

# A Big Stride Toward Healthier Poultry

Poultry is an important, low-cost source of high-quality dietary protein.

In recent years, poultry production has become increasingly threatened by a major parasitic disease called coccidiosis. Coccidiosis costs the U.S. poultry industry about \$700 million annually. It is caused by *Eimeria*, a parasite that infects the birds' intestines.

ARS immunologist Hyun S. Lillehoj, with the Animal Parasitic Diseases Laboratory, Beltsville, Maryland, is a pioneer of novel technologies to control infectious diseases that affect the poultry industry. She is focusing on avian coccidiosis and the *Eimeria* parasite that causes it.

During the last 4 years, Lillehoj led a team of ARS researchers in the effort to complete the first chicken intestinal expressed genomic library. It contains gene sequences that will be used to pursue genomic-based control strategies to counter poultry diseases.

The library was developed from tissue, taken from a chicken's intestine, that is vulnerable to being heavily infected by *Eimeria*. The genes from that tissue—about 34,000—were sequenced, one by one, to create the first tissue-specific chicken intestinal expressed sequence tag (EST) database. With it, researchers will be able to determine which host genes respond to *Eimeria* or other intestinal pathogens, such as *Salmonella* and *E. coli*.

*Eimeria* makes a protein, or antigen, that helps the parasite enter host cells—but it also evokes an attack response from the host's immune system. Lillehoj is using the chicken's immune system to outsmart and disrupt *Eimeria*'s ability to colonize, shed, and inflict intestinal damage.

Lillehoj has recently been awarded a \$270,000 National Research Initiative competitive grant to take the research to the next level. During the next 3 years, the scientists will use the EST database to create chicken intestinal microarray gene chips, which have 10,000 gene sequences on them. A microarray works by exploiting the ability of messenger RNA molecules (see diagram) to find and bind to their matching DNA. Such gene chips are used as research tools to gauge and count gene expression.

"Using a glass slide that holds many thousands of expressed genes [the microarray gene chip] from various host tissues, we can examine the expression patterns of genes associated with specific responses to various stimuli," says Lillehoj.

The newly developed chicken ESTs have been deposited into a public gene database maintained by the National Center for Biotechnology Information, part of the National Institutes of Health, Bethesda, Maryland. The data is available to both public and private scientists for further research and can be accessed at [www.ncbi.nih.gov](http://www.ncbi.nih.gov).

These tissue-specific expressed gene sequences will expand scientists' ability to apply molecular genetic technologies to poultry disease research.—By **Rosalie Marion Bliss**, ARS.

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*Hyun S. Lillehoj is with the USDA-ARS Animal Parasitic Diseases Laboratory, Bldg. 1040, 10300 Baltimore Ave., Beltsville, MD 20705-2350; phone (301) 504-8771, fax (301) 504-5103, e-mail [hlilleho@anri.barc.usda.gov](mailto:hlilleho@anri.barc.usda.gov). ★*

## Gene Chips Help Determine Gene Expression

1. Messenger RNA (mRNA) are taken from infected and noninfected chicken intestinal tissues.

2. mRNA are converted into complementary DNA (cDNA) and labeled red (infected) and green (noninfected).

3. When the green- and red-labeled cDNA are poured over the gene chip, they naturally seek out and bind to their matching gene fragments.

4. The gene expression levels help scientists determine which genes are expressed in response to *Eimeria* infection.

