

African Plant Breeding Academy CRISPR Course

*An Initiative of the
African Orphan Crops Consortium*



AFRICAN PLANT BREEDING ACADEMY CRISPR COURSE

Food security is a pressing need for Africa, especially given that its population size is projected to quadruple in this century. An essential aspect involves nutrition. It is simply not adequate to provide “enough” food; a balanced diet supportive of health and well-being requires access to a variety of nutritious foods on a year-round basis, foods produced in an environmentally sustainable manner. The AOCC (African Orphan Crops Consortium, africanorphancrops.org) is facilitating and fueling development of locally adapted, climate-resilient varieties of 101 diverse crops grown in Africa, including a number of fruit and nut tree species and a vast array of vegetables, to drive nutritional security for Africa, promote economic growth, and equip Africans with the tools to adapt to a changing climate.

The AOCC will partner with the Innovative Genomics Institute (IGI) over the next five years to empower 80 – 100 molecular scientists to employ the latest CRISPR technologies (i.e., genome editing) to fast-track development of new sources of vital traits in food crops. CRISPR was the basis for the 2020 Nobel Prize in Chemistry to biochemist Jennifer Doudna of the University of California (UC) Berkeley for her discovery of this precision tool for genome editing, together with French microbiologist Emmanuelle Charpentier. Professor Doudna founded the IGI, a partnership between UC Berkeley and UC San Francisco, to advance genome research for a better world. CRISPR holds huge promise for making desired genetic changes in a precise way, enabling plant breeders to rise to the challenges of a changing climate and rapidly growing population at the pace that these demand.

As an expansion of the AOCC and the African Plant Breeding Academy (AfPBA), the AfPBA CRISPR program has the full support of the AUDA-NEPAD (African Union Development Agency - New Partnerships for Africa's Development) and decisions taken by the African Union have clearly reflected this support. Furthermore, the cadre of molecular scientists trained through the AfPBA CRISPR course will be able to leverage accomplishments of the AOCC/AfPBA in its two-pronged mission to elucidate the DNA sequence information of its 101 orphan crops and to build scientific capacity in plant breeding.

That is, AfPBA CRISPR course participants can use the sequence data to inform and guide identification of new trait targets. In addition, connecting this cadre to the community



of 150 field-based crop improvement scientists from 29 countries trained to date by the AfPBA can expedite the development of crop varieties improved with the new CRISPR-generated traits as well as with other agronomic and nutritional traits prized by farmers and consumers. Thus, the CRISPR innovations will have a clear pathway into varieties “of choice”, into crop value chains, into the downstream marketplace, to directly benefit the African people. What's more, the training in CRISPR technologies is anticipated to spark innovation in crop improvement across the continent and position Africa as a key contributor on the global stage in this frontier area of agricultural invention.

LAUNCHING THE AFPBA CRISPR COURSE

We envision an intensive 6-week program to equip African scientists with the knowledge and skills to create new sources of essential traits for abundance of nutritious food crops. The course is delivered in three 2-week sessions in Nairobi, Kenya over a period of a year and can accommodate 20 participants per course offering. Through highly interactive classroom instruction and practical hands-on training delivered by world-class experts, participants are fortified with the knowledge and skills needed to successfully design and deliver traits such as disease resistance, stress tolerance, added nutrition, and prolonged shelf life in their crop of interest. Participants perform the steps of target formulation, plasmid design, trait delivery to the plant cells, plant regeneration, and identification of plants expressing the desired mutation to gain confidence in their ability to achieve success. For instructional purposes, banana, one of the AOCC's target crops with established procedures and protocols for regeneration, is used. However, each participant is positioned through the course to implement work in a crop aligned to his/her national and institutional priorities. The course culminates with each participant proposing a pathway to operational CRISPR capacity at their home institution, including any steps required for biosafety authorization at the national level, to advance targeting of specific traits. The course emphasizes the role of CRISPR in the overall scheme of cultivar development and in addressing the needs of smallholder farmers and will support a Community of Practice strongly linked to the disciplines required for product launch, seed distribution, and farmer adoption.

ELIGIBILITY AND RECRUITMENT

To be eligible for the course, applicants must hold a PhD in molecular biology (or related area) and be actively employed as a bench scientist in a public institution in Africa. Proficiency in the English language is essential as all instruction is provided in English. Applicants must have the support of their institution to develop CRISPR capacity and operations for commercial targets, and the facilities to do so, with



reasonable additions. The institutions must qualify for the biosafety authorization level required for CRISPR activities in their country or provide evidence of actively working toward this goal (for example, in Kenya, laboratories engaged in gene editing activities must have Biosafety Level 2 authorization). As the Academy aims to foster multi-disciplinary teams focused on national and regional crop improvement needs, applicants recommended by AfPBA field-based crop improvement alumni will be given priority. Applicants must show high motivation, commitment to professional growth, and strong aptitude for managing a genome editing program. Extensive recruitment outreach is aimed at representing in the program and providing benefit to as many African countries as possible and equal proportions of women and men scientists.

ORGANIZATION AND IMPLEMENTATION

The AfPBA CRISPR course is organized to deliver on its objectives, with a number of AOCC members serving as key partners in this program. CGIAR centers ICRAF, IITA, and BecA/ILRI provide premier classroom, laboratory, greenhouse, and field facilities in Nairobi, Kenya, along with technical support to advance plant materials between sessions. UC Davis leads curriculum design and, together with ICRAF, coordinates course logistics and delivery. UC Davis and IGI lead lesson development and on-site instruction, and foster linkages with plant breeding programs for product development. A unique element of this program, facilitated by the IGI, involves mentorship and ongoing support for sustained lab productivity beyond course completion and founding of translational partnerships for commercialization and value chain development.





Course cost-per-participant runs \$58,600 including tuition, lab and glasshouse fees and supplies, books and computer software, round-trip travel to Nairobi, lodging and meals during the sessions, as well as administrative costs, instructor fees, security, and insurance. As a follow up to the course, grants of up to \$15,000 will be available to participants to aid in outfitting their home laboratory, growth chamber, and greenhouse facilities for operational efficiency. Furthermore, guidance and mentorship to course graduates and their home institutions will be provided through UC Berkeley. The total cost for each cohort of 20 participants is \$1,600,000. Over five years, the total cost for this transformational program to empower 100 African scientists with CRISPR proficiency and spark innovation across the continent is projected to be \$8M.

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