

News Release

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Plant breeding, patience and molecular biology: Researchers at the TU Muenchen aim to make good strawberries even better

Small, red, delicious: Strawberries are among the most popular fruits in Germany. For us consumers the season is over, but the research team of the Technische Universitaet Muenchen (TUM) deals with the red fruit the whole year round. Together with Spanish and French scientists, a group headed by Prof. Schwab from the TUM Department of Biotechnology of Natural Products has sets its sights on the strawberry genes responsible for the fruit's health-promoting substances. Once the genes have been isolated, short genotype sequences can serve as markers to easily locate the genes in fruits. Armed with this knowledge, the team hopes to facilitate the breeding of particularly healthy varieties of strawberries.

Strawberries are indeed healthy – they contain lots of vitamin C, for example. The team of TUM professor Wilfried Schwab from the Department of Biotechnology of Natural Products is aiming at the so-called secondary substances, i.e. chemical compounds only produced in specialized plant cells. In strawberries these are primarily polyphenols. They are generally divided into three subgroups, all of which originate from the same polyphenol precursor material. First are tannins – tanning agents that protect strawberries from parasites with their bitter, astringent taste. Second are lignins – responsible for the mechanical stability of the plant and its fruits. And third are flavonoids – pigments that protect the plant from UV radiation and attract insects needed for pollination. In this sense, polyphenols are veritable all-rounders. And that applies to our health, too: Flavonoids reduce the risk of cancer, fortify the immune system and even kill germs, among other things.

That is why European plant breeders dream of producing strawberries with particularly high polyphenol content. This, however, is easier said than done. Different plants of the same strawberry strain can, depending on their location and the season, exhibit very different concentrations of polyphenol. The ratio of polyphenol groups also varies from plant to plant. It is thus crucial to understand the polyphenol metabolism process and its regulation mechanisms before breeders can start with their work. This is where Professor Schwab comes in: Breeders from Spain and France send their strawberries to his laboratory to have

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them analyzed biochemically. In the context of the FraGenomics research project, the TUM biotechnologists examine the content of the various polyphenol groups.

The production of these polyphenols is based on specific genes, which can be activated or deactivated. That is why the scientists are also searching for the connection between polyphenol levels and the activity of the associated genes. The team already has its first interim results: The overall polyphenol level is relatively constant in all plants; however, the ratio between the subgroups fluctuates strongly from plant to plant. This fact is probably attributable to the common precursor that the subgroups come from. Schwab's conclusion: It is easier to shift the ratio of polyphenol concentration in favor of a few selected compounds through breeding than to raise the level overall.

Schwab's team is now isolating the genes responsible for the particularly healthy polyphenols. Once that has been done, so-called molecular markers can be developed to simplify the plant breeding process. The principle behind the approach is that strawberry plants with high levels of healthy polyphenols show certain associated patterns in the respective genes. Short genetic segments that correspond to these patterns can be developed in the laboratory. This is precisely what Schwab intends to do. Once the genetic patterns have been identified and the corresponding markers are made available, breeders can quickly establish which plants have a particularly high number of genes for healthy substances. Ultimately, cross-breeding these plants in a conventional manner will result in healthier strawberries.

However, the TUM biotechnologists have one hurdle to take before they can implement the scheme: the high bruising sensitivity of the strawberry. Its durability depends on, among other things, the stability of the cell wall, which is in turn influenced by stabilizing cell wall components such as lignin. Since lignin is produced from the same raw material as the healthy flavonoids, it is quite possible that less lignin is produced in plants bred for high flavonoid content, resulting in fruit that turns soft faster. Counteracting this side-effect will require raising the overall polyphenol content. To achieve this, the team needs to analyze steps early on in the metabolic process.

So for the time being, there is plenty of work cut out for the staff at the Department of Biotechnology of Natural Products. The 2009 strawberry harvest has already been precisely tested for polyphenol content and genetics. Currently the freezers are chock full with the 2010 harvest. Two more harvests will follow before Schwab can finally unravel the secret of the super strawberry.

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Free picture material:

<http://mediatum2.ub.tum.de/node?id=997458>

Background:

The German-French-Spanish joint project carries the name “Genetic Genomics for Improving the Nutritional and Physiological Quality of the Strawberry Fruit” (FraGenomics). A total of 1.3 million euro are available for the duration of the project from 2009 to 2012. The researchers from the TUM have received funding of more than 300,000 euro from the German Federal Ministry of Education and Research. For more information on the project please visit: <https://chirimoyo.ac.uma.es/fragenomics/>

Technische Universitaet Muenchen (TUM) is one of Europe’s leading universities. It has roughly 420 professors, 7,500 academic and non-academic staff (including those at the university hospital “Rechts der Isar”), and 24,000 students. It focuses on the engineering sciences, natural sciences, life sciences, medicine, and economic sciences. After winning numerous awards, it was selected as an “Elite University” in 2006 by the Science Council (Wissenschaftsrat) and the German Research Foundation (DFG). The university’s global network includes an outpost in Singapore. TUM is dedicated to the ideal of a top-level research based entrepreneurial university.

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