THE HUMAN BODY AND IT'S COMMUNICATION SYSTEMS…

In a world where humans have endless possibilities to communicate at high speed and over long distances (internet, WhatsApp, mailings, telephone, etc.) it seems increasingly difficult to talk with people in our close environment. Not in the least because off the fear to come in close range with others or in a group due to the Covid-19 pandemic. Another barrier to communicate with our close-ones is todays safety-measurements like social distancing, mouth masks and group restrictions. A consequence of this is that we also approach less strangers than before. So, we could say we are forced to create more distance than we are used to. And when we speak out or communicate, for example on social media, it is waged and judged within seconds due to the high polarization of this moment.

As a teacher at the Osteopathic School in Amsterdam we try to give as much live sessions as possible. An alternative is online with the program Zoom. And how much I appreciate this possibility, it seems somewhat odd. What I certainly miss during these online sessions is the non-verbal feedback, the body language, the small signals that we observe unconsciously when we're within a short distance to others.

Let us leave for a few minutes the polarized verbal part and have a look at the non-verbal communication of our body. When we study this from an evolutionary point, we see that it has a certain hierarchy. This means that every new communication system is built upon the previous older dimension.
Let's look at how this is constructed in our body in different levels or dimensions.

The first question is off course about the definition: What is communication?
Communication comes from the Latin word 'communicare' which means to share, to make common. It involves a sender, information and a receiver. But off course it is not only a human act. Every information exchange between living organisms can be seen as a form of communication. It can be human but also non-human.

So let's start with 'living organisms. When I teach Physiology and we study 'living' and 'live' we begin at the dimension of the cell. Each cell has its own metabolism. This is the whole of chemical processes as a reaction to its environmental changes, to maintain its homeostasis. This means a kind of exchange between one cell and its direct environment. This is (one of) the eldest systems, and we call this autocrine communication.

In each cell of our body there are several cell-organelles and a few of them are 'strangers' to us because they don't evolve out of our own stuff (DNA). For example, the mitochondria, the energy suppliers of the cell. They are probably ancient bacteria that were eaten by a primary phagocyt about 1,45 billion years ago. The phagocyt and the mitochondria started to work and metabolize together (symbiosis). The mitochondria used oxygen and turned it into energy (ATP), and the phagocyt provided transport, nutrition and protection for the mitochondria. This is called 'the endosymbiont theory'. In this way working and communicating together with strangers is as old as the cells we contain.

Let's take a (big) evolutionary jump to multicellularity and look at the dimension of the first tissues that arose. These are epithelial tissues (entoderm-ectoderm) that behave as a sort of protection layer (ectoderm) or primary absorption-system (entoderm).
Both layers also work together with strangers like bacteria, fungi, archaea, viruses, etc. to support its integrity. For example, on the human skin we find a large amount of micro-organisms. The epithelial

skin cells provide an optimal environment (trough sweat- and sebum glands) for ‘the strangers’ to survive, and in return they help to protect our outer line of defense.

If we zoom in on the dimension of the first system that arises evolutionary, the digestive tube, we see that there is also a symbiosis between our own cells and ‘stranger cells’.
For example, the epithelial cells of the digestive tube produce mucus. The protein mucins in mucus are ‘used’ by the bacteria of the tube for their metabolism. In return, the bacteria produce metabolites, like short chain fatty acids, that are ‘used’ by the epithelial cells for energy.
Also, the fibers in our nutrition (MAC’s or Microbiota Accessible Carbohydrates) are metabolized by the bacteria. The end products of this metabolism have an influence on the whole body’s physiology. Examples are cytokines and glutamate and their influence on the cardiovascular system, weight control or nervous system.

We establish that there is not only local communication of 1 cell and its environment (autocrine), but also communication with other cells and ‘strangers’ or micro-organisms.
And these local interactions not only influence the local metabolism, but also the systemic health of our body.

Bacteria of the gut also communicate with each other. An interesting part of this is ‘quorum sensing’. When the bacteria ‘sense’ that a certain population density is reached they act differently than alone. A bunch of bacteria that sticks to each other and to a surface (like epithelial cells), and communicates together, is called a biofilm. We find this for example in our mouth and colon. Communicating together works for them in a more beneficial way than acting alone. The term ‘quorum’ was proposed by a lawyer who saw similarities with the formal social meetings in which, once a minimum number is reached in order to formalize agreements, quorum is declared, and the session begun.

Off course there is also communication on the inside of our body. The most of this happens within the third tissue that arises evolutionary, the ‘connective tissue’. The local communication system includes exchanges between two different types of cells. It acts trough diffusion in the ground substance or fluidic (liquid) part. This is called paracrine communication and can be seen as an independent self-sustaining and self-organizing system.

The evolutionary younger communication systems develop when the body increases spatially and gets more complex. We call this telocrine communication (endocrine or neurocrine). They use their anatomical counterparts like the circulatory and the neurological system to exchange and communicate. They are dependant on the older ystems for their metabolism.

Studying the stomach (organ dimension) we encounter another ‘stranger’ which is often demonized, the Helicobacter Pylori bacteria. Surely this is a bad guy? It’s the cause of gastritis, ulcers and stomach cancers. We treat it with antibiotic to get better. And two decades ago there was a vaccine strategy to eradicate it. But is this the whole story?
Could this stranger also be somehow beneficial for us? Let us have a look.
H. Pylori are bacteria that join our evolutionary path for approximately 116 000 years and an estimated 50% of the world population is infected with it, 85% without symptoms. Only in the last decade there is more and more attention for the positive effects of H. Pylori. Examples are their effects on the immune system, esophageal reflux disease, obesity and hunger hormones.

These are just a few examples of communication in different dimensions. Off course there are many more to explore. But what can we learn from this?

We could conclude that ‘an optimal communication’ is a prerequisite for a healthy body. The local communication systems are evolutionary the eldest, and these are fundamental for the younger systems (endocrine and neurocrine), and the total body physiology.
Taking care of ourselves should be our first priority. The next step is to communicate with our close ones (autocrine and paracrine).

The strangers, (mitochondria, bacteria, viruses, fungi, etc.) are also an essential part of our communication. Most of them co-evolved with us and we cannot divide them in ‘good’ and ‘bad’ guys. Actually, we can learn a lot from their behavior. They function at their best in small groups and in symbiosis with their host (quorum sensing).
In this way the momentary group restrictions doesn’t feel so bad.

And in an era were communication faces ever increasing speed and distance, we must value our local conversations, small gestures, body language, et cetera.
Off course nowadays this is a huge challenge, but also an opportunity.
For me, next online lesson, I will let the students appear and speak separately for a while on the big screen. Like this, I can value their expressions better…

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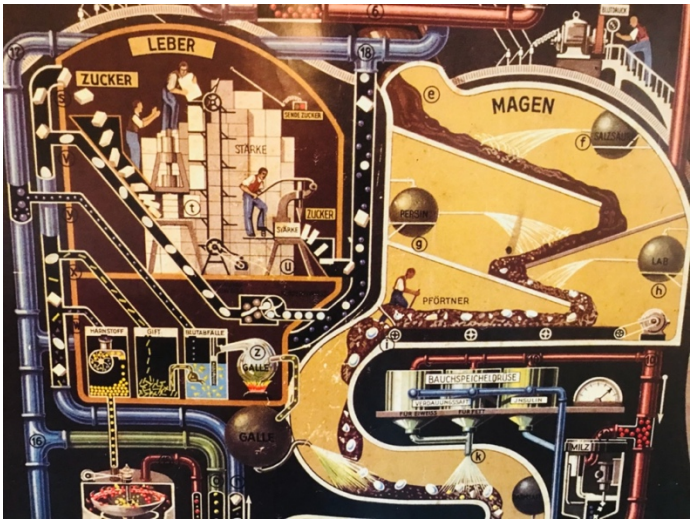

Detail from: Der Mensch als Industriepalast – Fritz Kahn


The loneliness of online lessons…