I have decided to chose my own topic as it is connected with the areas that interest me, namely, astronomy, ecology, evolution and geology. It is evident that my essay touches some aspects of the International Year of Planet Earth.

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Earth's organism in amiable Universe

by

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We should not be surprised to observe that the Universe is so large. No astronomer could exist in one that was significantly smaller. The Universe needs to be as big as it is in order to evolve just a single carbon-based life –form.
J.D. Barrow

The way the universe and our Earth are build, their features and properties of the world far and near, are the main concerns of a specific branch of science. It's not often that science looks into the question of how the world should be like and why is it built this way and not the other. But those questions are the core of the anthropic principle and the Gaia hypothesis.

The anthropic principle tries to solve the mysteries of why space, as we know it, is three-dimensional, why is the world so vast, or why is it so old. The whole problem of the appearance of life is confronted with meeting the right conditions. What we mean is, for example, presence of the right elements, achieving the right density and the right temperatures. The fact that our world meets these, and many other, requirements is not a coincidence – they are the foundations on which life could start to arise. These are the only possible features, that could support life on Earth. But fulfilling these qualities took a long time after the Big Bang. The existence of life on our planet implies that the universe has to be adequately big and old. Billions of stars and galaxies are therefore connected with our presence – there has to be so many of them in order to get a fair chance of life evolving on at least one planet.

The basis of this rule is the fact, that some features of our universe (physical and mathematical constants, age or space) are not free, but are dependant on some biological factors.

One of the more important facts worth mentioning is the vast presence of carbon – the element essential to life. Scientific research shows, which is incorporated into the anthropic principle, that the elements that build living organisms, water or carbon dioxide (carbon, hydrogen, oxygen and nitrogen) aren't just some accidental combination – their specifics are linked with the possibility of fast metabolism and occurrence of other fundamental life processes.

Physicists, as well as astronomers are certain, that a small increase of nucleus forces in comparison with electromagnetic forces would result in helium becoming stable and hydrogen ceasing to exist! Such conditions would stop life from arising in a world based on carbon. But if those forces became just a little bit smaller, than only hydrogen could be stable and all chemical compounds with be much simpler and, frankly, boring. Yet, the appearance of carbon wasn't connected directly with the Big Bang.

It was necessary for a few, rather unlikely, cosmological events to take place. For carbon to show up a few constants had to have the necessary values from the very beg of the Universe. So it couldn't be created at once, as it is (as well as all other heavy elements) a product of nuclear fusion inside stars. You need massive stars in order to produce enough carbon atoms and then you still need to blow the star up in order to redistribute the carbon throughout space. From what was spread around the Universe a new star was born, equipped with those heavy elements which also began concentrating in the space around the newly born star. Matter seems to like gathering into lumps, and soon the evolution of a planetary system began, and the outcome was the appearance of first living organisms.

Billions of years and billions of stars were needed for the first living cell to emerge on Earth, alas the enormity of space, time and matter aren't that unfamiliar to us. For the first human to be born we needed another few billion years. In that time the Universe grew even bigger and even older.

There is no evidence for life existing somewhere outside our planet, and even if it does exist we still don't know if intelligence evolved. To understand this we have to acknowledge that fact that we shouldn't feel uncomfortable with the Universe being so big, because this was necessary for humans to happen.

The anthropic principle is characterized by seeing all astronomic, physical and chemical events as leading directly to the rise of men. If we take this idea further we will see that this rule may be considered in three aspects, from the so called "weak" through "strong" to "final". The weak anthropic principle tells us that the properties of the Universe were created the way they were only in order to make sure that life on Earth comes into being. What we mean is that if the evolution of stars would be terminated on the stage of burning helium, than such a Universe couldn't be called life-friendly and therefore nor could Earth be given such a quality.

The "strong" version of the anthropic principle needs the presence of a thinking being on a certain stage of the creation process, who could ask questions about it's point.
And even though the "final" version goes way beyond typical science (it is an attempt to solve all the questions through a theological approach) it convinces us that the sole purpose of the Universe evolving in such an order was to create the best possible conditions for life to arise.
Earth – the planet on which life is the sum of many processes, complementing one another, and factors that shape life.

The whole Universe that surrounds us also shows similar properties, that by harmonizing all it's aspects it creates a unanimous entirety. A thought comes forth, that the world was designed in a way that would allow us to function in this creation without any greater obstacles to overcome.

The above attitude doesn't expel the possibility of life emerging as a result of an overlapping of various circumstances. The amazing fact about this stance is, that the friendly conditions on Earth haven't really changed in the last 5 billion years of circling around the Sun. And this is the moment where the anthropic principle enthusiasts have to give way to the Gaia hypothesis. That's because this hypothesis explains why there was no dramatic change in the life-friendly conditions in all those billions of years. The point of the Gaia hypothesis comes down to searching for links between the natural environment that surrounds us and developed life, which means an influence of a certain set of elements of life on the habitat around it.

The presence of life on our planet has a tremendous impact on it, because it's a self propelling engine influencing it's own development by a series of abiotic factors. It becomes clear that, contrary to the anthropic principle which explained only why was it possible for life to be formed, this hypothesis explains the phenomenon of the continuity of life.

Considering the geological time scale we can easily see some relationships between abiotic factors and the biosphere. The way of picking out that the biosphere isn't only a reflection of the environment, but it also creates it's own surroundings, thus creating optimal conditions for a further expansion of life, is essential to this idea.

When we take into account the processes that are taking place in the biosphere and their connection with our planet, we may relate this to a kind of physiological process and refer to the flow of matter in the environment as to a constant flux of matter in and out of a living system. One can demonstrate this using a well known and understood circulation process of elements that are the main constituents of living organisms (C,O,H,N,S,P,Ca). Their voyage through the environment takes them through many systems (atmosphere, hydrosphere and lithosphere) while not avoiding the biosphere.

If we take into account the fact that the mass and energy flows are of physiological character than we may call them the Earth geophysiology. The next step in investigating this superorganism is to consider the Earth's pathology, because the planet, as every other living being, may be affected by different agents that can disturb it's proper functioning. One of the main sources of these effects is the human race, who because of their actions, causes such disturbances as acid rain or the greenhouse effect. Therefore humans with their negative influence on the natural environment act as a kind of pathogene – a virus that is destroying the planet's structure. Continuing this current of thoughts we may come to a conclusion that the Earth has developed various sensors and effectors responsible for keeping the status quo, so that way a kind of environmental balance is assured. Every Earth's ecosystem has a determined part in keeping Gaia's normal functioning. Geological processes such as the continental drift, volcano eruptions or subduction could be the equivalents of some human biological functions - the flow of blood, bone growth or respiration, which are essential processes in developing and sustaining such a complex composition. In this case it's very difficult to separate the concept of life from the concept of the biosphere. Life requires stable and predictable conditions and these can only be provided by a sufficiently global mechanism. For the earthly body to function properly some kind of regulatory mechanism is needed, just like our cells need the whole body to work right. The growth of our kind by the spread of the developed areas and regions connected with them, reducing the reach of natural ecosystems and forests, or the constant increase of pollution, can be called Earth's tumor. If the rate at which this process takes place is kept it may lead to the final destruction of the host-body – Earth. But human activities shouldn't be only thought of as negative – as our knowledge of

how our planet works increases, we may be able to save it from a possible annihilation from the outside. We, humans, are the Earth's awareness.

The Gaia hypothesis engages the Earth's nature and it's astonishing functioning. Above all it shows us our place amongst other living creatures. It's an intriguing alternative for looking at wildlife as an unsolvable riddle. It gives us hope that Earth isn't just circling around the Sun for no apparent reason.

Gaia is of course just a hypothesis, but it shows it's values by asking new question, giving new answers and conducting new interesting experiments. Both of the ideas shown above share a certain amount of theological aspects, which take their source from the belief that the world, life and humans have been deliberately created and are in their creator's constant care from the very beginning. The theological meaning of the anthropic principle can be presented as a religious cult based on divine providence and putting one's destiny in the hands of the creator. In this case one has to accept that what was once created is not everlasting and it's existence can come to an end at any moment.

On the other hand of the theological aspect, the Gaia hypothesis depicts the creator as identical with nature. In Gaia's world living creatures have been created and appointed the role of regulating their own and the Earth's being. The main part in this world has been given to periodic processes, resistant to disruptions and not easy do destroy. But we should never try to think of these ideas only in the theological meaning, because they are really only loosely connected with this aspect. In the anthropic principle and in the Gaia hypothesis science and religion will sometimes come so close together, that will in fact be very hard to tell apart, and this may interfere with the suitable outlook on life and the Universe.