International Pig Topics

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ESPHM 12th EUROPEAN SYMPOSIUM OF PORCINE HEALTH MANAGEMENT

Number: 176

Vaccinology XII

Cell mediated immunity versus humoral immunity

In most articles dealing with the system providing protection against micro-organisms, the words cellular and humoral are used. What do these two parts of the immune system have in common and what are the differences? We do know that they both act against invading micro-organisms and both can be triggered by vaccination or field infection. And the differences?

Humoral immunity is characterised by circulating antibodies that are produced by a certain type of white blood cell. These white blood cells are instructed to produce these antibodies when the immune apparatus is stimulated. It takes time before the initial instructions lead to a measurable amount of antibodies. We know this, for example, as the time interval between vaccination and protection.

When the same immune system is confronted with a second exposure to the same type of micro-organism, this time interval is shorter and the measurable amount of antibodies is higher. We call this action of memory the booster response or an anamnestic reaction. It occurs after a second dose of a vaccine is given or when the vaccinated animals encounter a field infection with the same micro-organism. These antibodies circulate in the blood system of the animal and when the antibody meets the micro-organism, binding of antibody and micro-organism or with a part of a micro-organism like APP toxins or atrophic rhinitis toxin, takes place. This binding will then lead to full or partial protection.

Besides vaccine or field infection origin, antibodies in young piglets can come from the colostrum of the sow or gilt and are than called maternally derived antibodies (MDA). The major advantage of these circulating antibodies is that their action is immediate. When they are present and meet the micro-organism they will immediately do what they are supposed to do. This is a major difference to cellular immunity.

In general, the cells involved in cellular immunity first need to absorb or ingest the micro-organism, then the micro-organism is cut in pieces by different sections inside the cells, and the parts are presented to the immune apparatus for inducing a reaction.

This reaction can be that more of the same type of white blood cells are made to ingest the micro-organism, but can also be that signals are sent out to the other type of white blood cells to produce antibodies. However, this route takes more time and costs more energy that needs to come from somewhere. The required energy is either taken from the body, leading to growth retardation, or from the feed, leading to a higher feed conversion ratio – both resulting in a lower average daily gain. The differences with healthy controls can be minimal but still cost money!

When possible, humoral immunity is the preferred route of protection. It works immediately and at minimal expense. However, cellular immunity is sometimes the only possible means of protection. And when humoral immunity is not present or not sufficient to protect the animal, the fall-back scenario is cellular immunity. An excellent team!