1. Introduction

January 2009, Google publishes its annual report regarding the most popular search questions. One of the top questions: „what is life". „Jackpot!" – I thought. „Despite there being so many books on this subject written by philosophers, theologians, mathematicians, physicists, economists and God knows who else, people still don't know the answer! They are still searching for it. This is a great opportunity, since the book I am working on just happens to bring an answer to this very question!".

"What does it all mean?" – we ask ourselves when we hear about an outbreak of a new war or when somebody lies to our faces. During the communist era I've been trying to understand the reason for all the lies on the radio, in television and the newspapers. Everyone knew that this took place, especially those doing the lying – and even though lying was denounced as an evil act by the communists – still, lies were all over the media! Most interesting is that the people responsible for creating and distributing these lies did all in their power to appear truthful! After "real democracy" stepped in, called here capitalism for short, things were supposed to get better – the media were going to be independent and objective. And, essentially, it has got a little better – before, the lies were blatant and direct. Now, pure lies have almost disappeared. What is becoming more and more popular though is a method of oblique statements, misrepresenting the truth and bending reality so it fits somebody's strange scheme.

Why - I kept asking myself. Why are some countries rich, and some poor? Why is war so brutal? Why do girls play with dolls and boys with guns? Why hasn't any psychic won the lottery yet? Why...? Why...? Trying to find an answer to these and similar questions I have come to believe that all the phenomena mentioned above are hard consequences of human nature. And so another question appeared: "What is human nature?"". Thinking about this, I noticed that there are many similarities between the behaviour of humans and animals. If two and two equals four (an equation based on an objective mathematical law), then entropy, John Paul II, Hitler, volunteerism, communists, shooting prisoners in the back of their heads, charity, burning at the stake, a kidney, a lion, a mosquito and the lazy neighbour from the second floor**... all of this has to be based on something, there must be some kind of logic to it.** If the October Revolution took place, and one of its main elements was mass genocide; if the French Revolution took place, and one of its main elements was mass genocide, it means that both of these revolutions were a natural phenomenon! Just like, for example, apples falling from a tree! Hell! Everything happening around us must be based on some fundamental principles and laws! Therefore, there **must** be something like... **the physics of life!** The problem is - we just don't know about it yet.

The physics of life – easy to say... but what is it? Physics, as we know it, is the science of the essence of everything that surrounds us. And life? Since a good and explicit definition does not exist as of now (the year 2009) – let's just say that life is us. Therefore – simplifying it as much as possible – physics of life is the science dealing with the principles and laws governing who we are, and the way we behave. Life in itself is immensely complicated, but the principles which it follows, as you will soon see, are not so many and what's more, can be comprehended.

Once I was asked: „Is the physics of life some kind of pseudoscience, or is it real science?" Like humans, scientific fields have their early, youthful, and mature stages, and sometimes seniority. Physics of life is already past its early stage, its roots reach the sixth century B. C. Currently we are entering the youthful stage – there are no refined systems of mathematical equations, but we can already formulate general laws and set good guidelines.

For the question of whether it will be worth one's time to learn to understand the physics of life, my answer is: „The benefits are exactly the same as in the case of all other types of sciences. We gain an understanding of the subject matter which is better than that of others, sometimes this knowledge may be profitable for us, and may help us avoid someone "pulling a fast one on us".

1.1. Please do not be afraid of the word "physics".

$E=mc^2$? No! Never! First of all, physics of life cannot be that easily summarized in an equation. Second, its understanding is not as difficult as understanding why E equals mc^2.

Life is a consequence of the laws of nature! A hard consequence! Why hasn't there been a book written on the subject yet? Well, great discoveries don't come easily, even though they are later considered as obvious facts. The problem of understanding life results from the complexity of the matter. There are many interweaving subjects to talk about. Let us then look at the general plan of the book. We will start with the idea of dualism of nature, with its basic premise that particles scattered all over the universe form groups; however, there are areas where gravitational forces acting upon them are too small, and particles remain in a constant state of scatter. This state is characterised by the fact that some of these particles are still grouping, but there are also some that „don't want" to group. In these areas, forces other than gravitation gain significance. Next stage will consist of a very careful discussion regarding biological

evolution, based on its simplest model – the process of evolutionary development. Then, we will formulate a definition of life, slightly different from ones currently used, and discover the mechanisms of self-improvement possessed by living objects. We shall also find the time to answer the question of life's origin, explain the issue of death and discuss the formation of multicellular organisms. After these basics, we will move on to subject much closer to us, the coexistence of special living organisms - humans. We will find out what mechanisms are at work in our interactions and how we function within a society, a nation, an office, a factory or a family.

Will it be difficult to comprehend the physics of life? I'd lie if I told you that it will be as easy as ABC, but its individual elements are not especially difficult – all that is needed to comprehend them is a high-school level education and a curious mind. On the other hand, the number of these elements and their interconnections is rather large. Thence, most difficulty will be in making one's way through this jungle of aspects, not in a lack of some unique intellectual gifts. The knowledge of higher mathematics such as differential geometry is not necessary, what is necessary is this: imagination and an explorer's passion.

1.2. Why am I writing about this?

The main reason for creating this book is my great desire to answer the questions which have been on my mind since I can remember: "How should one live?", "How to raise children?", "Who to vote for?", "Why are things the way they are, not the way I think they should be?" Similar questions bother us all, humans have been asking them for thousands of years. Sometimes we wonder: "A great businessman!? He wasn't anything special in school.", "How could've such a moron make a career?", "It's impossible, she was so gifted and she can't find a job?" Since the ancient times humans try to find answers to similar questions. I know it might sound rather bold, but I've done it! If each of these types of questions were seen as an element of a puzzle, in my mind they are put together into a uniform, coherent and clear whole – the physics of life, the goal of which is precisely to answer these types of questions.

For geopolitical reasons, at the age of thirty-one my material wealth amounted to zero – I owned practically no materially valuable possessions. In the non-material aspects, my situation wasn't so bad: I held a degree in applied science ; I knew three languages, for ten years have been an active mountain climber, had a hobby of writing computer programs and a passion for work.[1]

[1] More precisely a passion for becoming rich by making something others would want to pay for.

Several years later I was an owner of a small IT company. Starting my company at 31 – despite the fact that I was, as I mentioned, not a wealthy individual, but full of enthusiasm – I was eager to conquer the world. I truly believed that I would create a worldwide company.

The company, after fifteen years of hard work is not as big as I initially intended, but... thanks to this, I gradually discovered something I later called the physics of life, among other things. And this gradual process of discovery has helped me to continue to successfully run my business.
I sincerely hope that getting to understand the physics of life will also help my Readers.

1.3. Methodology of observation

We are free to make observations of any objects or phenomena. No one says we can't. We can draw our own conclusions, create rules and discover the laws which make these objects and phenomena do what they do. Of course, others may or may not agree with our discoveries. And whether they do or not depends on many factors, for example, whether our discoveries agree with those of others, whether they are the logically consistent, or can be proven in real life.
Observations, analyses of these observations and experimental tests are a basis of building any type of science. While making observations it is important to make sure that we do it in an objective and independent way, since each attempt is "contaminated" in its own way. An interpretation is also susceptible to contamination. Let's remember the child pointing out that "the Emperor is naked!" while the whole crowd maintained that in fact, "the Emperor is wearing the most exquisite clothes." It seems that even the Emperor himself was sure of it. Why did each member of the crowd say that he is clothed, while in fact he was stark naked? The answer is simple: contaminations of observation and interpretation. In the case of the crowd and the Emperor, there can be two reasons: fear or the psychological "principle of the social proof of rightness" [ISBN 9788387957520, page 110], meaning believing in and fully accepting majority's or a known authority's opinion as a fact. Even if our eyes tell us something completely different.

There are many contaminants in observing life. The main one is the fact that as humans we think of ourselves as unique, while in essence, we are not particularly unique besides the fact that we are a special case – a living being, one of many. And still today an enormous part of human population refuses to

accept apes as men's ancestors. They cannot imagine that man is a transformed - in some way (let's admit rather reckless way) - ape. There plenty of other contaminants distorting observations of life and the interpretations of these observations which follow. Some of the reasons for this could be an unsuitable intellectual level, too narrow of an observational field, a lack of disposition for drawing conclusions, cultural influences, etc. In my research, I tried to limit the amount of contamination to the maximum. In order to do this, I employed mathematics. It is well known that physicists use mathematics in order to describe natural phenomena. I thought: „since life is a natural phenomenon – mathematics should be a very suitable tool which could define it".

Key issues to which the physics of life must find answers, are: „How did life originate?" and „Can life be studied using physics?". The first step leading to the answer is the undeniable fact that every living object is a group of appropriately arranged chemical elements. Therefore life does not result from what we are made of, because it is a group of elements, but from how these elements are arranged in relation to one another, and how they interact – the problem is not in the matter but in the structure and interactions! Another question arises: „how is it that the currently unimaginable for the human mind number of these particles and atoms arranges itself to become me, or you, dear Reader?". Mathematics can also lead us to find an answer to this question: living objects are a series of descendant objects, or more precisely, a series of transforming descendant objects. And if a human is a transformed ape, which in turn is a transformed prosimian, and a prosimian is a transformed something – then „What lies at the beginning of this process of transformation?" and „What factor has given a higher complexity to descendant objects?". As you can see, our initial question creates another, but less fundamental questions. These questions will gradually, step by step, lead us to finding the explanation of the essence of life.

1.4. Mathematics and Physics

What is mathematics? Turns out that there isn't a definition which suits everyone. I will tell you my definition, so you know at least what I mean when I use this term. Mathematics is a science dealing with objects and their properties, with interactions between these objects (their mutual effects) and with transformations (metamorphoses) of objects.

In the special case when the objects we are dealing with are numbers, and the interactions taking place are addition and multiplication, we are talking about arithmetic. If these objects are generalized numbers written in the form of letters, and the operations remain the same, addition and multiplication again, we

are talking about algebra. Higher mathematics considers more complicated objects - functions. There are many known fields in mathematics besides arithmetic and algebra, for example differential calculus, probability theory, classic geometry, analytical geometry etc. The objects may vary, but the way of studying their properties is always the same. The approach is ruled by iron laws of logic, it's scientific, it doesn't allow any ambiguity – in one word, it is mathematical.

Mathematics is a pure science – everything takes place on an abstract plane, there's no room for mud and dust. Everything has to add up and it does add up. A mathematician can even prove that some problems cannot be solved and he stops there – it is enough of an answer for him. Mathematics possesses a certain form of communication which is understood everywhere and by everyone. This language is a wonderful tool for recording various phenomena. At its root lies an explicitness of definition. Mathematicians, saying "two plus two equals...", talk about exactly the same thing whether they are mathematicians from Korea or Peru, whether they are mathematicians who favour communism, democracy or fascism. Definitions are not as explicit in other fields. For example, let's look at the term democracy. Ancient Athenians understood it in one way; Americans view it in another way, different from the Russians, or the Swiss, who have their own view. In order to be as explicit as possible I will give the definition of every term I use, whenever possible - like I did in case of mathematics just a moment ago.

Mathematics is easy to learn and to teach – because it is logical, omnipresent and its first stages are simple enough, intuitive and obvious. Since it's universally applicable, many consider it the queen of sciences. My grades in mathematics were always higher than in other subjects and they should evoke such "royal" approach towards math in me. But on the contrary, I think that mathematics is a tool - excellent, perfect - but only a tool. Physics is the science with a capital "S"! It's the study of nature in the widest sense possible. The science which studies the nature of things which surround us, regardless of the way they are. After Wikipedia, we can add that **nature** means objects, processes and phenomena. Within the limits of these terms are animate and inanimate objects - which means basically everything: a dog and a man, and a rock, and fog, and condensation, and gravitation, and evaporation, etc... Physics studies everything and discovers its properties, mutual interferences and transformations. It does everything that mathematics does but deals with real objects which surround us. And its methods of research have a very practical aspect.

Does life follow the laws of physics; can it be described with the language of mathematics? I am a hundred percent sure of it! If animate objects are made of matter, they must follow the laws of physics, since matter follows the laws of physics! Question is, have we discovered these laws yet? And even if we

have, does enough people know these laws and are conscious of their effects? Because it is not enough to know about something, one must also know how it functions in real life. An example of this could be Newton's Three Laws of Motion. Each person after high school should know them. Everybody has learned them in elementary school, yet only few know how these laws influenced the construction of flying machines.

Summing things up: since life follows the laws of physics and mathematics is the language of physics – therefore the methods of physics and mathematics should be used to study life! We must remember that some laws still have to be discovered. And they might not be ones which we will be able to describe with a nice and neat mathematical equation[2]. Most importantly, we must study living objects. Study them in a most objective way possible, removing any observational contaminations. Such diligent observation will determine their properties; these properties will allow for discovering laws and relationships.

1.5. Obstacles

In all probability, you will approach my theses with a big dose of scepticism, especially in the beginning, as you would with any type of unknown innovation. Physics of life is something new, something which is just being born, some of its terminology and theses are being formed for the first time. A branch of science is of course most easily evaluated when it has matured and verified in real life over and over. This is not the case with the physics of life – we don't even know at what stage of development it is at. In order to explain what I mean by a stage of development of a branch of science, let's look at a certain events in the history of mechanics. Free falling bodies were being studied as early as 350 B.C., by Aristotle. As a result of his observations he stated that bodies having various masses thrown from the same height do not fall equally, meaning that the lighter ones fall slower and the heavier ones fall quicker. This view, even though it is wrong, is very strongly rooted in our subconscious. In order to find out that it is so, all we really need to do is ask a child who has never studied physics, and it will always answer that a stone falls faster than a similarly sized piece of wood. In all probability, it is this inner conviction and the authority of a great scholar, supported by the arguments given by him, which made it so that for nearly two thousand years people have accepted this wrongful thesis! Only around the year 1600 Galileo (1564-1642) performed a simple experiment. From the Leaning Tower of Pisa, he threw two objects with

[2] In case of formulas, equations and scientific theories, similar phenomena take place in music. There are melodies which catch our attention easily and we are glad to hum them under our noses. One of the most important discoveries of sociology is that people are eager to agree not with well grounded, appropriately and precisely presented but complex arguments, but with arguments which are simple and spoken with a great conviction. [9771642568715, p. 126]

various weights and saw that they fell at the same time. Galileo himself did not explain the nature of this phenomenon, but he gave a mathematical description of the movement of the falling object, employing his excellent musical ear[3]. Some years passed until Newton (1643-1727) discovered and formulated his laws and wrote them down using mathematics. It's smooth sailing from then on and in the result, since around 1900, we are able to move around the world in airplanes.

If we were to place the events related with discovery of the principles of dynamics on a timeline, Aristotle's observation from around 350 B.C. - an observation that objects fall - would be the first event. The next point on the timeline (around 1600) marks two aspects of the matter, discovered by Galileo: a correct observation and a mathematical description of the motion of falling bodies. The third point (around 1700), authored by Newton, was an introduction of such terms like force and mass, and formulating principles of dynamics, which bound their mutual dependency with a formula. The fourth point, or rather stage, is the use of these laws in practice. In short, this is the way individual branches of science develop – according to the following scenario: observation, discovery of laws, mathematical description, definition of terminology, creation of a model, analysis of this model and practical implementation of the results.

Scientists, especially those dealing with natural sciences, will find specific formulas and sets of equations lacking in this book. Essentially, there will be none of these, but as you will see that even without them you will learn plenty.

[3] The story of how Galileo's musical ear contributed to the development of dynamics makes for an interesting digression:
"Galileo, lost in the land with no time-measuring devices, decided to make a sort of musical instrument out of a ramp. He stretches few lute strings across a board. Now the falling balls moved these strings. Next, Galileo moved each string up and down till he decided that the ball rolling on a plane makes an even rhythm. When the strings were finally attached correctly, humming a march, on the count of "one" he let go of a ball, which struck a perfect rhythm, hitting each string every half a second. Galileo measured the distance between them and – mirabile dictum! – it turned out that the distance grows geometrically. In other words, the distance between the start point and the second string was four times greater than the start point and the first string. The distance between the third string and the start point was nine times greater than the distance set by the first string, and the fourth was equal to sixteen times the distance set by the first string, and so forth. Despite that, the time needed by a ball to travel each distance was always half a second. (Ratio of these numbers: 1 to 4 to 9 to 16 can be presented as the squares of consecutive natural numbers: 1^2 to 2^2 to 3^2 to 4^2 etc.). But what would happen if, by lifting one end of the board, we make the plane a little more steeper? Galileo tried many angles: from gentle to rather steep, to so steep, that the motion was too fast for his "clock" to measure time precisely anymore. Each time he found the same relationship, the same sequence of squares of consecutive natural numbers. The most important thing in this discovery was that it showed that a falling body doesn't simply fall, but as it falls it accelerates, and this acceleration is constant." [ISBN 83-7469-2219 str.68]

1.6. Encouragement

If the possible difficulties presented above did not discourage you, dear Reader, and you would like to hear some words of encouragement, here they are:

- I am convinced that you will find something new in this book;
- This book was not written by another madman trying to discover the absolute truth yet again
- I rely on observations of others as well as on my own. Others people's scientific research and observations have also been taken under consideration. In the following chapters you will find out that the physics of life encompasses the thoughts and observations of saints and popes as well as lowlifes, such as a death camp officer. [see bibliography]
- A lot of what I write about I have used in real life - with good results;
- Despite the fact that I'm dealing with an extremely complicated topic, everything is very coherent and logical.

1.7. Why me?

Why isn't the Physics of Life written by some professor from Oxford, Sorbonne, MIT or some other renowned university? Well, I'd like to answer using a quote: (cytat z książki angielskojęzycznej) *A microchip made it possible to encode the whole central unit of the computer on a silicone board no bigger than a nail of one's big finger. However, this step wasn't achieved by big corporations like DEC or IBM, with their funds and experts. It was achieved by entrepreneurs and hobbyists with wide horizons and big dreams…* [ISBN 83-204-1782-1 p. 06] Besides that, does any university have as good laboratories as I do? I have lived under two political systems: a Polish variation of Soviet socialism and in a Polish version of capitalism after 1991. I have visited a number of countries, and not as a typical tourist, on a tour organized by a travel agency. I lived in these countries relatively long, meeting interesting people, watching life unfold from "behind the scenes". For four years I have lived in Moscow, the capitol of the Union of Soviet Socialist Republics at that time. While living there, I befriended a Tatar named Rustem, whom I met at school. Later, I worked as an engineer in one of the wealthiest countries in the world – Switzerland, for a German man named Klaus. From him I learned the secrets of running a company. I learned a lot travelling throughout France with the members of a large, wonderful family of Emil and Yvonne, and in Spain I conversed with Esteban, a scientist, who explained to me, among other things, why a great cook became the president of a national sport association...

From Philip, a Frenchman living on a Polynesian island of Tahiti, I found out things like the fact that Polynesians have no future tense in their language. Also, if scientists from renowned universities had laboratories as good as mine, they would never agree to work under the same conditions as me: no steady pay, no sponsors, no grants, no students who will gladly and freely do a whole bunch of work, and no facilities of any kind.

Freeslow is a pen name which reveals my nature in the best possible way. “Free” and “slow" translate to the same Polish word, "wolny", so this word cumulates two separate meanings in itself – "free as a bird” meaning independent, and “slow a turtle” meaning, not fast. John Freeslow freely translates into Polish as Jan Wolny. Why a pen name in English, and not Polish? The answer is simple - English language is the Latin of the 20th Century.

1.8. Writing methodology

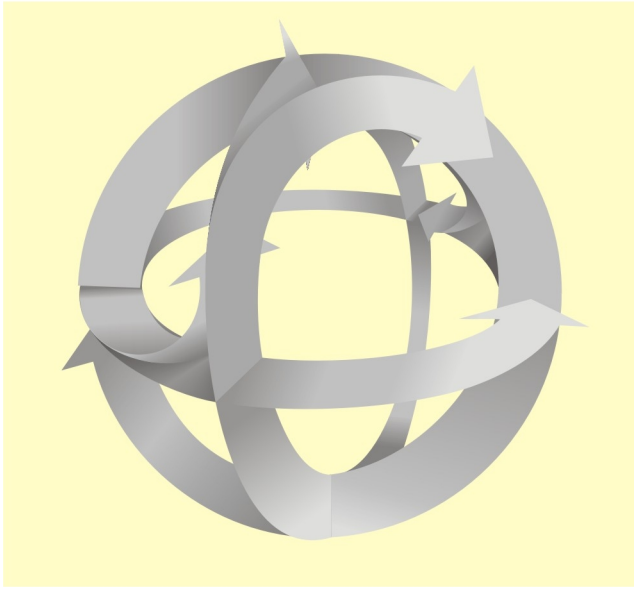
Now you know who is doing the writing. Now I'd like to say a few words about how I'm going write. Unfortunately, I was not born with a literary gift, an effortless style... Therefore pouring my thoughts onto paper doesn’t come easily and please forgive the fact that this book will not be written in a wonderful, flowery and lively literary style.

Describing the physics of life must be done with the help of the language of physics and mathematics – boring by definition; therefore I hope that my two „shadows” – Paweł and Karolina – have successfully flavoured the text with their style.

My consultants have repeatedly told me that it is not necessary to explain certain concepts, which are obvious to some highly educated individuals. But I didn't want to follow their suggestions to take out some explanations, for example of what a mathematical function is. The terminology used and its exact understanding is crucial to the process of cognition. Please remember that explanations will be given, and don’t be discouraged if they seem obvious. I will explain and define everything what I think is necessary, because this book, at least in its premise, is meant as a monograph of the physics of life.

Seeking an explicit definition is exceptionally creative task; it explains and uncovers totally new horizons. It is a mechanism which really works. If you are not totally convinced of this, try to define these three concepts: „energy", „life" and „evolution". Put this book away and examine all materials available to you. Search until you are fully satisfied with the definitions created by you. They can be someone else's definitions – but you must be totally sure of them! Write them down on a piece of paper entitled: "My definitions, which I consider explicit, correct and clear." Date and sign it, put inside an envelope, seal and put it away. After reading the Physics of Life, you will return to these definitions and change what you think should be changed. I don't guarantee that I will provide any definite definitions for you but I guarantee that you will change yours after reading this book.

Various subjects mentioned by me will connect with another ones in complicated ways. One depends on many others, and each of those depends on yet other ones. It could be called a system of communicating vessels, but that would be an oversimplification. These subjects are interwoven with one other and it is best to imagine this interweaving as a sphere of knowledge, something like a tangled up ball of barbwire. Because of this mutual interweaving, the physics of life cannot be presented in a linear way, subject after subject. Sometimes I'll have to run way ahead or return to an already discussed material. So please excuse me if you feel that, as one of the consultants said, "shoot! I think I read this already".



The sphere of science

Having said all that, I wish to invite you to take a trip on the fascinating, winding and intertwined paths of the physics of life.

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