UNIVERSIDAD NACIONAL DE QUILMES
INGLÉS NIVEL DE SUFICIENCIA
DIPLOMATURA EN CIENCIA Y TECNOLOGÍA

NOMBRE Y APELLIDO:

LEGAJO:

IMPORTANTE: Realice el examen con letra clara y legible. No utilice lápiz. Responda las consignas en castellano. No traduzca. Elabore sus respuestas de modo tal que demuestren su comprensión del texto. Es indispensable responder el 70% del examen en forma correcta para aprobarlo. No podrá rendir si no presenta su libreta de estudiante o DNI o CI.

Biochemistry as a Biological Science: Distinguishing Characteristics of Living Matter

The chemistry of life has in complex chemical substances and reactions their significance as part of living matter and life processes. What distinguishes living matter from nonliving matter?

Daniel Koshland has described seven distinctive attributes, or "pillars of life", the essential principles on which a living system operates. First is a program, or organized plan for constitution and regeneration of an organism. **In fact**, for life in Earth, that program is the information stored in DNA. Second is improvisation, the ability of living matter to change the program to assure survival as the surroundings change. This notion explains that processes of mutation and selection ensure that, as the environment changes (aqueous to terrestrial, for example), organisms can adjust so that survival continues under the new conditions.

The third pillar is compartmentation, the ability of an organism to separate itself from the environment (with membranes, for example) **so** that the chemistry needed to carry out the program can occur under favorable conditions of temperature, pH, and concentration of reactants and products. The smallest organisms contain just one compartment, while larger organisms contain many cells, specialized to carry out different functions, such as sensory perception or movement. The fourth pillar is energy. Thermodynamics tells us that spontaneous processes occur in the direction of simplicity and randomness. **Yet** living matter must create complexity in order to sustain the program and the other pillars of life. To do this, cells and organisms carry out reactions that yield energy, such as the oxidation of nutrients, and they couple some of that energy to energy-requiring reactions that create complexity, such as the synthesis of nucleic acids and proteins or the transmission of nerve impulses. The ultimate source of that energy is the sun, which is used either directly, by photosynthetic plants and bacteria to drive the synthesis of biomolecules, or

indirectly, by organisms that consume other organisms and derive their energy from the breakdown of dietary nutrients.

Fifth is regeneration, the ability to compensate for the inevitable wear involved in maintaining a physical state far from equilibrium. For example, all of the proteins in a cell are subjected to continuous degradation, either because they suffer environmental damage or because, like digestive enzymes, they undergo degradation as part of their normal function. The ability to continuously replace damaged molecules of this type is a distinguishing characteristic of life. The sixth pillar is adaptability, the capacity of an organism to respond to environmental changes. For example, when nutrient stores within an animal are depleted, the animal becomes hungry and seeks food. Adaptability, a property of individual organisms, is distinguished from improvisation, the capacity of populations of organisms to respond to environmental change over a time scale of many generations.

The final pillar is seclusion, which means that metabolic processes and pathways must operate in isolation from one another, even though they may take place within the same compartment of a cell. When we digest carbohydrate, a consequence is a rise in intracellular glucose concentration. In liver or muscle that glucose can either be consumed to provide energy or polymerized into glycogen, a glucose polymer, comparable to starch, which is stored for later release when there is an energy demand. Glucose polymerization and the initial steps in breakdown occur within the same cell compartment. Yet intracellular control processes and the specificities of the enzymatic catalysts involved ensure that one of the pathways is favored and the other inhibited, in response to the cell's needs.

How did this remarkable process we call life arise? We do not know, but we do know that it is truly ancient, almost as old as the earth itself. The earth condensed from cosmic dust about 4.5 billion years ago, but recognizable traces of living microbes have been dated to 3.8 billion years, only 700 million years later. It is possible that some of these earliest organisms utilized pre-formed chemical building blocks. For example, traces of amino acids have been found in meteorites, strong evidence that such substances can be generated abiotically, without the involvement of a living system.

Whatever their origin, we know that the earliest organisms must have lived an anaerobic existence, for the earth was devoid of free oxygen. **Indeed**, it is believed that all of the oxygen now present in the earth's atmosphere is the product of photosynthesis by algae and plants. It probably required 3-4 billion years for the present oxygen level to accumulate. Life has not only occupied this planet, it has rebuilt it.

1) Read the text carefully and answer the questions below. IN SPANISH. BE TO THE POINT AND DO NOT TRANSLATE WHAT THE TEXT SAYS. WE DO NOT WANT TRANSLATION, WE WANT COMPREHENSION (0.80 each= 40)

a- What's the meaning of "pillars of life"?
b- In what way is improvisation related to the first attribute?
c- Which are the sources of energy?
d- Explain the process of digestion of carbohydrate in seclusion.
e- In which sense the author says that life was rebuilt?

2) Reread the text. Analyze the four connectors in underlined bold type (in fact, so, yet, indeed). What category do they belong to? Explain what ideas they are connecting in each case. (20p)

3) Analyze the four references underlined (this notion, to do this, they, this type) . (20p)

4) This paragraph belongs to the text. Identify where to insert it and explain what information is given before or after it that helped you to decide. (20p)

> «Interconnected with all seven pillars of life is the function of semipermeable membranes, which surround cells and intracellular organelles, such as mitochondria, maintaining homeostasis, a condition in which the chemical composition of a biological system is held constant.»

KEY

Answers

1- Son los siete principios esenciales sobre los que opera un sistema vivo, Daniel Koshland los denomina atributos.

2- El primer atributo es un programa o plan organizado para la constitución y regeneración de un organismo (por ej.: ADN). Improvisation es la capacidad de la materia viva de cambiar ese programa para asegurarse la supervivencia en el entorno (por ej.: mutación).

3- La energía es el cuarto atributo. Las células y los organismos provocan reacciones que emiten energía, como la oxidación de nutrientes, y las asocian a otras reacciones de emisión de energía más complejas, como la síntesis de ácidos nucleicos o la transmisión de impulsos nerviosos. El sol es la última fuente de energía, y se usa de manera directa (fotosíntesis) o indirecta (organismos que consumen otros organismos).

4) Al digerir carbohidratos, se eleva la concentración de glucosa entre las células. Esta glucosa puede consumirse en el hígado o en los músculos para dar energía o puede polimerizarse en glicogeno, un polímero de la glucosa parecido al almidón, que se almacena como reserva para cuando exista una demanda mayor de energía. La polimerización de la glucosa y los pasos iniciales para su descomposición tienen lugar dentro del mismo compartimento celular. Incluso los procesos de control intracelular y las particularidades de los catalizadores implicados aseguran que prevalece una de las secuencias metabólicas y que la otra queda inhibida como respuesta a la necesidad de las células.

5) Se sabe que los primeros organismdos deben haber tenido existencia anaeróbica, porque no había oxígeno en la tierra. Incluso se cree que todo el oxígeno presente en la actualidad en la atmósfera terrestre es producto de la fotosíntesis de las algas y las plantas. Es probable que se necesitaran 3-4 mil millones de años para acumular el actual nivel de oxígeno. La vida no solo ha ocupado este planeta, sino que lo ha reconstruido.

Connector

in fact: la vida en la Tierra y la información del ADN
so: la capacidad de división de un organismo para favorecer las reacciones químicas
yet: los procesos espontáneos simples y la complejidad necesaria
indeed: la ausencia de oxígeno y su presencia en la actualidad

References

this notion: improvisation
to do this: create complexity
they: proteínas de la célula
this type: moléculas de proteínas intracelulares dañadas

Párrafo: Entre párrafo 4 y 5 (... to the cell's needs/How did this remarkable process)