NEBRASKA EPSCoR

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NATIONAL SCIENCE FOUNDATION

EXPERIMENTAL PROGRAM TO STIMULATE COMPETITIVE RESEARCH

EPSCoR

Nebraska's NSF EPSCoR Track-1 research discoveries improve food, energy, and health

In 2010, NSF EPSCoR awarded Nebraska a five-year $20 million Track-1 grant for nano-materials and algal biofuels research.

For Dr. Don Weeks, University of Nebraska-Lincoln Biochemistry Emeritus Professor on that team, pursuing goals in this work resulted in significant outcomes.

Weeks' algal biofuels research discovered new components in the carbon dioxide concentration mechanism. Collaborations with other labs around the world began testing in higher crop plants on how this mechanism can enhance yields. This has potential to improve farmers' ability to supply food for the world's increasing population—with 9 billion people on earth projected for the mid-21st century, at least 50% more food production capability is needed beyond what exists now; a wealthier population demands more protein, requiring more grain for animal feeding.

Weeks and team apply new CRISPR/CAS 9 capabilities for targeted gene editing and gene replacement in algal cells using Chlamydomonas Reinhardtii, (a close-up of the cells are pictured right), which was previously thought impossible to do. The ability to knockout genes or replace gene sequences using CRISPR/CAS9 will stimulate much new research including the use of Chlamydomonas alga organisms' flagella to understand cilia in human body passageways; for diseases related to fluids movement, conditions can be mimicked in the "chlamy" setting to discover what molecules are involved and how they work – with important medical implications.

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Building from their Track-1 research, Weeks' group has also made important discoveries with a new crop plant, Camellina. They changed its seed oil composition to alter the seeds' fatty acid profile, from low to high in oleic acid, which is more favorable for human and animal oil consumption, as well as biodiesel use. Another discovery in their CRISPR/CAS9 work explored double strand DNA breaks, and observed that homoeologous chromosomes may be able to recombine – totally unexpected because those entities normally do not interact; figuring out how this is happening advances basic research and has implications for plant breeding, to make new combinations of chromosomes that could improve plant yield and or quality.

Camellina plant

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