Popular scientific summary of the docent lecture to be given by Ida Lager, Department of Plant Breeding, LTV Faculty

On the track to understand the mechanism behind the vast diversity among the seed oils of plants.

Energy is stored in seeds in the form of oil, proteins and starch. Oil is accumulated in the seed during its maturation and is broken down during germination in order to utilize the energy. Oil is made up of carbon chains, called fatty acids, which are connected to a backbone of glycerol. The fatty acids in the seed oil vary depending on plant species, giving the oil specific characteristics. Rapeseed oil is for example liquid at room temperature whereas coconut oil is solid. The reason for this difference is that oil consists of fatty acids that differ in length and other chemical properties. The plant kingdom shows a high diversity in oil composition with more than 300 known fatty acids in their seed oil. Fatty acids that exist in only a few plant species are referred to as unusual fatty acids. One example is the plant castor bean, where the seed oil predominantly consists of the fatty acid ricinoleic acid. Castor oil is used in the chemical industry as lubricant but commercial cultivation is highly challenging due to the presence of the toxin ricin in castor bean. Would it be possible, to transfer the ability to produce ricinoleic acid, or any other unusual fatty acid, without transferring negative effects to a plant normally lacking the fatty acid but can easily be cultivated? To answer this question we need to know how unusual fatty acids are synthesized.

Fatty acids are added to the glycerol in a stepwise fashion where also the backbone is undergoing chemical changes. The enzymes catalyzing these reactions mainly belong to a group called acyltransferases. All plants contain acyltransferases but their properties differ between different plant species, which, at least partly, explains the high diversity of oil composition. In plants, lipids do not only have a crucial role as energy storage, but also as a major structural part of membranes. All plant cells are surrounded by a membrane. The membrane lipids have a great impact on the physical properties of a membrane. Therefore they must be degraded and resynthesized for the membrane to adapt to changes in the environment. Acyltransferases are also highly involved in the process of producing membrane lipids and this group of enzymes is thus part of the plants ability to survive changes in the surroundings.

Research about enzymes involved in lipid metabolism in plants will provide basic knowledge about how plants produce their oil, which can be incorporated into new generations of oil crops with improved qualities. Plant oils from these oil crops could replace fossil oil as a feedstock in many applications in the future, assisting the goal of a sustainable society as well as generating oil of improved nutritional quality.