just an accumulation of parts. She researches the results of tossing things together. Yes, they can make amazing patterns that never repeat, which are fascinating, but it is still just a pile of parts. We need something more. If we see a plane in the air we can be sure that it was not assembled by randomly throwing scrap metal togetherâ€¦ [4] Intentional flight requires a different type of complexity. A plane allows people to travel around the world. That is what jumps out at us. Because planes are designed and constructed by human beings from a plan, from a blueprint. On the other hand, multicellular creatures, such as animals, fish, even trees and plants, develop from single cells, into complex bodies, made up of many organs that work intricately with each other. Can we explain the difference between the complexity of machines and organisms? Here is another, plants and animals are not assembled by outsiders. Organisms clearly show us a different kind of complexity than machines. Scientists keep trying to treat creatures as if they are sophisticated machines, but the metaphor fails in important ways. For example, biologists have been forced to abandon the old idea that

DNA contains a blueprint for constructing the body of animals. When DNA was first discovered, biologists expected to find one gene for every protein and enzyme needed in the human body. Every gene is involved in multiple roles. They also need to work with countless other genes. Many times, parts of one gene are used with parts from another, to get what is needed. And genes are turned on and off from outside the DNA. This is one of the many failed attempts to compare living things to machines. So we need to find a different kind of complexity than we see in machines. How do we describe this difference? Here is one way: If you try to do this, you will kill it. That leads us to an even bigger difference: If a bird dies, it can no longer fly or search for food. Its body is just as complex as it was the moment before it died, but now it no longer hops on its feet, flaps its wings, or sings. A living organism is a system that cannot be fully explained by reducing it to its parts because it can only live when its parts work in a relationship with each other as a whole. Rosen puts it this way: It has turned out that, in order to be in a position to say what life is, we must spend a great deal of time in understanding what life is not. Thus, I will be spending a great deal of time with mechanisms and machines, ultimately to reject them, and replace them with something else. But this turns out to be only a prejudice, and like all prejudices, it has disastrous consequences. No amount of refinement or subtlety within the world of mechanism can avail; once we are in that world, what we need is already gone. This is the puzzle we need to solve. Now that we understand the mystery we are up against, it is easy to see why most discussions about complexity and the origin of life completely miss the point. Complex mechanisms and chemical reactions are not enough. No one has found a mixture of chemicals that alters its course, avoids threats, or replenishes itself. Chemical reactions simply stop when the energy driving them runs out. Then where does the remarkable desire for life come from? Living things do so until all options are exhausted. Some of the simplest organisms engage in surprisingly elaborate behaviors to forestall cessation. We do not know. Moreover, we do not appear to be overly concerned that we do not know. The answer cannot be, it just did. Self-ordering should not be confused with self-organization. They are all the result of physical dynamics that can be explained with physics and chemistry. No truly sophisticated function has ever arisen from self-ordered states. They require relationships between responsive life forms. For example, human beings work together for a common purpose. Cells and organs work together as a whole. And flocks of starlings fly together as a group. What Glotzer is talking about is clearly self-ordering, not self-organizing. Living organizations and living organisms have a special form of complexity that can never be fully understood by taking them apart. Columbia University Press, , p. Self-Ordering events in life-origin models. Physics of Life Reviews. Also available from http: Life Origin, A Scientific Approach, edited for the non-scientist.

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4: What'sNEW in Cosmic Ancestry, Jul-Sep by Brig Klyce

This chapter highlights Carl Woese's message about cellular complexity. It addresses the phenotypic distance between a putative, hypothetical ur-replicator or ur-chromosome and anything that can function as a cell that can effectively respond to its environment in ways that maintain its metabolic and physiological integrity.

Quintner "An evolutionary stress response hypothesis for chronic widespread pain fibromyalgia syndrome ," Pain Medicine Lyon "From quorum to cooperation: Lessons from bacterial sociality", Studies in History and Philosophy of Science: Series C, Biological and Biomedical Sciences 38 4: Lyon "The biogenic approach to cognition", Cognitive Processing 7 1: Lyon "Autopoiesis and knowing: Lyon in press "Stress in mind: The role of the stress response in the evolution of cognition," in L. Lyon "Extracting norms from nature: A biogenic approach to ethics," in P. Lyon "To be or not to be: Where is self-preservation in evolutionary theory? Cambridge, MA , Keijzer "The human stain: Psychology After Cognitivism, ed. Imprint Academic , pp. Lyon "Book review: Other research publications P. Lyon The land is always alive: The story of the Central Land Council. Lyon The health of young Aborigines aged 12 to A short report for Aboriginal communities. Wynter J The way forward. Final report and grog action plan. Lyon "The continuing dilemma: Lyon Prevention, intervention and treatment strategies for Aboriginal alcohol problems: Lyon What everybody knows about Alice: A report on the impact of alcohol abuse on the town of Alice Springs. Parsons We are staying: To facilitate these activities, entries in the University Phone Directory are not limited to University employees. The use of information provided here for any other purpose, including the sending of unsolicited commercial material via email or any other electronic format, is strictly prohibited. The University reserves the right to recover all costs incurred in the event of breach of this policy. Sunday, 11 Sep Information for.

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Show Summary Details Preview. This chapter highlights Carl Woese's message about cellular complexity. It addresses the phenotypic distance between a putative, hypothetical ur-replicator or ur-chromosome and anything that can function as a cell that can effectively respond to its environment in ways that maintain its metabolic and physiological integrity.

Their announcement was hailed as a milestone. The big lesson learned by the biologists is that no one can explain why almost one-third of the genes are needed for survival. However, hidden in the subtext of this study, we believe, is an even more important lesson: The most essential ingredient of life may not actually be genes or a substance of any kind, but rather a relationship. Image of the new freely-living cells with the smallest genome. The first thing you should know is that the new cells created by these biologists were NOT made from scratch. No one knows how to do that. They started with bacteria that had the smallest genomes they could find. They began deactivating genes, one at a time, to see which ones were needed for survival. Progress was slow, but after many years the genome was reduced to half its original size. Every remaining gene has been tested. None can be eliminated. The biologists can explain what two-thirds of these genes do, but the other third remains a mystery. Their goal is now to identify the role of these mystery genes. They hope this will give them a blueprint of what is needed for living cells to survive as independent entities. Illustration by Thomas Shafee via Wikipedia. Is it fair to say that these are independently living cells? This is where the story gets interesting. You see, the genomes of these cells may be tiny compared to other single-celled organisms, but they are still times larger than the genomes of simple viruses. Outside of a cell, a virus shows no signs of life. Photo by Andrzej Pobiedzinski. They need a host in which to live, and they need the genome of the host to reproduce. Viruses are nothing like the life forms that live outside of host organisms. Is true independent living even possible? All organisms depend on their environment for energy, carbon, and mineral nutrients to grow and reproduce. No plant, animal, or microbe can survive without this supply. Cutting them off leaves them as inactive as a car without fuel. All biologists know this. But if we consider the implications of this deeply, it frames the question of life in a new way and it opens the door to a new explanation for how biological life may have emerged. Trees create habitats that team with life. Painting by Alan Rayner, from Mycological Research, , Life is a relationship between creatures and their environment. They become inactive chemical compounds. Does this mean they are alive? But if life is a relationship between a life form and the world it is nourished by, then yes, DNA and RNA are involved in life when inside a cell. This offers a new solution to the debate over viruses: Viruses show no signs of life outside of a host cell. But they truly do spring into life-as-a-relationship inside cells. Seeds remain dormant until they are in the right habitat. Photo by Adyna Seeds act the same way. If they land on fallow ground with no water, they remain dormant. They need a habitat that welcomes them, to develop. Are seeds alive before the rain comes? If life is a dynamic, shared relationship between individuals and the world they live in, then we have good reason to say that while seeds are viable, as capsules of living potential, they do not truly come into life until they germinate. Inactive existence, biologically, is completely different from thriving. The distinction between inert material and active living is the crucial mystery of life we are trying to understand. Seeing it as a relationship completes the picture. This opens a new door on the origin of life. Every day, biologists see the liveliness of enzymes, as they work for the benefit of the cells they belong to. In other words, life reaches all the way down, even to molecules and atoms, as long as they are in the right environment. This shifts the puzzle of life to a new question: How do molecules act in such a directed way, as if they are following a plan? We would then be the source of the plan they are following. The reason they dedicate themselves to us is because they depend on us. If we die, they die. Our survival is needed for their survival. And we are just as much in need of our cells and neurons to live. This is the relationship we are in. Living is a shared experience. Photo by Subhadip Mukherjee. Looking at life this way seems enigmatic. It brings to mind the paradox of the chicken and the egg. In this case we have to ask: Which comes first, a nourishing environment or the forms that spring into life and embody it? Once we see life as a relationship, the puzzle is solved. Eggs and chicken need each other. This also resolves the mind-body question that has been hounding philosophers for centuries: How do we control our bodies? We just answered that. Our cells do all the work. No life force needed. They move our bodies toward food, away from threats, and into the adventure of life around us, because our life is their world. We depend on each other. Life is only possible when mind and body work together. Can we explain how this works scientifically? Yes, we only need to turn to quantum mechanics. We find the same principles at work in the subatomic world. There we see that the force of attraction that holds quarks together and forms the bodies of protons emerges from relationships between quarks. Invisible exchanges between quarks create a shared attraction, a bond. The quarks then stop moving as independent particles. They start spinning as one. Photo by Krzysztof Szkurlatowski. Something invisible passes between us and others, pulling us together. Our lives then move in synchrony with each other. This is the nature of relationships. Dissecting organisms will never explain this mystery. It will never reveal the secret because the relationship is essential. All of this leads us to a strange conclusion: The relationship of life reaches all the way down to fundamental particles, as long as they are involved in the right environment. Does this mean that quarks are also dedicated to us because their lives depend on us? That makes no sense. Quarks may form the bodies of protons, but those protons will continue to survive after we die. Is it only our cells that are bound to us in this way? The key to understanding this is that we are not talking about inert existence, we are talking about participating in the experience of life. This is the only reason that cells are involved in a relationship with us. This is what reaches all the way down. The authors can attest to this. If that is the lens we use, we will never see life as it is or experience what it means to belong to a living world. We will see only the inertness of things.

6: Project MUSE - The Major Transitions in Evolution Revisited

This chapter highlights Carl Woese's message about cellular complexity. It addresses the phenotypic distance between a putative, hypothetical ur-replicator or ur-chromosome and anything that can function as a cell that can effectively respond to its environment in ways that maintain its metabolic.

7: The cognitive cell: bacterial behavior reconsidered

To be or not to be: where is self-preservation in evolutionary theory? By Pamela Christine Lyon. Abstract. Pamela Lyo.

8: The Major Transitions in Evolution Revisited by Brett Calcott

To Be or Not To Be: Where Is Self-Preservation in Evolutionary Theory? more by Pamela Lyon Cooperation, it is commonly said, is a puzzle for evolutionary biology because of the intrinsic selfishness of living things (Queller ; Sachs et al.).

9: Cognitive biology - Wikipedia

Dr Pamela Lyon Biography/ Background An idiosyncratic, mature-age student with a chequered past (including newspaper journalism, independent social research, and institutional public relations), I earned my PhD with a thesis on the biology of cognition.

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The Official Patients Sourcebook on Arachnoiditis French-speaking women film directors Vol. I, pt. 1-3. Descendants of Daniel, James and Joshua Brainerd, sons of Daniel and Hannah (Spencer Bra The Foresters Notebook Introduction : rituals of transmission, fetishizing the trace My day with animals Studies in Semitic Philology (Studies in Semitic Languages and Linguistics , No 6) The teddy bear book Computing developments in experimental and numerical stress analysis 2005 jeep wrangler owners manual The everything psychology book Bobby Blake At Rockledge School Winter Preparations Poems of the Nude Formalism (20 Pages) A manual of falconry Pmbok 5th edition process chart The Song of My Life The Rough Guide to Czech and Slovak Republics Little Miss Splendid and the Princess Navigating nature Moving House (Tough Topics) Data Book of Child and Adolescent Injury The final piece of the puzzle an investors guide Neebs fundamentals of mental health nursing Climbing and abseiling around the world An interview with Chukwuemeka Ike B.E.C. Oguzie Byrhtferths Manual (A. D. 1011) Limited Edition Java Library Set (4-Volume Set) Impa marine stores guide 6th edition Land Use and Watersheds The Twilight Zone Radio Dramas Cassette Collection 1 The CIA in Hollywood Residents As Teachers Fifty shades novel The paris option NATEF Standard Jobsheet A1 (Natef Standards Job Sheets) Six. Limits to Britains policy towards Japan 148 British initiatives The circle of stars Dante, and other essays