

## Homomorphic encryption to enable sharing of confidential data in agricultural genome to phenome

Data sharing is essential for agricultural research. This includes sharing the extensive proprietary phenotypic and genetic data generated by industry, as well as sharing data among academic researchers. For example, many federated analyses have demonstrated that the outcome of genetic analyses is significantly improved by combining multiple genetic studies into a single analysis. In addition, many funding agencies and journals now require research data to be made public following the FAIR (Findable, Accessible, Interoperable and Reusable) principles.

Many of these concerns may be overcome by secure data encryption such that confidential and sensitive information is protected, while allowing the data to be used for validation and further research. Among secure encryption methods, homomorphic encryption (HE) refers to encryption that obscures confidential aspects of the data without affecting the outcomes of certain computations. We will present an HE method called HE of Genotypes and Phenotypes (HEGP). This method is based on high-dimensional random orthogonal transformations. We will show that HEGP accommodates most widely-used mixed models for genomic prediction, GWAS, and genetic parameter estimation, including Bayesian variable selection methods. We will also show that HEGP enables the combining of data for joint analysis when each data set is encrypted with its own key. This allows each contributor to use its own private key prior to sharing the data, without having to share the key.

**Presenter:**

**Hao Cheng** is an assistant professor of quantitative genetics in the Department of Animal Science at the University of California Davis. His research interests are broadly involved in the development of statistical and computational methods for the (genetic) improvement of populations through more accurate, efficient, and biologically meaningful analysis (learn more at <https://qtl.rocks>).



**Presenter:**

**Jack C. M. Dekkers** is a C.F. Curtiss Distinguished Professor in the Animal Science Department at Iowa State University. He grew up in the Netherlands and earned B.Sc. and M.Sc. degrees from Wageningen Agricultural University, and a Ph.D. in animal breeding from the University of Wisconsin. The focus of his research is on the integration of genomics and quantitative genetics to discover the genetic basis and enhance genetic improvement of traits of importance in livestock.



**June 21, 2023**

**10:30 AM - 12:00 PM**

(Central Time, UTC-5)

**Purpose:**

Demonstrate a new method of encrypting data that preserves privacy of proprietary information.

**Register for this Zoom virtual field day:**

<https://tinyurl.com/AG2PI-FD27>

Upon registration, you will receive a confirmation email with information about joining the meeting.

A recording will be available at a later date at: [www.ag2pi.org](http://www.ag2pi.org).

**Registration is not required to view the recording.**