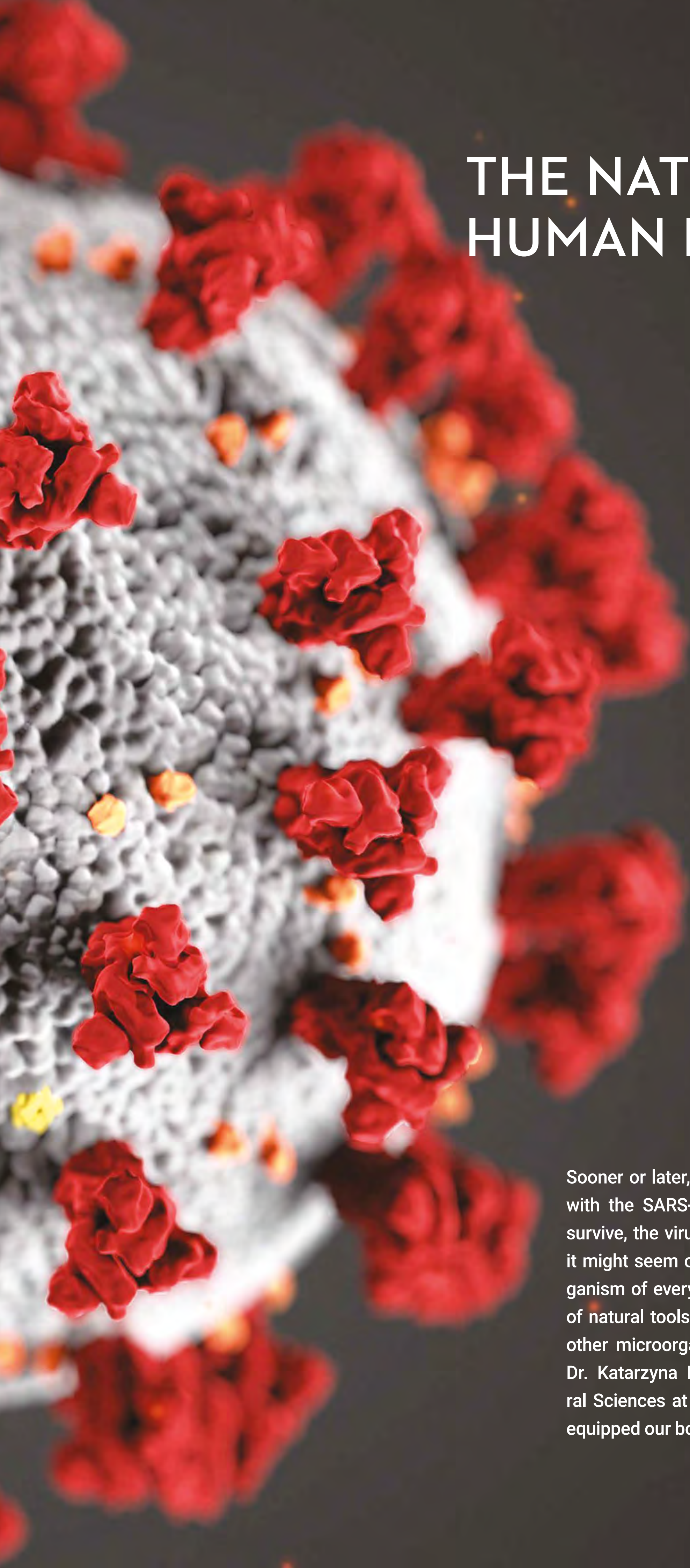

THE NATURAL HUMAN FIGHT VS VIRUSES

Sooner or later, everyone will probably come into contact with the SARS-CoV-2 coronavirus. However, in order to survive, the virus must first reach our cells, and although it might seem otherwise, this is not an easy task. The organism of every human being is equipped with a number of natural tools to effectively fight against this and many other microorganisms. Microbiologist and immunologist Dr. Katarzyna Kasperkiewicz from the Faculty of Natural Sciences at the University of Silesia tells us how well equipped our body's arsenal really is.

Microorganisms can penetrate our body mainly through the conjunctiva, oral mucosa, and the upper part of the digestive tract. Fortunately, tears and saliva contain a highly bactericidal enzyme called lysozyme. Whatever comes into contact with our eyeball or with the inside of our mouth is immediately disinfected. Unfortunately, lysozyme does not work so effectively against viruses, and this is why we are often reminded about the necessity of frequently washing our hands and about the need to unlearn the habit of unwittingly touching our face with hands, especially the area of our nose, mouth, and eyes.

Our skin also contains a number of protective barriers. A prerequisite for the penetration of our cells by bacteria or viruses, is an adhesion between the surface layers of two objects, in this case the human skin and the microorganism. This is effectively prevented by the process of exfoliation of the epidermis and by the presence of natural fatty acids in our skin which are responsible for a properly functioning antimicrobial barrier. Therefore, we should not merely wash or disinfect our hands frequently, but also remember to properly moisturize the skin, since this makes the process of adhesion difficult.

Another natural barrier for microorganisms, including viruses, is… breathing. The upper airways are covered with cilia. The entering and leaving of air causes the movement of cilia, which automatically makes it harder for microorganisms to "stick" to our body cells. Continuous air movement certainly does not encourage an invasion of pathogens. In the bronchi and lungs, there are cells which produce mucus. When we have a cold, these cells become very active, and the mucous membrane swells. Precisely this is the body's defensive reaction. Mucus produced in excess glues the microorganisms together to prevent contact with the cell, and they are expelled as soon as possible while sneezing or coughing. When mucus accumulates in the lungs and bronchi, anaerobic conditions are created there, and this makes it for some microorganisms difficult to function.

Further defensive reactions include vomiting and diarrhea. Our body, by expelling rapidly a large amount of content, gets rid of the substances that have harmed it.

Another defense shield is the change of pH level in our digestive tract, from a very acidic environment in the stomach, through slightly alkaline in the duodenum, to acidic pH of the urinary system. In the stomach, only the *Helicobacter pylori* can exist. All microorganisms that cannot tolerate such a low pH will not survive.

Many microorganisms will die or will not multiply if merely the body temperature rises. We are usually overzealous and want to lower it as soon as possible. However, doctors indicate that only a fever of about 39°C or more can become dangerous, although of course there are sporadic cases where temperature of 38°C can cause harmful seizures in patients. Therefore, lowering body temperature blocks one of the more effective defense mechanisms in the fight against microorganisms.

If, despite our efforts, microorganisms come into contact with our cells, we still have a very well equipped system for special tasks, i.e. the immune system. In our body, two types of immunity – innate and acquired immunity – work together and complement each other. The most important innate immunity cells are macrophages. Among other things, they emit interferons, which are also effective against viruses. Microorganisms, i.e. foreign bodies, attract the attention of macrophages, which, using the process of phagocytosis, simply "swallow" the enemy and digest it. This is a very quick and effective response, and it remains unchanged throughout our lives.

The acquired immune system works a little differently. If, for example, a coronavirus attaches to a cell, it is 'noticed' and recognized as a foreign object. In a way, the 'patrolling function' is performed by certain types of T lymphocytes, which pass on the 'enemy' to B lymphocytes. They, in turn, are responsible for producing the appropriate antibodies to fight the microorganisms. Under these conditions, the so-called immune memory also has a chance to appear. This means that if we come across such a pathogen again in the future, our immune system will react faster.

However, this process requires much time and energy. When our body fights against bacterial, fungal, or viral infections, it consumes huge amounts of energy. When we are sick, we do not want to eat, we have no energy to exercise, and need more sleep. This is normal. The cells of the immune system belong to the group of cells with the highest metabolic activity. They must act quickly and effectively. They live shortly, multiply quickly, and work heavily.

We also have a subpopulation of T lymphocytes in the body. They are called *Natural Killer T-cells*, and for a good reason, since they look little like grenades and act accordingly. Once they are attached to the enemy, they just tear it apart. They become immediately activated, live shortly, and are very effective. The are launched mainly to fight cancer cells and viruses.

The ongoing search for an effective coronavirus vaccine is also worth mentioning. On the one hand, scientists are working on a solution that will contain a coronavirus antigen. When it is given to patients, their immune system will be able to produce suitable antibodies to fight the pathogen. In such a case there would be a chance for creating immune memory. On the other hand, patients can be given antibodies from plasma of recovered persons. This is an example of so-called passive immunization. These antibodies, however, do not destroy the coronavirus. They only make it unable to adhere to the host's eukaryotic cell, so that it cannot multiply.

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