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Editorial Article

Virus-Inducing Informational Processes vs. Cell Antivirus Info-Sensitivity and Implication of the Biostatistics/Metric Applications in the Detection/ Prediction of the Covid-19 Infections

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Editorial

Information is deeply involved in our daily activity, both at the micro and macrolevel. However, the powerful effect of information both in the human organism and in the other living structures is not yet well understood and studied. If we look to the micro and macrolevel scale, we can observe that information is the fabric matrix of the entire world [1], and especially that of the living organisms [2, 3]. Indeed, the living systems, starting with the living cell unit, in particular with the eukaryotic cell (Figure1) – the basic unit structure of animals and plants, are self-organized dynamic systems, which continuously work to maintain their structure and functions, under nearly constant conditions of temperature and environment. Each composing structural unit of the multicellular organisms consumes an input material (foods, air, water) to produce energy (E in Figure 1), basically by the conversion of glucose from foods during an oxygen assisted process in mitochondria (specialized organelles similar with lungs and bowels in animals and human), within the metabolic process. Part of this material is used as substituting microelements for the body maintenance, the "hardware" of the informational system of the organism. Such a process is automatic, necessary to sustain continuously the material structure and energy of the living organism, so a maintenance informational system (MIS) can be defined, which manages the metabolic processes. In the eukaryotic cells, these processes are simulated similarly like in human and sub-human organisms. Indeed, the Golgi's apparatus is equivalent with the heart and distribution system, the activity of the endoplasmic reticulum with that of the pancreas/blood vessels functions, the vacuoles – storing the nutrients, with the stomach, lysosomes with spleen and liver-kidney, the cytoplasm with the sustaining role of muscles and tissues, and the cytoskeleton – assuring the static resistance of the body, with the bones in vertebrates.

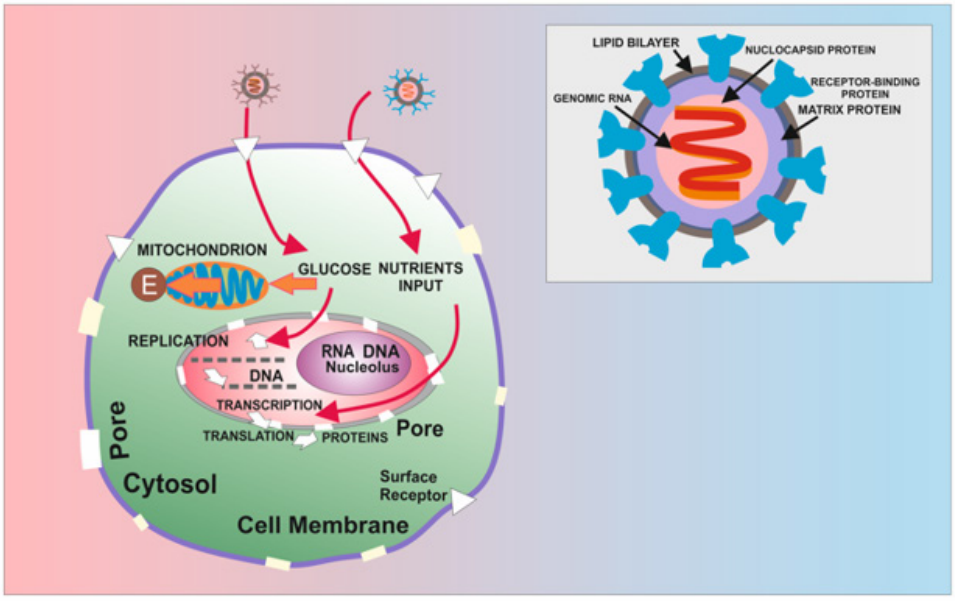

Figure 1: Schematic representation of an eukaryotic cell (central region) and of the coronavirus architecture (right upside), exhibiting the main automatic/programmed processes and a DNA genomic-type virus intervention (left upper side) and a RNA genomic-type virus intervention (right upper side) in the cell processing machinery.

The prokaryotic cell, typical for bacteria, is the simplest unicellular organisms, which is different from the eukaryotic by the non-distinctive organelles in the cytoplasm. However, the same type of processes and functions are achieved within the reactive pathways of the cell, with the participation/intervention of enzymes, special organic molecules able to decrease the barrier energy of the reactions, which sustains the metabolic processes [4,5]. The life starts actually with a cell, the basic unit of life. The human egg is also a single cell, of about 200 micrometers, but from the union of an egg with sperm arise the 10 trillion cells of the human body [6]! This process shows the extraordinary power of life, and extraordinary power of informational organization of the living matter, because the self-organization and coordination of such a complex structure/process would be impossible without communication and information-assisting cooperation between its components.

The metabolic processes are cyclic, the living cell and the multicellular organisms consuming input material and eliminating wastes and uric acid, in an automatic mode. The reproduction process (cell division in two components) is one of the fundamental characteristics which defines the living systems. This process is initiated by the replication of the deoxyribonucleic acid (DNA) inside of the nucleus of the cell, resulting finally two identical mother/daughter cells. A genetic transmission system (GTS) can be therefore defined in unicellular and multicellular organisms [5]. The (re)construction of the cell/body by the informational communication from DNA sequences to form specific proteins with specific role (Figure 1), the "bricks" of the body, is assured by transcription/translation processes, so an info-genetic generator (IGG) could be defined also as a programed informational "software" system. This communication is based on a "four-letter alphabet" of DNA/RNA, built with combinations of no more than four nucleotides [7].

The viruses are not really living organisms. They can be considered at the sub-limit of the living systems, because they do not dispose of their own metabolic and reproduction functional/autonomic mechanism. Their architecture consists in a central single strand RNA or double elicoidal strand DNA genome, associated with a nucleoprotein within a capsid comprised of matrix protein and an external lipid bilayer, provided with receptor-binding proteins (Figure 1 right upper side), which allow the coupling with a surface receptor of the cell and its penetration [6]. The genomic DNA-type viruses (left upper side of Figure 1) show the ability to intervene in the replication process of the cell, while the genomic RNA-type viruses like COVID-19 (right upper side of Figure 1), in the transcription and translation process of the protein in cytosol. The simplest viruses contain RNA or DNA genomes to encode only four proteins, but the most complex viruses can encode up to 100–200 proteins.

Due their simplified structures, but which however contains a genomic DNA or RNA component, the viruses cannot develop by themselves a metabolic and replication or a transcription process, characteristic only to the living systems [7], but can use the cell system "machinery" to develop these functions, so these species are parasite of the living organisms on the entire living scale, from bacteria to the multicellular complex organisms like the human. The translated proteins and the replicated genomes associate

during an assembly process to form virions, which finally produce the lytic death (disrupted disintegration) of the cell or its gradual degradation [6].

In the infected cells, the info-communication agent is therefore the messenger RNA (mRNA) of the virus, instead of the own mRNA of the healthy cell. COVID-19 is a novel pneumonia virus causing respiratory illness, detected for the first time in the region Wuhan in China [8], and spread in the entire world at a pandemic scale. COVID-19 belongs to human Beta coronaviruses (SARS-CoV-2, SARS-CoV and MERS-CoV), which have many similarities, but also differences in their genomic and phenotypic structure, which can influence their pathogenesis [9]. COVID-19 is a spherical particle containing single strand RNA genome with a structure similar with that represented in (Figure 1 right upside). In the host cell virus uncoats, the genome is transcribed and translated by the cell mechanisms and the replication takes place in the cell cytoplasm. Typically, the viruses exhibit a spherical form with a diameter of the order of 100 nanometer (1 nm = 10^{-9} meter), much smaller than the cell diameter, which is of the order of 1000nm for bacteria [6], the simplest unicellular organism. Such dimensions are too small to be observed by a current microscope, so electronic microscopy and special techniques should be used for observation. Modern methods able to combine image collection and computationally demanding image processing, which can provide incredible details about virus architecture are used nowadays, besides the common methods to visualize viruses using fluorescent tags or dyes [10], all of them useful for biometric application in this field of investigation.

The informational model of the living structures recently elaborated [4,5,7], shows that the living organisms are sensitive to information on the entire evolution scale. This quality is not only a consequence of their dynamic functional mode, but also a duty for survival, necessary to detect in due time the nutrients in the environmental neighborhood, the potential dangers, and the changes in the climatic conditions. Therefore, they are provided with sensors for internal and external signal detection, and they are able to operate with information and to transmit information as a reactive response for adaptation. From informational perspective, a center of acquisition and storing of information (CASI) and a center of decision and command (CDC) can be defined therefore, consisting in a network of sensitive elements (sensors) plus the local memory (surface receptors), and a network of operational reactive pathways in the cell, respectively. Moreover, similarly with the emotive reactance at the human, where an Info-Emotional system (IES) can be defined, there are arguments to show that a info-reactive sentience system (IRSS) at the organisms on the inferior scale of evolution could be also operative [1]. The human body and the human cell work actually as informational devices: during the sleep period in a "stand-by" minimal operational regime assured by the programed informational system (PIS=MIS+GTS+IGG), and during the awakening state as a signal-coupled to reality and reactive operational device with attitude as a informational output of the operative informational system (OIS=CASI+CDC+IES), overlapped on the PIS [11,12]. The human cell contains 8.38×10^{8} Bits in the genetic stable memory of the cell, able to configure/reproduce the entire structure and functions of the cell [3]. When a virus invader enters into the cell, an automatic info-detection process initiated by specialized internal sensors of the cell is activated, working at human within the frame of the immune system. In particular, the protein interferon molecules acts as sensor which activate a guardian team of other molecules, working together to stop the easily spreading of virus to other cells in the body [13]. The ability of viruses to penetrate the cell membrane and to enter inside of its cytoplasm can be speculated for scientific and investigation purposes.

This is an actual developing task in the immunology field, opening new promising ways to study not only the behavior of viruses and antivirus processes, but also the response/rehabilitation of the cell, with application in biotechnology and medicine, by use of the genetically manipulated viruses as transport and intervention vehicles for cell response studies, cancer possible treatment [6, 13], and for the finding of new generations of vaccines [14]. Recent researches have revealed a special DNA molecule called DNA-PK, earlier known as a reparatory agent of the DNA damages, which starts to transmit alarm signals when virus invaders are detected in the cell, triggering a strong cell immune response [14]. A sentinel in human which can recognize/distinguish differentially the DNA or RNA genomic type of virus with respect to the own cell components, is an enzyme called cGAS, which synthesizes a signaling molecule cGAMP, that alerts cells on the viral infection [15,16].

From informational perspective, the sensor network and informational operating agents against the viruses belong to IGG, intervening automatically in the urgent situations of risk. The problem for the scientific community nowadays is however that SARS-Cov-2 is particularly efficient at shutting down this alarm system compared with other respiratory viruses and seems to have a unique ability to avoid our immune system from recognizing and combating infection in the first stages [17]. A scientific network around the entire world had mobilized their efforts to find an efficient antidote (drug and/or vaccine) against this virus, and for this it was necessary to sift a high volume of data (through the 29,811 RNA bases) in the virus's genome, seeking out the instructions for each of its estimated 25–29 proteins [18]. A strategy at macrolevel, based on artificial intelligence and their method ability [19] to predict the infection rates with this virus, is the using of the big data analysis for decisional support in due time [20], as a valuable statistic tool involved in this effort. Notable results shown in Figure 2 were obtained by applying the autoregressive integrated moving average (ARIMA) model, demonstrated to be the most suitable to generate the best prediction, when an exponential increasing trend is operable in each particular case, on a large area of geographic territories including Europe, North America, Australia, Asia, South-Africa [21], as it is shown in Figure 2. The application based on

artificial intelligence is compatible with human health and ability to serve and anticipate/accelerate the technological progress in a large area of domains and of the society, as it was recently shown [22], including biostatistics/biometric field.

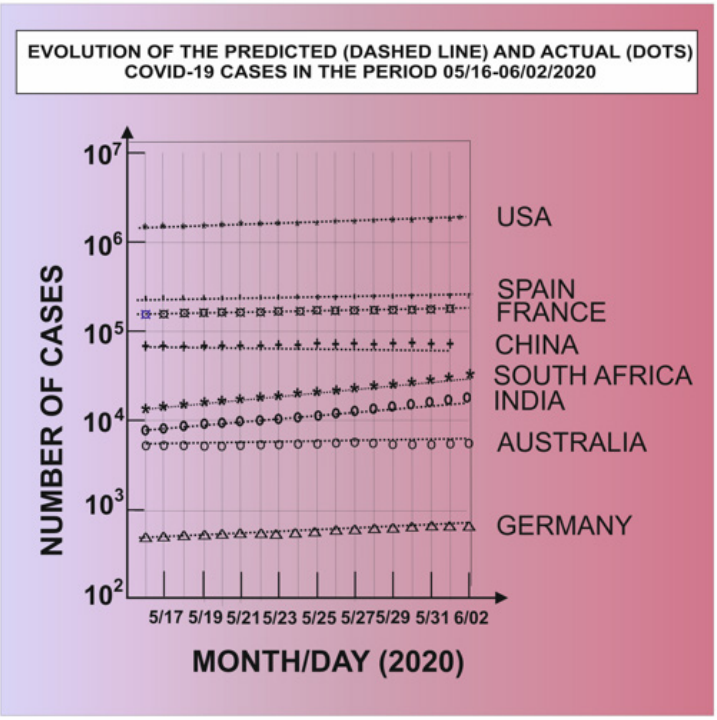

Figure 2: Evolution of the predicted (dashed line), and actual (Dots) COVID-19 cases in the world (North America, Europe, Asia, South-Africa, Australia) during the period 05/16-06/02/2020 on a data set of 95% confidence interval collected from [21], showing an exponential variation with specific rates.

Conflict of Interest

No financial or conflict of interests.

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