THE BIOLOGICAL CLOCK AND…?! LIFE IN 0.8 S

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Abstract - In the presentation we are looking for answers to these questions:
1. What mechanism does the organism use to define the quantity and the velocity separately for every physiological process?
2. How are all these physiological processes synchronised together?
It is not possible to synchronise two physiological processes without a clock. The operation of the humoral system is impossible without a clock. The velocity of every process with a set quantity of substance is defined by means of a clock. The clock puts order in the system and it becomes controllable. It synchronises the operation of all systems together. What is achieved by means of the clock:

- the cycle of all processes in a cell is the same;
- the cycle of each cell in an organism is the same.

The concept 'clock' in our mind is linked to some objects – electronic, mechanic … 'Clock' is a symmetry. Objects can be different but the symmetry that they measure is always one and the same.

Key words - Biological Clock, Physiology, Processes, Regulation

I. INTRODUCTION

Processes and events in the circulatory system of a healthy human being are described in my book 'Blood circulation for 0.8″ or 1♥/hc'. The matter under discussion here is the principle and the action of the biological clock and the way it appears in the circulatory system.
In order to describe the events in the circulatory system it is necessary physical principles to be derived, laws and their mathematical dependencies, which have one and the same meaning for all physiological systems of the organism, based on various symmetries, thanks to which it operates as one whole. Some of them are:

- The principle of the biological clock, where:
- the cycles of all processes in a cell coincide;
- the cycles of every cell in an organism coincide.
- 'everyone separately and all together between them' is a principle.
- The principle of triple correspondence (correspondence between the electric, chemical and thermodynamic activities).
- The principle of equality between the flow, debit and impulse.
- The principle of equality of blood volumes, which the circulatory system transfers to all its parts.
- Quantities accepted as units in principle.
- Stroke volume of the heart (1♥) and the principle of equality of blood volumes.
- Heart cycle (hc) and the principle of the biological clock.

The mass of the stroke volume and continuity of the heart cycle as well, are not constant quantities but for the vegetative system their value is a unit.

II. MEASURING SYSTEM OF THE ORGANISM

The measuring system laid out here is incomplete, because, in order to be entirely grounded, it is obligatory to pass strict laboratory research. Some principles of measurement the way the organism does it have been exposed here. Measuring in it defines the connection 'humoral apparatus ◄► brain'.
The core of diagnostics is measuring physical parameters. 'Diagnostics' or reflection of the condition is the letter 'a' of treatment. The precision of measurement and the possibility to have the values of all important parameters as well, define the precise actions of the physician and the happy end. The evaluation of the condition is performed through:

- explanations given by the patient (anamnesis);
- directly – measuring definite parameter with a diagnostic apparatus;
- indirectly – external signs (symptoms).

The good qualifications of the physician and the precise evaluation of the condition guarantee good treatment, but the analysis of the means at our disposal show that the opportunities of measurement are poor – the parameters measured are insufficient and the methods for direct measurement – questionable.

II.1 Measuring units applied in diagnostic equipment

The measuring units applied in diagnostics are the same as the ones applied in wine production or hydro engineering:

- velocity of blood – meters per second m/sec;
- systolic volume – milliliter;
- minute volume of the heart – millimeters per minute;
- pressure – millimeters mercurial column (mmHg);

- volume - ml³;
- time – second.

Example:
A stroke volume of the heart which medicine has adopted as a measure is 70 ml for a 25 year old person. This measure is accepted 'in principle' and is usually applied in all cases. The question is what does it measure? The answer is – nothing:

- the measure 'milliliter' does not exist for the brain;
- the stroke volume changes its value since the birth of man and changes during the whole life. Two consecutive strokes of the heart might have different volume;
- there are no two people with identical hearts.

The conclusion is that the volume given is conditional and similar 'measurement' is inapplicable because it is devoid of sense. It is a similar case with all measures as mentioned above – the brain does not use any of them.
In the exchange processes in the cell the organism reaches the accuracy of a molecule! The question is whether the measuring units applied in diagnostics are of equal value or we are simply trying to put the entire living nature in SI system? The measuring system SI is created by man for convenience and in no way that type of measurement coincides when applied to the organism. As you are to see below the basic way of measurement in the organism is not based on exact quantities that the organism tries to follow. In its greater part that measurement is achieved through proportions – DNA gives proportions the brain defines values. That enables correct values during the entire human life, notwithstanding whether it is a child or a grown-up, slim or plump.

The new type of measurement presented here is based on three principles. The first one is the fixing of the 'zero' point. The position of the zero is a criterion for the size of the quantity. In medicine is accepted the concept 'normal'. It is the value of a parameter in the organism of a healthy person, which in practice is a criterion, 'zero' of the deviation. To the point, it is not a bad rule, but the question is that when a physician finds out deviation from the 'normal' value and by means of medicines tries to restore that value in the framework is the person really healthy?
The second principle is to define the precise values in the organism are the constants. They are the 'zero' according to which the regulative value of all variables is defined:

$$t^b = \kappa v \qquad \textbf{(1)}$$

where:
t is velocity constant;
v is velocity variable;
κ is humoral regulator of velocity;
b is autonomously set regulation of velocity.

It is possible that the constants in the organism are far more, but here only those that have direct relation to the matter discussed are referred to.
The constants given here are:

- time constant – the velocity of time is an absolute physical constant;
- DNA (contains all biological constants; DNA is a constant – might not change for millions years ahead);
- constant of the internal temperature of a healthy person (37˚C);
- constant of velocity of the movement of blood in the capillaries in the big vessel circle;
- constant of velocity of the movement of blood in the capillaries of the small vessel circle;
- constant of velocity of movement of the glomerular filtrate in the tubuli of the lever nephron;
- the tension at the exit of arterial vessels (the point of the arterial sphincter is a constant)

$$R*I = const. \qquad \textbf{(2)}$$

- The product from the force of the stroke (F) and the duration of the heart cycle (t) is a constant:

$$F*t=const. \qquad \textbf{(3)}$$

- constant length of an electromagnetic wave in the brain, defining the measuring process of the biological clock;

The third principle is the application of units which the organism makes use of.

- In conclusion I might point out that in order to have a measurement which to precisely reflect the condition of the organism what is necessary is:
- measure units applicable in living nature;
- zero point of the measurement;
- constants that organisms support.

The three conditions pointed out allow the application of various algorithms with which direct measurement is possible.

The advantages of that kind of measurement are great. At first place it gives a precise picture of the condition. In organisms all values are symmetric. Such measurement allows the results received to be compared and precise mathematical solutions to be found. It on the one hand reveals the logic of the regulation processes and the final result from them.
Basic units for measurement in the organisms applicable to the circulatory system are:

- mass - 1♥ - one stroke volume of the heart, whatever it is;
- time – hc – one heart cycle, whatever its duration is.

When examining different algorithms in the circulatory system other units will be examined as well and also the relations between them.

II.2 Short analysis of the measuring units

mass - 1♥

Stroke volume is an inconstant quantity. It changes its value as with the aging so with a change of the physical condition – depending on the fact whether the organism is at rest or it bears some loading.

The vegetative system defines the stroke volume as a 'measure unit in principle'. That is:

- such quantity of blood containing all substances which are about to take part in the exchange during the impending heart cycle;
- such quantity of energy carriers which will be turned into heat during the same heart cycle.

These conditions are connected to setting of mass in physiological processes, the principle of equality of blood volumes which the system transfers to all its parts. That is to say one stroke volume enters the systems and the same volume leaves them. The exchange cannot be performed with different volumes because similar action will change the blood picture. The only chance to preserve the parameters of blood constant is the case when the quantity of incoming blood and the quantity of blood leaving are the same.

Velocity

The parameter the value of which is constant and the same in the organism during its entire life is the capillary velocity of blood. That velocity is a constant.

$$Vc = const \qquad \textbf{(4)}$$

The velocity of blood in capillaries is obligatorily the same for all organisms of a certain kind. The constant of velocity makes the reproduction of that kind possible (constant of life; the holy constant):

- the velocity of movement of the blood in tissues is a function of the velocity of exchange between the circulatory system and the cells;
- two preceding organisms can reproduce a following one only when the parameters of the physiological processes in them are the same (they belong to one and the same species – the velocity of blood and the velocity of exchange are equal).

$$V_a = V_{fp} = V_b \textbf{ (5)}$$

Where:

V_a is velocity of exchange in an organism (a)

V_b is velocity of exchange in an organism (b)

V_{fp} is velocity of the general physiological process

Fertilization is a physiological process in which the products interacting are produced by two organisms. The equality of the conditions permits product of one organism to be transferred into the other and directly take part in that physiological process.

With mammals that event is easy to explain – during the pregnancy the velocity of exchange in the foetus is the same as the one in organism of the mother. That velocity is directly transferred from one organism into the other; the mother gives birth to female and male organisms as well. In every one of them the parameter mentioned is the same. The question is how that is achieved in a bird's egg?

Time

The application of that parameter in organisms is applied with the biological clock.

There are two types of clock in nature – astronomic and biological.

There are many examples of connection between the astronomic and biological clock:

- Migration of birds, fish and mammals;
- Lethargy of mammals, serpents and etc.;
- Reproduction cycles;
- Rhythmic changes in the organism with the sequence 'liveliness/sleep' and etc. In reality a connection between the astronomic and biological clock is given. There are exceptions of that rule of course. The question of similar connection with bathyal fish to which reaches no light is debatable and the parameters of the surrounding environment are constant.

Jeffrey C. Hall, Michel Rosbash and Michael W. Young got the Nobel Prize in 2017 in Biology and Medicine for 'their discoveries of molecular mechanisms controlling the circadian rhythm' in 2017.

What the connection between their discovery and the biological clock is as described here?

Chronobiology examines the cyclic processes with duration over 24 h. It does not discuss events in the framework of one heart cycle. A definition of the terms 'astronomical and biological clock' is not given; the principle of operation, the mechanism or the law of the clock at 'vegetative level' is not described.

Nevertheless the enormous merit of these discoveries is pointing the genetic connection between organisms on the one hand and the Earth on the other. These discoveries and the clock as described here allow me to quote the levels of conformity:

physiological process ► cell ► physiological system ► organism ► biological type ►…

III. PRINCIPLE OF THE BIOLOGICAL CLOCK

Before discussing the question to the point it is necessary to answer another preliminary question which is:

Is life possible without a clock?

The answer is 'no'! Without a clock life is impossible.

What is the importance of the biological clock and how is it applied?

Physiological processes in biology are examined as biochemical reactions where masses interact under the laws of chemistry. With laboratory tests the criterion 'time' is not applied. As it is well known there exists a regulation for all physiological processes which permits a change in the quantity of substances taking part in the process and change in

the velocity of the process. That explains the existence of an entire humoral system the purpose of which is to point out the precise velocity and quantity of substance to enter the process of exchange for every physiological process separately and for all processes together.

Similar approach does not answer several questions:

- What mechanism does the organism use to define the quantity and the velocity for each process separately?
- how is commensurability performed for all processes together?

It is not possible to synchronise two physiological processes without a clock. The operation of the humoral system is impossible without a clock. The velocity of each process is defined with a clock and the quantity of substance given. The clock is the means which puts order into the system and it becomes calculable and controllable but the clock also synchronizes the activities of all systems together. What is achieved with the clock is:

- the cycle of all processes in a cell is equal;
- the cycle in all cells of an organism is equal.

The term 'clock' in our imagination is always linked to an object – solar, sand, electronic, mechanical, nuclear … 'Clock' is a symmetry. Objects may be different, but the symmetry measured is always one and the same.

What is a 'clock'?

Definition:

'Clock' is a cyclic dependency, defined by a law, in which time is a parameter.'

All clocks, whatever they may be, depend on one preliminary condition, defining their work – a physical process with constant speed is applied in every clock. The condition quoted is based on the physical fact that speed of time is a constant. The clock shows the symmetry between the speed of time, on the one hand, and the speed of the physical process, on the other. In order to explain the principle of the biological clock we will make use of an analogy with the astronomic clock. The laws they work under are different but the principle is the same.

Law of the astronomic clock:

$$\frac{2\pi}{t}=1 \qquad \textbf{(6)}$$

Where:

t is time.

2π is rotation

Law of the twenty-four-hour clock: *'One turning of the Earth round the axis (2π) for 24 hours is one twenty-four-hour cycle':*

$$\frac{360°}{24h}=1tfhc \qquad \textbf{(7)}$$

Where:

360˚ is rotation (2π)

24h is a period of rotation

1tfhc is one daily cycle

Law of the yearly clock:

'One turning of the Earth round the Sun (2π) for 365.24 days is one yearly cycle':

$$\frac{360°}{365,24days}=1yc \quad \textbf{(8)}$$

Where:

360˚ is rotation (2π)

365.28 days is a period of rotation

1yc is one yearly cycle

Both dependencies indicated are based on the constant speed at which the Earth rotates round its axis and the constant speed it rotates round the Sun. It is clear from the Law as given that every space object which performs cyclic movement in constant speed is an 'astronomic clock'. The other important conclusion is that there are no two compatible clocks because the cycles of the space objects do not coincide (the cycle of one clock is not divided into precise number of elements from the cycle of the other clock). The twenty-four-hour and the yearly clock of the Earth are also incompatible. From that point of view it is not possible to apply one clock to be applied for all space objects (they measure one and the same time but with a different cycle). Therefore comes the conclusion that a 'second' is not a universally applicable unit of time. With two clocks, measuring different symmetries seconds are different. This is a fact obviously seen in the biological clock where units are not equal.

The principle of the biological clock is 'a unit of mass for a unit of time':

'*One stroke volume, left the arterial system for one heart cycle is equal to one':*

$$\frac{1\heartsuit}{hc}=1 \qquad \textbf{(9)}$$

The symmetry of the biological clock as shown above is based on capillary speed of blood. That speed is a constant in all capillaries during the entire human life.

It was pointed above that one physiological process is possible when the events occurring in the chain 'heart ► final point ► heart' have their counterpart in the chain 'brain ► final point ► brain'. That is to say that an electromagnetic wave with constant length exists in the brain which is an equivalent of the capillary speed of blood, a second electromagnetic wave with inconstant length (e.g. reflecting the electromagnetic impulse of the heart) is laid over the constant wave and as a result the precise duration of the action is obtained. Similar statement is backed up by the fact that the heart has got a 'plateau' – a period during which it is insensible and cannot make a new

contraction. The plateau is an instrument of the brain with which it directly defines the duration of the heart cycle.

Dependency between the force of the heart cycle and the duration of the heart cycle:

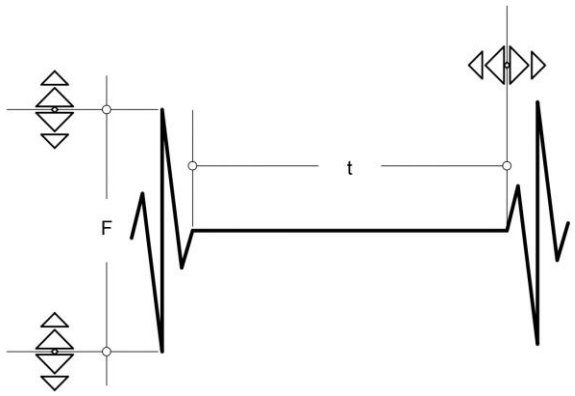


Fig. 1

Where:

F is force of the stroke

t is duration of the heart cycle (plateau)

$$Ft = const. \quad \textbf{(10)}$$

Though the principle of the clock is one and the same in its biological and astronomic form a difference exists in the way it is applied – with the astronomic clock the dependency is 'round for time' while with the biological clock that dependency is 'mass for time'. From that point of view every movement of mass with a constant speed is a clock. The more essential difference is that with astronomic clocks the cycles have one and the same continuity – same number of rounds for the same period of time. With the biological clock the mass of the stroke volume can vary and so can the duration of the cycle, but every cycle is self-dependent and independent. The great role of the vegetative system is to make the cycles of all processes equal.

In the organism of animals the cycle is its own and internal. I give three constants through which the 'biological clock' dependency is reached – the product of constant speed of movement and a unit of mass taking part in it:

- circle A – the speed at which blood moves through the capillaries of the big vessel circle and the mass of the stroke volume that has entered ($1♥*Vc$);
- circle B – the speed at which blood moves through the capillaries of the small vessel circle (pulmonary capillaries) and the mass of the same stroke volume ($1♥*Vpulse$);
- circle C – the speed at which the glomerular filtrate is moving in the renal nephron and the mass of the substances reabsorbed back in $1♥$ (absolute mass at absolute speed, ($m*Vgf = const$) (gf – glomerular filtrate).

The renal nephron is the absolute biological clock. The mass of the glomerular filtrate going through each nephron separately is always one and the same. It is regulated through the bloodstream of the incoming arteriole, standing before the glomerulus, because the arterial velocity is changeable. The aim of this regulation is the mass going through the renal nephron to remain constant. For example:

If for a blood cycle with duration of 8" through a random nephron passes glomerular filtrate with mass A then for another heart cycle with duration of 2" – 1/4A will pass (that question is discussed in detail in chapter 'System bloodstream'). In order to reach the same efficiency four nephrons are included in the action.

In fact every physiological system which contains a speed constant might be considered a clock. The task of the vegetative system is to synchronise its clock in such a way that they work with an equal cycle – 'one system' – one clock; 'a sum of clocks' – a sum of clocks working in step.

III. 1 Classification of clocks in nature

- Plant – external astronomical clock (the astronomical clock of the Earth defines the lifecycle).
- Animal – internal biological clock (synchronizes all physiological processes separately for every organism).
- Virus – external biological clock (has no biological clock but cannot live without it. The lifecycle of the virus begins when it gets into another organism and its clock defines the synchronization of physiological processes).
- Mixed system – animals with a biological clock of their own breed on the basis of the astronomical clock (the entire life cycle of the Earth is synchronized – uncountable number of biological clock (each one for itself), but only one astronomical clock (all together).

III. 2 Compatibility of the basic processes in the blood circulatory system

Heart cycle is:

- the time of the beginning of the heart cycle till the beginning of the next, which is equal to the sum of the duration of the heart stroke plus the time in which the pulse wave passes from the entrance to the exit of arteries;
- the time in which a blood volume equal to the last stroke volume that has entered passes form the arteries into the capillaries;
- the time needed by all cells taken together to exchange all substances needed with the same stroke volume – neither more nor less;

- the time in which the entire quantity of heat produced leaves the body.

The duration of the heart cycle in the arterial vessels is defined by the power and continuity of the vegetative brain impulse directed to them.

The time in which one stroke volume passes from the arteries into the capillaries is defined by the constant of speed and the common exit arterial vessel lumen.

The time of exchange in direction 'blood circulatory system →cells' (incoming cell processes) is defined by the constant of speed and the exchange mechanism of every process *(each one separately and all together for equal time).*

The time of exchange indirection 'all cells together → blood circulatory system' (outgoing cell processes) is defined by the thermodynamics inside the cell.

The transfer of heat from the blood circulatory system to the environment is defined by the bloodstream in the venous vessels.

All activities as mentioned above are performed for an equal period of time:
one blood cycle in all directions .

IV. FIRST BASIC DEPENDENCY

Definition:
The mass of the exit substances at suitable velocity of the physiological process produces the mass of the final substance, needed by the organism for a unit of time.
'Exchange of substances' is interaction of masses in which all physiological processes have at their disposal the same time for action:
one heart cycle.
Within the limits of that heart cycle the entire quantity of products needed by the organism for the same time is being produced:
quantity produced = quantity used.
During the given heart cycle all physiological systems can exchange all necessary products for all physiological processes in a limited quantity of blood:
one heart stroke,
neither more nor less:
quantity received = quantity given.
The obligatory quantity for exchange with the obligatory quantity of blood and obligatory time for exchange with the same quantity set the exact proportion between the mass of substances exchanged and the speed at which the physiological process operates. The change in one of the parameters in the process – mass or velocity – in the frame work of the same heart cycle causes a system answer, changing the second parameter in such a way that:

$$m*v = \frac{m}{t} \qquad \textbf{(11)}$$

$$v = \frac{1}{t}. \qquad \textbf{(12)}$$

It is clear from the equation that the velocity of the physiological process and time are mutually reciprocal. So to say if we go back to the formula of regulation and with t mark the constant of time then k will give the precise humoral regulation:

$$\boldsymbol{t^b = \kappa v} \qquad \textbf{(13)}$$

$$m*kv = \frac{m}{t^b} \qquad \textbf{(14)}$$

$$kv = \frac{1}{t^b} \qquad \textbf{(15)}$$

where:
t is time
b is a vegetatively set change of duration
k is a humoral regulator of velocity
v is a velocity changeable.
The product 'mass*velocity' defines the quantity 'impulse':

$$p = m*v \qquad \textbf{(16)}$$

The ratio 'mass/time' defines the quantity 'debit'*(Q):

$$Q = \frac{m}{t} \qquad \textbf{(17)}$$

where:
*m*v* is a condition for synthesis
$\frac{m}{t}$ is a condition for decay
The first basic dependency can be put down as:

$$p = Q. \qquad \textbf{(18)}$$

Through the first basic dependency the quantity 'organism' is defined as:
'physiological systems with common impulse'
The duration of life with higher organisms is one heart cycle. The action of a following heart cycle extends the life of the organism with the same time. The absence of a following heart cycle means it is dead.

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The theory of the 'primordial soup' in which life appeared is well known. If we are looking for an equivalent of that theory - there is the egg. From my point of view if you would like to have a chicken for lunch put a watch into the omelet.

REFERENCES

[1] G.Totolakov,,, Circulation of blood for 0.8s" pp. 36, July 2025, https://bodyphysics.eu/

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