FROM TRANSGENIC CORE TO GENOME EDITING CORE FACILITY

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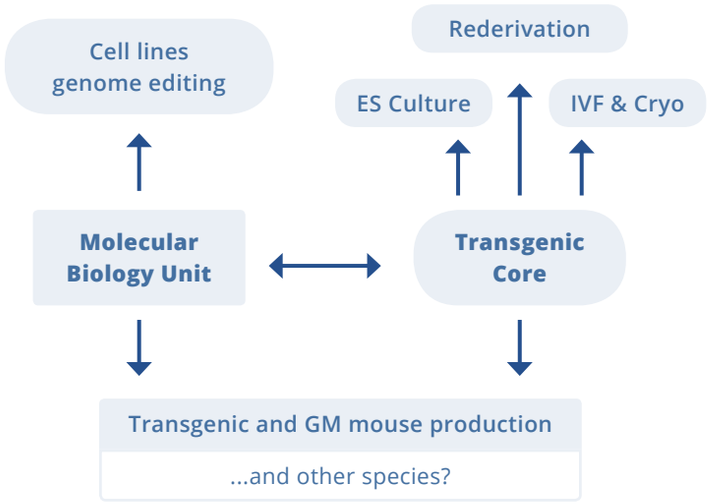
Dr. Ghassan Yehia has over 20 years of experience in all aspects of mouse transgenesis. He received his doctorate from Strasbourg, France in the Institute of Genetic, Molecular and Cell Biology, where he first started generating knock-out and transgenic mice. He then joined the University of Medicine and Dentistry of New Jersey to work on cancer research and cell signaling. While there, he helped establish and then manage the mouse transgenic facility. In 2016, he joined the Genome Editing Core facility at Rutgers, where he helped implement CRISPR/Cas9 platform for genome editing in mouse.

Institutional transgenic core facilities play a central role in advancing biological and biomedical research by providing research communities with services to generate and preserve transgenic and genetically modified (GM) mice. Traditional mouse transgenesis methods for the last 30 years allowed great advances in science, generating thousands of GM mice to model human diseases and to study gene functions in vivo. Transgenic facilities applying these methods require a dedicated and highly skilled staff in ES cell culture and early stage embryo microinjection. The design and the materials used to generate GM mice were often not part of a transgenic core but, to certain extent, incumbent on the research laboratory. Recently, the advent of CRISPR/Cas9 technology for genome editing directly in the zygote, completely revolutionized transgenesis technologies with its simplicity and efficiency. This exciting new technology was of great appeal to many facilities and most moved quickly to adopt it for their services. Nevertheless, in the last 3 years, at a remarkable rapid pace, several CRISPR/Cas9 technologies were published; this dynamic pace poses a challenge to any facility on deciding which methods to deploy for their services. In addition, transgenic facilities found themselves with no control over the quality production of CRISPR components, like the gRNAs and donor templates.

At Rutgers University, the role of the Genome Editing Core Facility (GECF) was redefined to include a molecular biology unit, as an integral part of the core, in order to take control of the design, production and testing of all CRISPR components, including genotyping of CRISPR-generated mouse founders. This unit was essential for the successful implementation of CRISPR/Cas9 technologies and for the efficiency in generating GM mice. As such, the GECF will soon bypass conventional steps to generate GM mice, using instead CRISPR/Cas9 components to electroporate zygotes either in vitro or in situ, directly in the oviduct. For sure, core facilities are outgrowing their original role as producers of transgenic mice to expand the range of their services, including genome editing in species where gene targeting was not available. The GECF organization could be used as a blueprint for other institutions seeking to fully integrate CRIPSR technologies into their own transgenic cores for the research of the future.



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Organization of the Genome Editing Core Facility at Rutgers University:

In addition to its transgenic core, including Embryonic Stem cell culture, mouse rederivation, IVF and cryopreservation, a fully equipped molecular biology unit is added to give a quality control over the production of all CRISPR components. This unit is also used for genotyping and sequencing mouse founders. Services provided by GECF could be extended to cell lines genome editing and to possibly other species.