

# Nanotechnology at Work: Getting the Atom in the Right Place

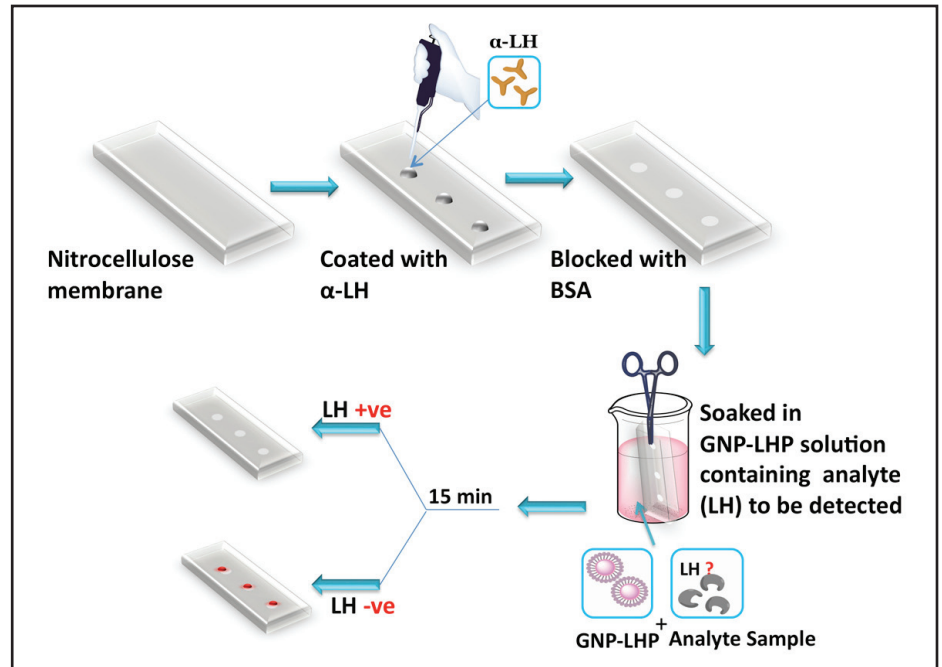
Nanotechnology is the manipulation of matter on an atomic and molecular scale. It is used to create many new devices and materials that have a vast range of applications. Nanotechnology draws from biology, chemistry, physics, and mathematical sciences. The development of unique nanoscale structures has the potential to revolutionize industry, including electronics, medicine and consumer products.

Nanotechnology will change the agricultural sector and food industry from production to conservation, processing, packaging, transportation, food safety, biosecurity and waste treatment.

The National Nanotechnology Initiative (NNI) ([www.nano.gov](http://www.nano.gov)) identified the next 10 years as the time to develop nanotechnology applications.



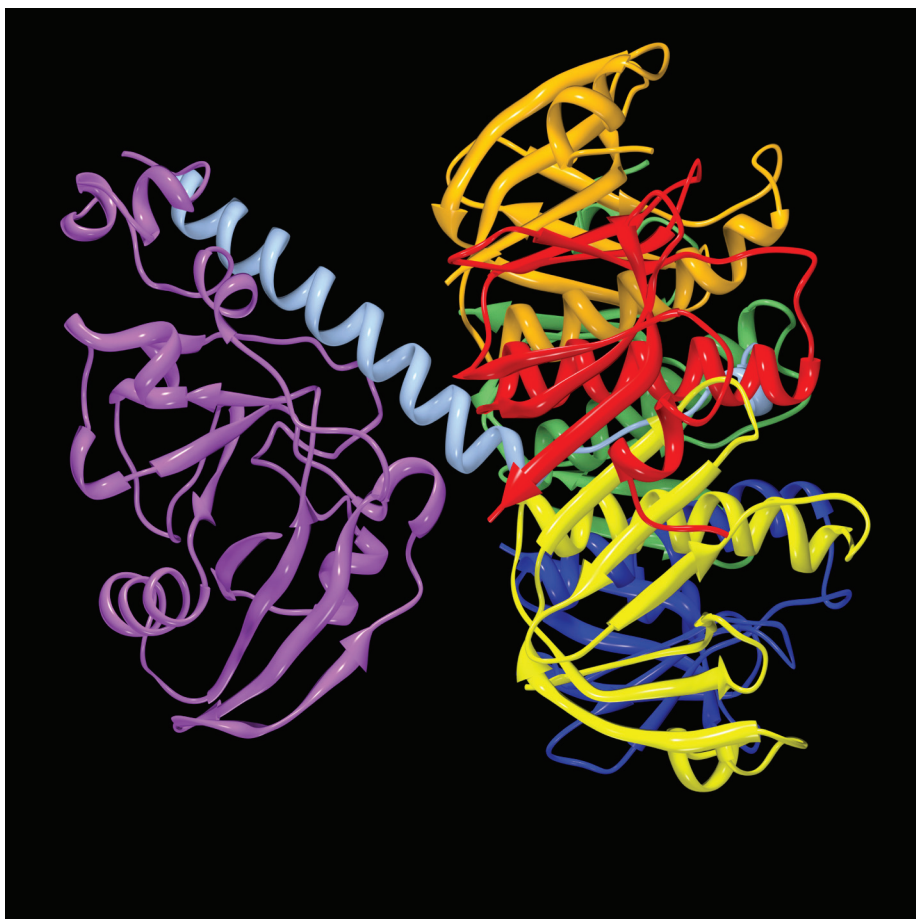
Cooperative Extension and Research



*Fertility Check: To test sheep's blood for luteinizing hormone (LH), researchers first spot an antibody of the hormone ( $\alpha$ -LH) on a nitrocellulose membrane strip (left). They then dip the test strip into a sample of sheep's blood (center) mixed with gold nanoparticles coated with LH peptide (AuNP-LHP). If the hormone is present, it binds to the spots, blocking the nanoparticles from binding (right, top). Without the hormone, the nanoparticles bind to the spotted antibodies and produce a red color (right, bottom).*

Lincoln University Cooperative Research (LUCR) Animal Sciences program is applying this technology in livestock breeding. For goat and sheep, sales in the US rose 30 percent between 2002 and 2007, according to the 2007 Census of Agriculture. LUCR will improve production methods for small ruminant farmers with limited resources.

Dr. Zahra Afrasiabi, Principal Investigator, and her collaborating team built a special nanoscale biosensor (a device that takes biological information and transforms it into a more readable form). This biosensor detects a hormone in small ruminants that increases before ovulation. This invention will enable producers to determine the best breeding time for goats and sheep. This means less wasted time and money for farmers.



*A ribbons molecular model of Escherichia Coli (E. Coli) enterotoxin - the bacteria-produced poison that induces cholera-like symptoms.*



Dr. Majed El-Dweik, Principal Investigator, human nutrition and food safety, is working to improve solar cell efficiency by using nanomaterials as a conductive layer and a nanostructure to allow more energy to be harvested.

Lincoln University is taking a proactive approach to support the mission of food safety and security. Dr. El-Dweik is actively designing state-of-the-art biosensors to detect foodborne pathogens (cause of disease) before they reach consumers. The research in food safety has been supported by grants from the United States Department of Agriculture and the National Science Foundation (NSF). Currently, several research projects have been funded using nanobiosensors to detect pathogens in food, such as a particular type of *E. coli*.

For more information on our Nanotechnology program, contact Lincoln University Cooperative Extension and Research at (573) 681-5543 or (573) 681-5380.

*Left: E. coli bacteria growing in laboratory dish.*