

Tomorrow's tobacco to save lives

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In the future, tobacco may be a crop that saves lives. Tobacco is one of those plants that could be used as green factories for high-tech production of drugs. A new discovery shows how production can be made considerably more efficient.

Tobacco is seen as one of the major causes of premature death, from a global perspective. The tobacco plant itself is a well-researched model system that is easy to transform. A research team from Umeå Plant Science Center in Sweden, working with scientists in Stockholm and France, have identified a new transport route inside plant cells. The discovery may be of great significance when tobacco and other plants are used to produce protein-based drugs, such as therapeutic antibodies and vaccines. These drugs are used to combat certain types of breast cancer among many diseases. The findings are being published in the coming issue of the journal *Nature Cell Biology*.

Many diseases today are treated with specific so-called monoclonal antibodies. They function as target-seeking robots that can find their way to diseased or damaged cells in the body and destroy them without affecting healthy cells. It is estimated that the need for these new types of medicines will increase dramatically in the future. The demand for them already seems to be exceeding the supply.

Today animal cells are most often used to produce these medicines. To make 1 kg of antibodies, at least 10,000 liters of cell solution is needed, and the costs are very high - about SEK 10 million. For patients with diseases requiring recurrent treatments with high doses of antibodies, the

price tag will be extremely high. If plants could be used for this form of drug production, costs would plummet. By way of comparison, it can be said that even at present one hectare of cultivated land would suffice to yield the equivalent amount of antibodies.

Since plants and humans are similar in many respects at the cell level, scientists have attempted for many years to use plants to produce certain types of antibodies and vaccines. The foremost advantage is that the technology is easy to scale up without driving up costs. Moreover, the risk of transmitting diseases from plants to humans is non-existent, while this is a real danger when animal cells are used. There is one problem in using plants though. Most often the yield is relatively low and the sugar groups that are attached to the antibodies are different in plant and human cells. With the help of biotechnology, however, it has been possible to make these sugar groups nearly exactly the same as in humans. On the other hand, the low yield is still a major problem.

Swedish scientists in Umeå have now discovered a new transport route inside plant cells. This may make it possible for plants to produce and store much greater quantities of these drugs. The newly discovered transport route is found between the membrane system (ER), where the sugar groups are formed and attach to proteins, and the chloroplasts, the organelle where photosynthesis takes place.

“Thanks to the newly discovered transport route we believe that antibodies can be produced in the ER membrane and then be sent to the chloroplast, where they can be stored until the plant is harvested. It is hoped that greater quantities of antibodies could be stored in the chloroplasts. We therefore hope that the yield can be boosted and that it will be easier to purify the antibodies at an early stage,” says Göran Samuelsson, professor at Umeå Plant Science Center.

This transport route is interesting not only from the point of view of

applied science. It may also explain certain issues regarding the origin of plant cells and how the chloroplast's genes could have been transmitted to the nuclear genome.

Source: The Swedish Research Council

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