Insect Genetic Technologies

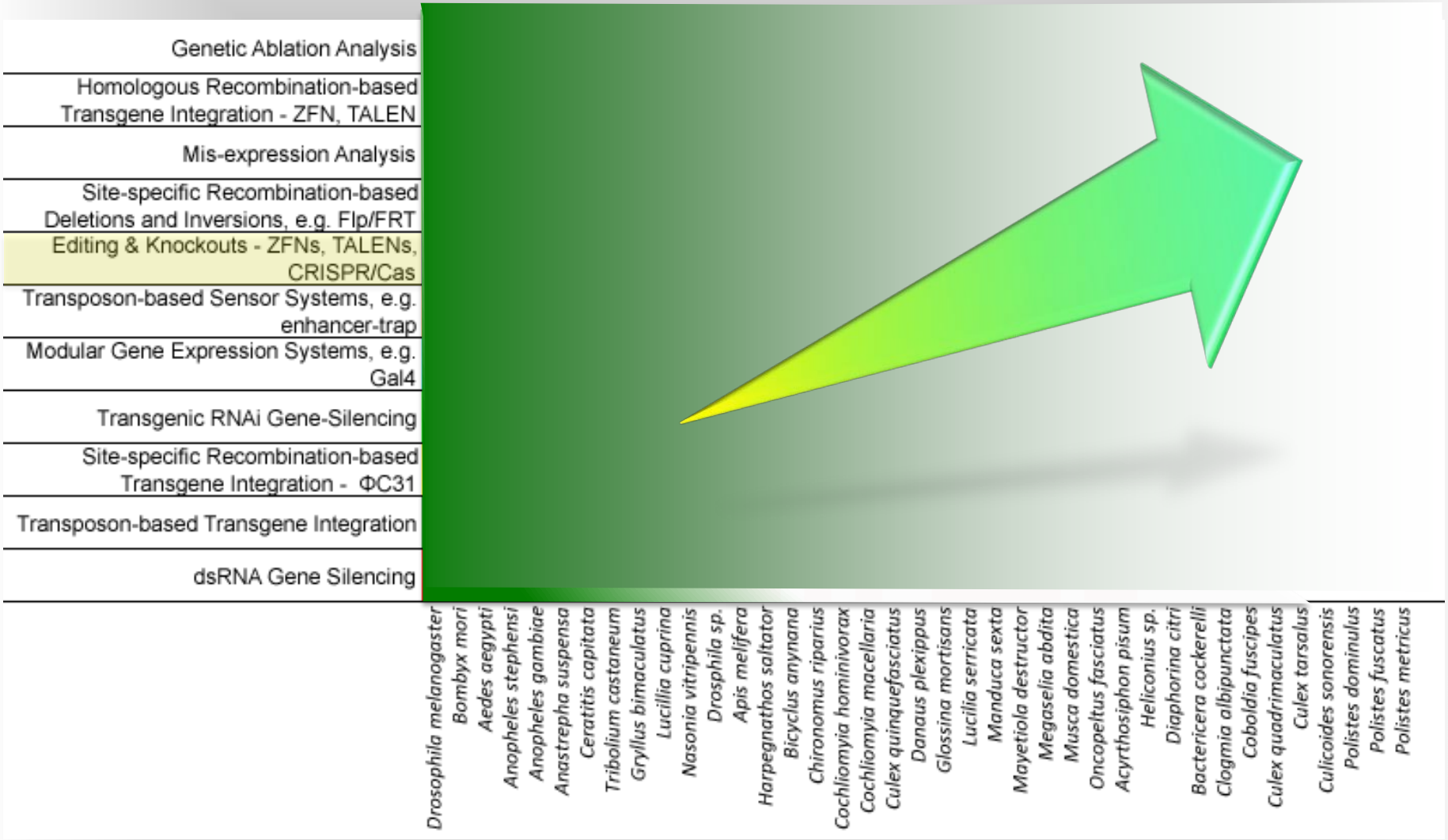
Why, How

Biosafety Challenges

David O'Brochta, Ph.D.
Institute for Bioscience and Biotechnology Research
Department of Entomology
University of Maryland, College Park
dobrocht@umd.edu

UNIVERSITY OF MARYLAND

Insect Genetic Technologies:



Why?

Research

Functional Genomics

Applications

Physically Contained

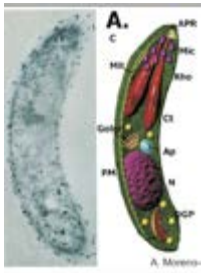
Genetically Contained

Uncontained

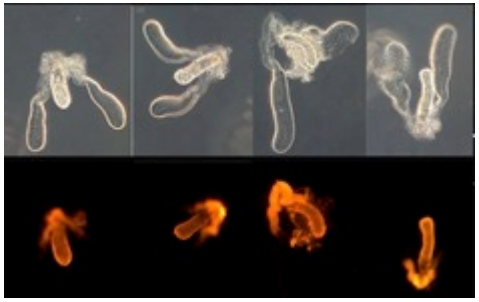
Research
Functional Genomics

Saglin

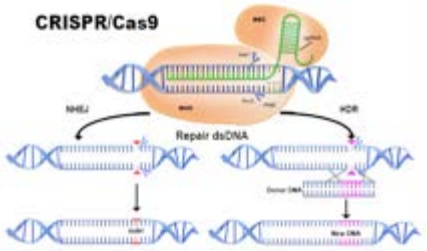
Salivary Gland

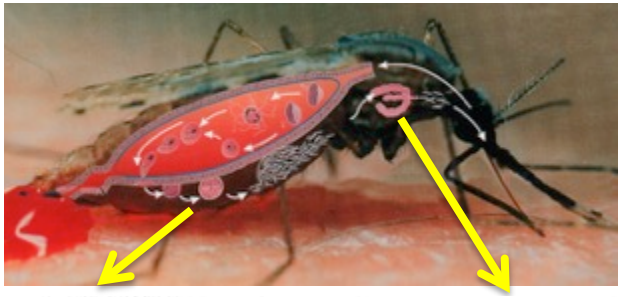


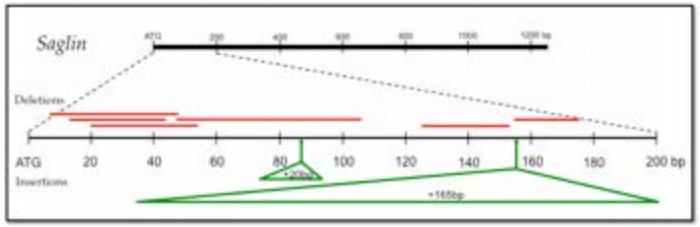
Sporozoite

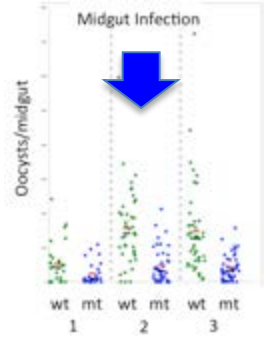


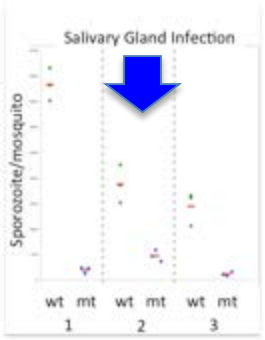
CRISPR/Cas9 Mutants





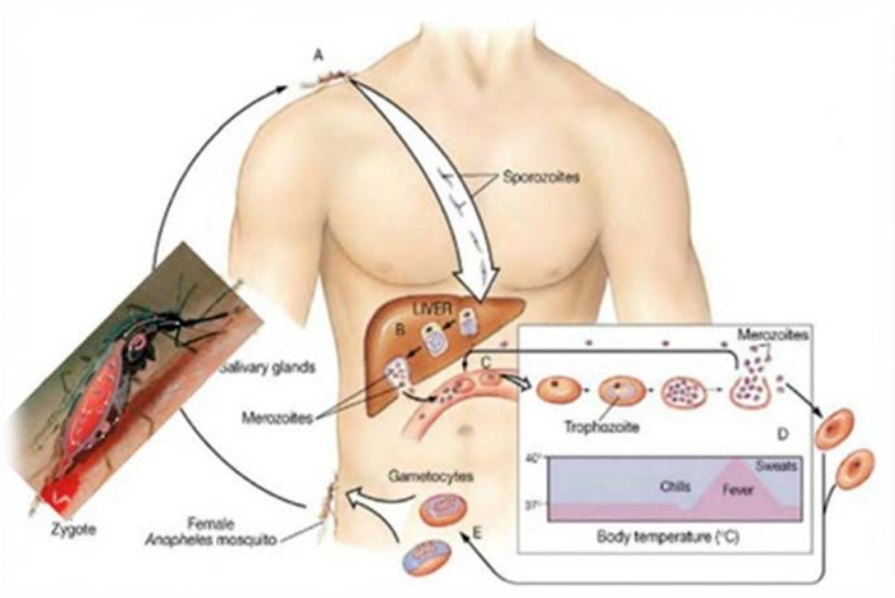




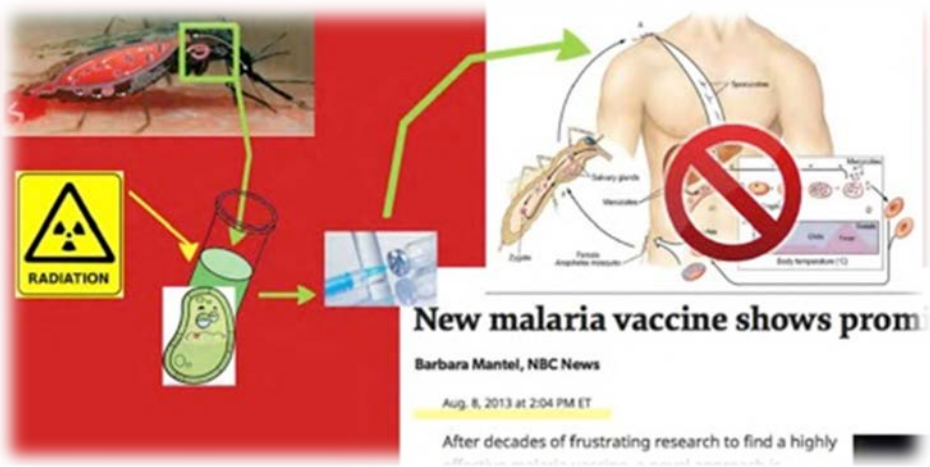


Physically Contained Applications

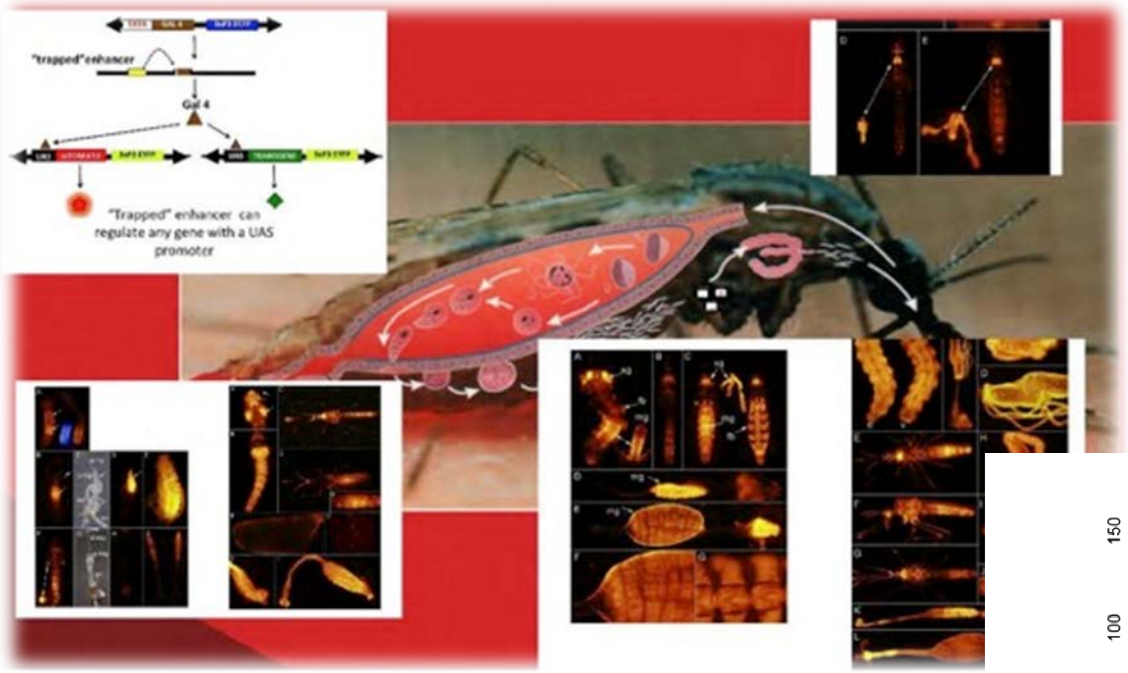
Genetically Modified Mosquitoes and a Malaria Vaccine



Sanaria, Inc.



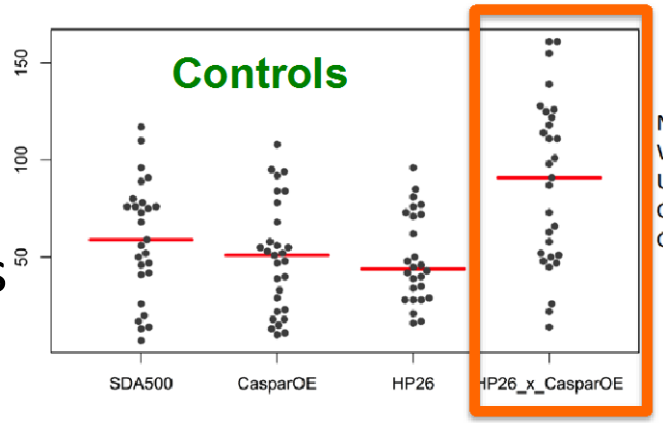
Genetically Modified Mosquitoes and a Malaria Vaccine

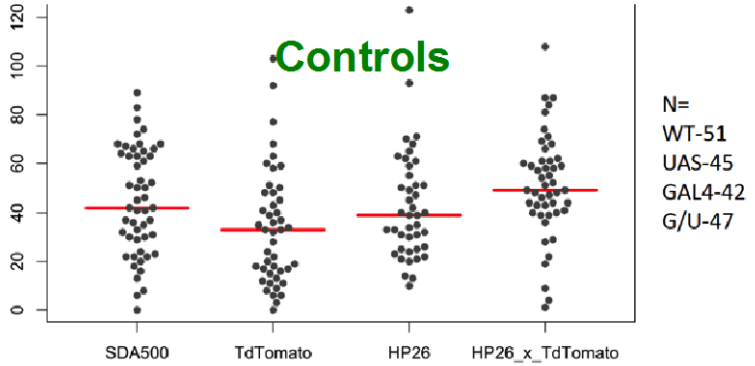


Create Immune-compromised Mosquitoes

Transposon-based Transgenics

Binary Gene Expression System



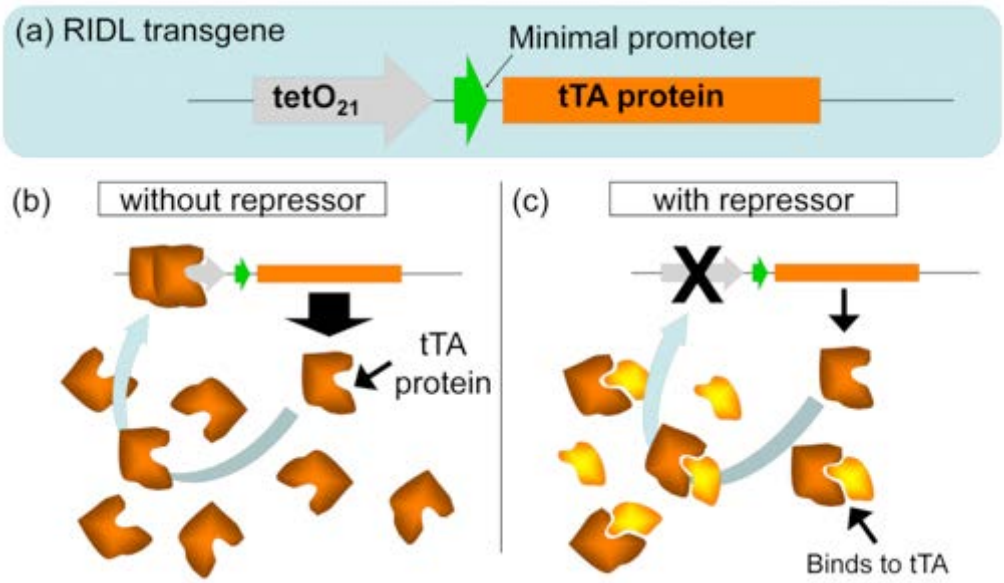


Genetically Contained Applications

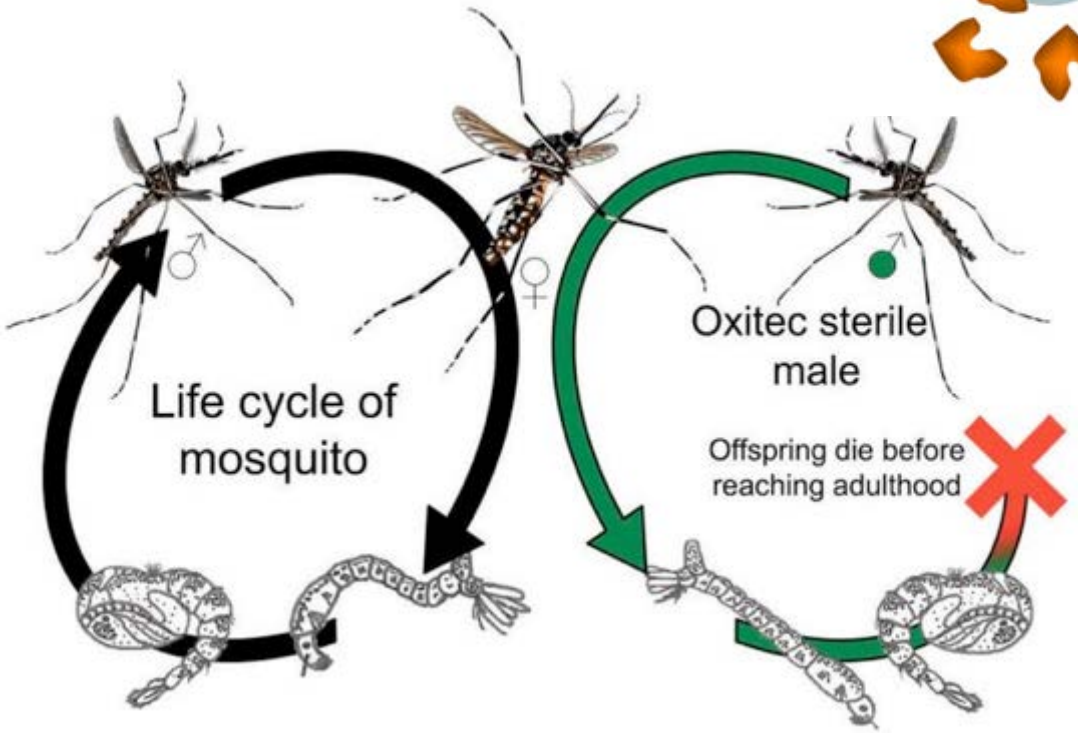
Oxitec, LLC

RIDL Strategy

Release of **I**nsects with **D**ominant **L**ethals



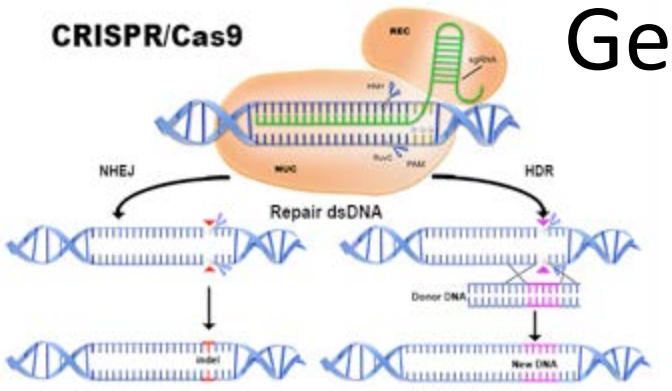
run-away transcription



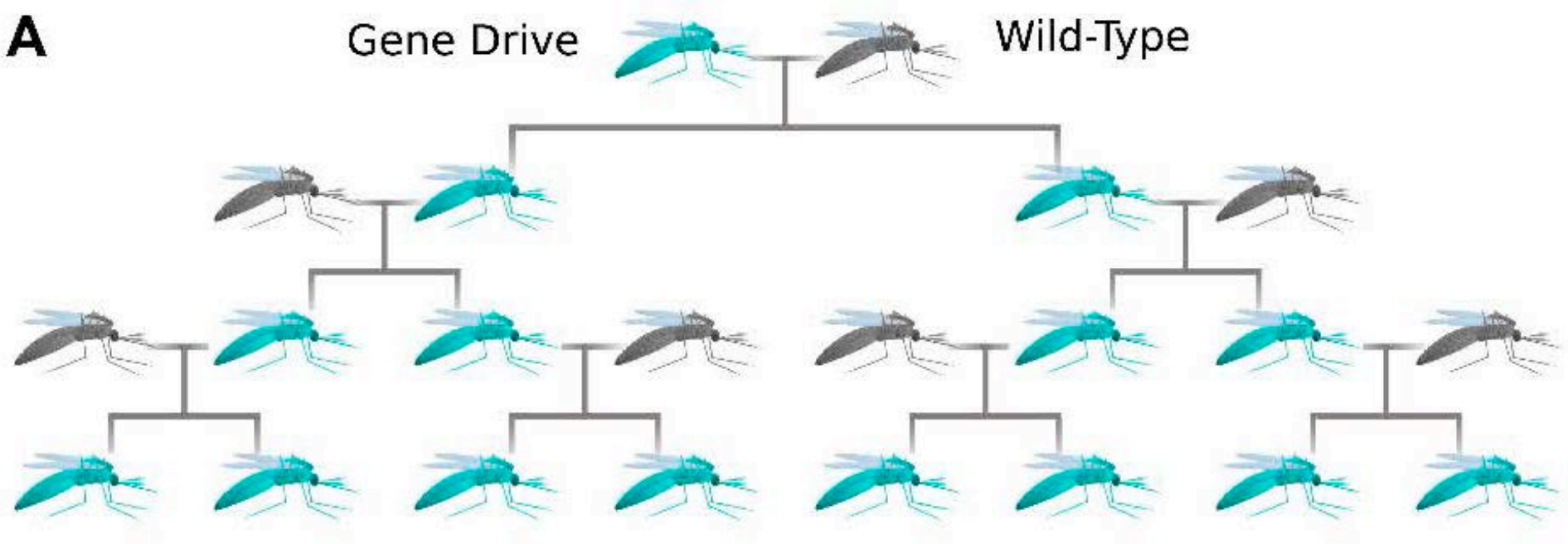
Transposon-based Transgenics

Conditional Promoter

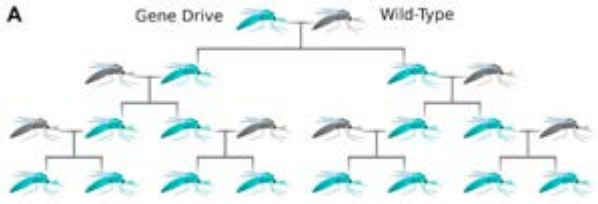
Uncontained Applications



Gene Drive Systems



Gene Drive Systems



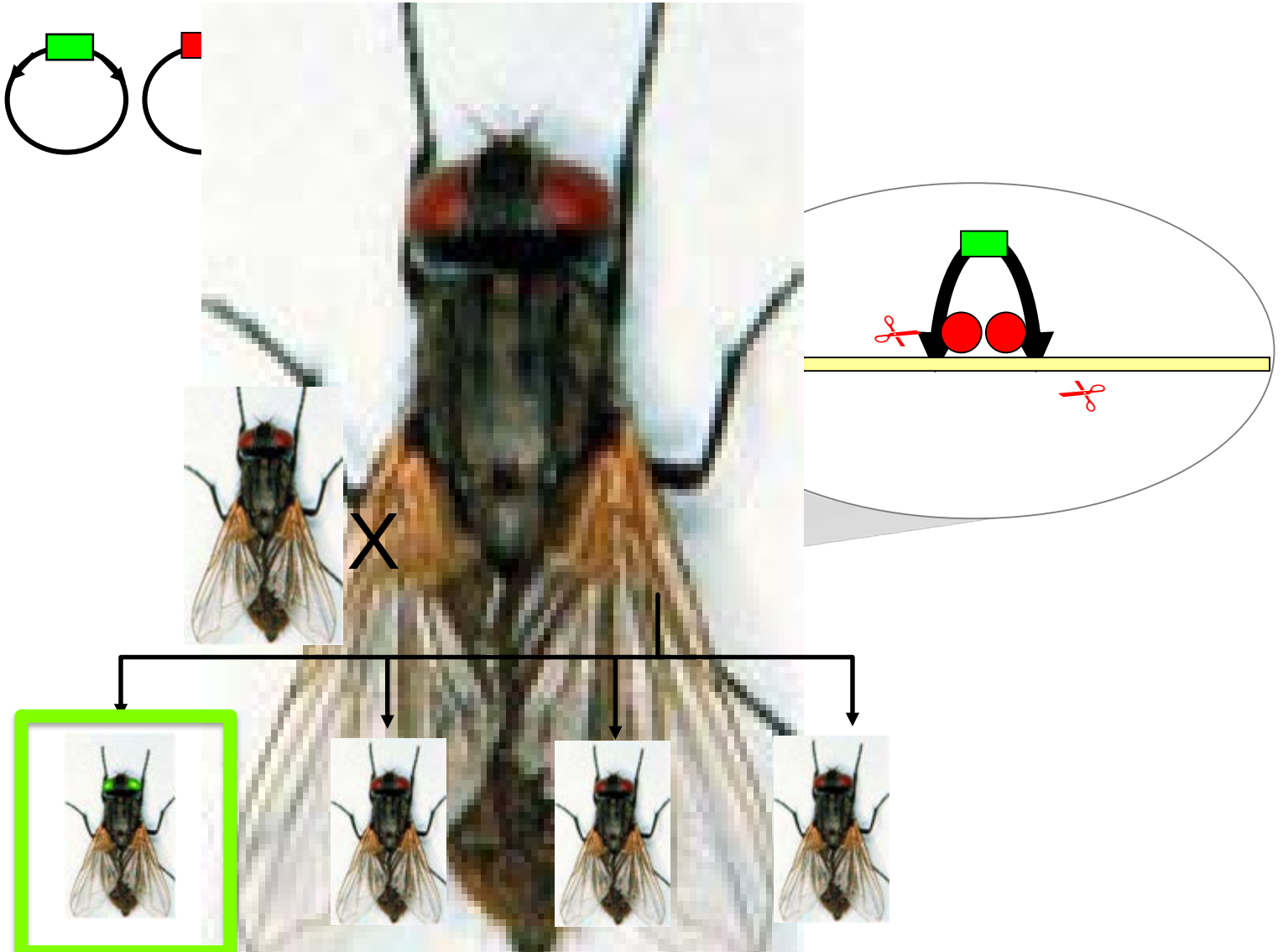
Erradication:

Sex-Ratio Distortion
Reduce Fitness

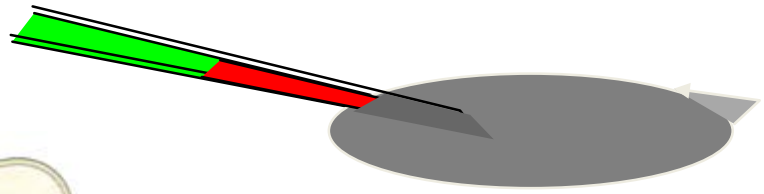
Gene Introgression:

Anti-parasite genes
Anti-virus genes

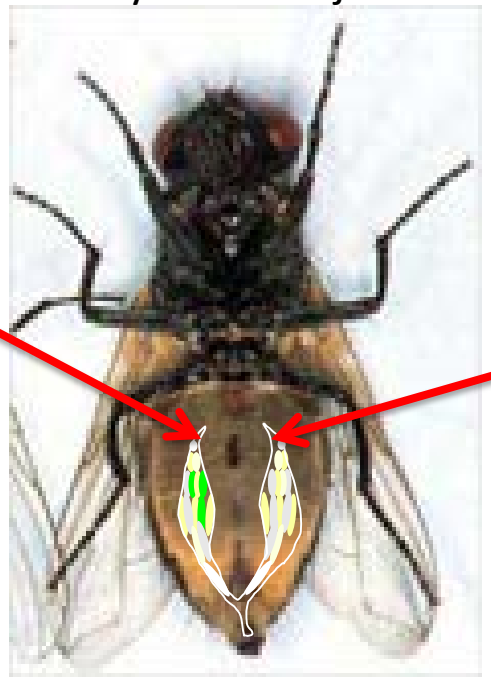
General Strategy for Genetically Modifying Insects

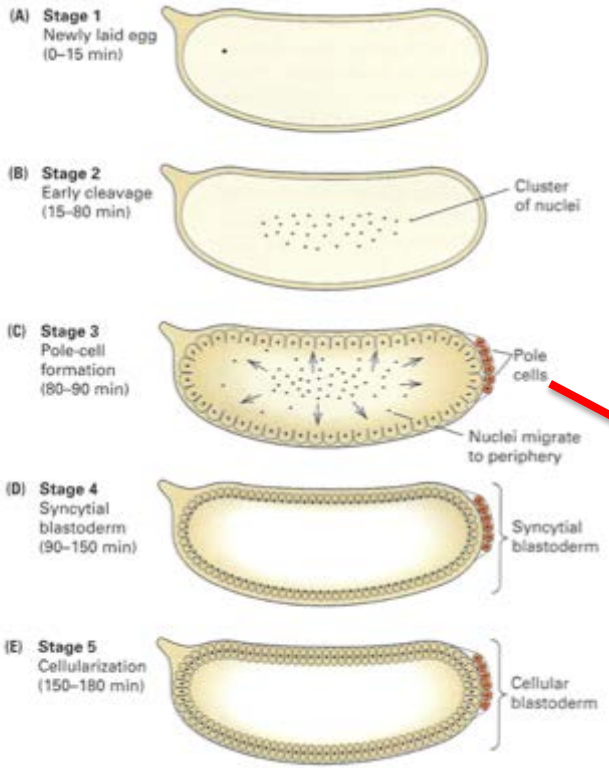


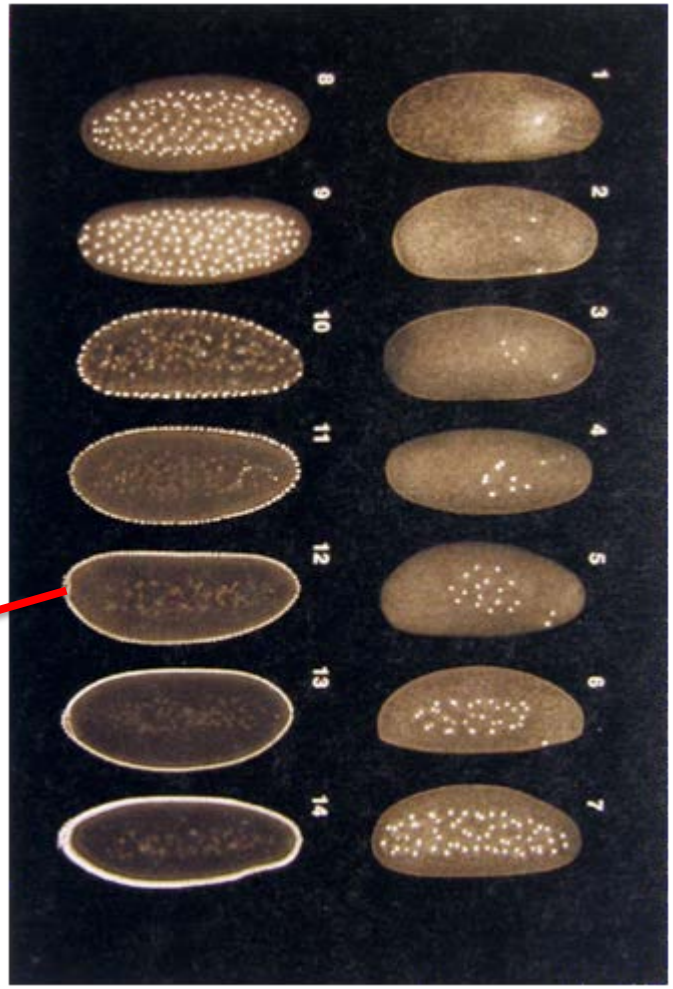
Delivery of Genetic Technologies to Insect Germ Cells



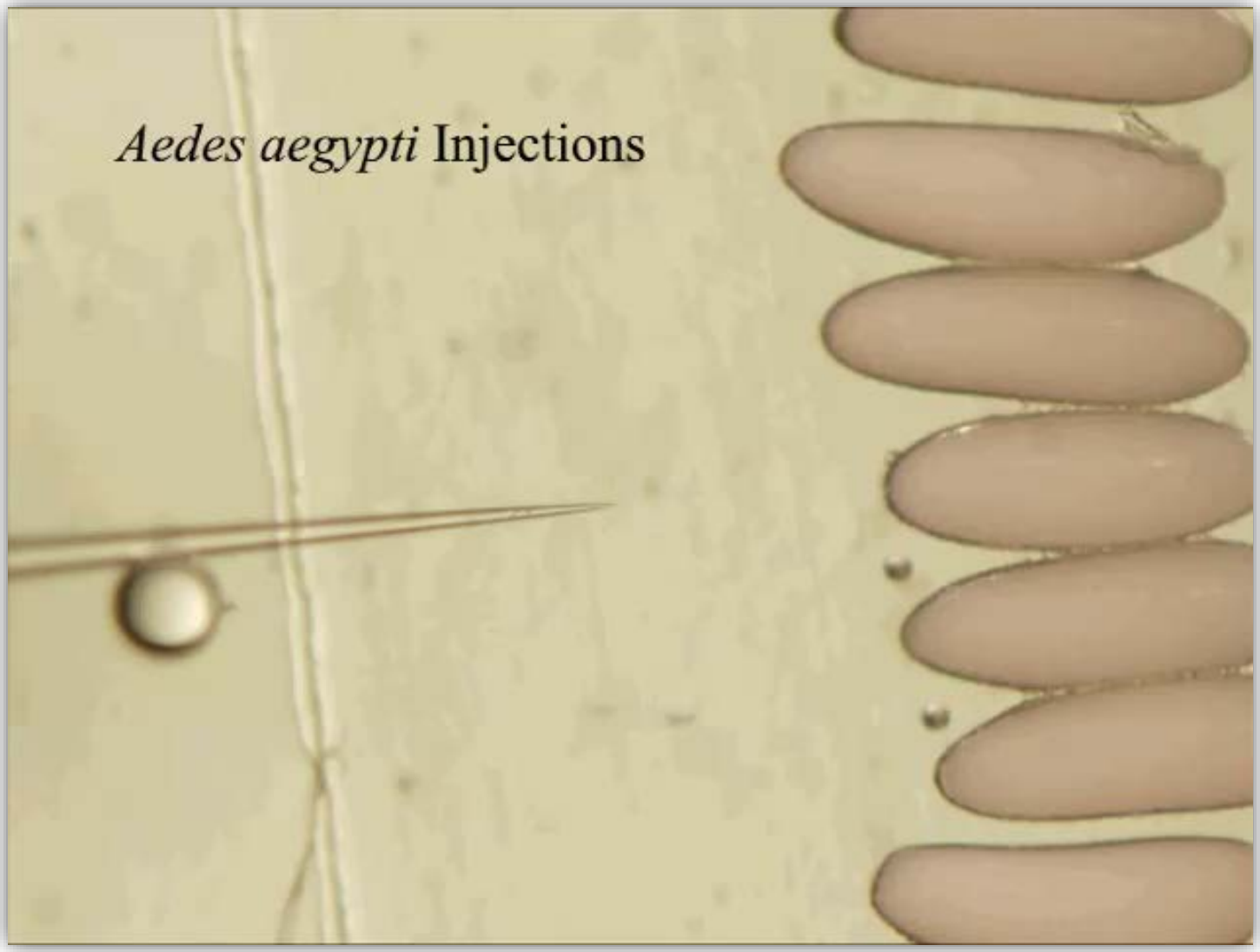
Embryo Microinjection





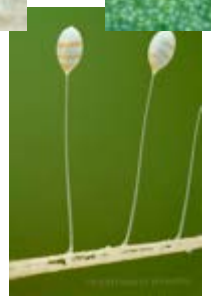


Aedes aegypti



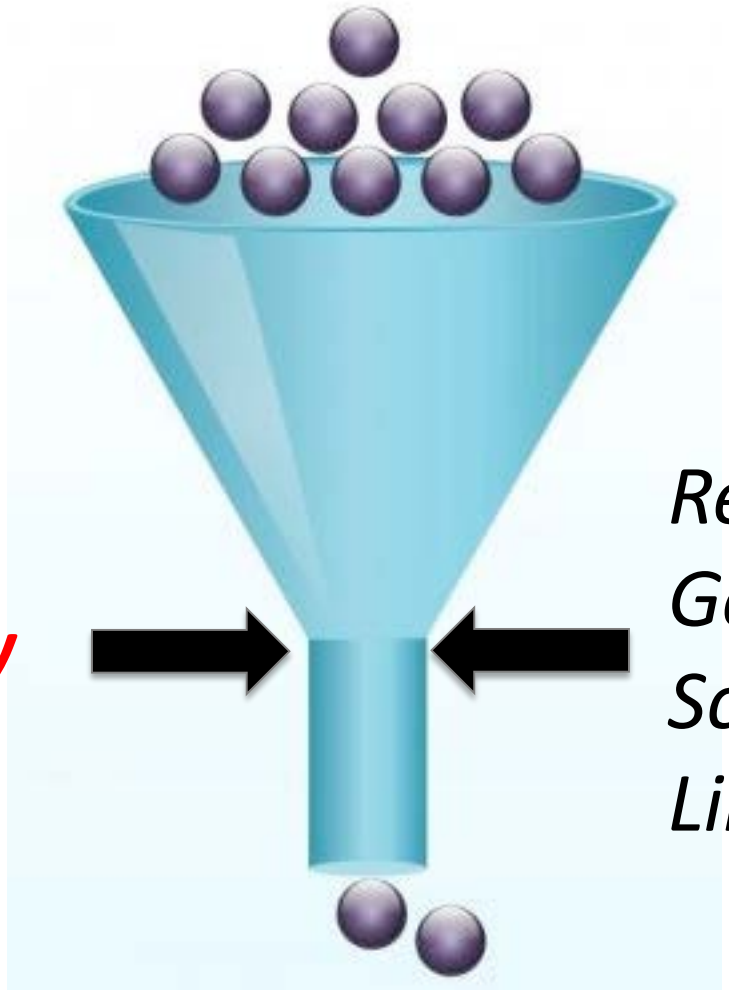
Aedes aegypti Injections copy 2.mp

Delivery by Early-Embryo Microinjection Limits Availability of Technologies



Early-Embryos Inaccessible in Many Species

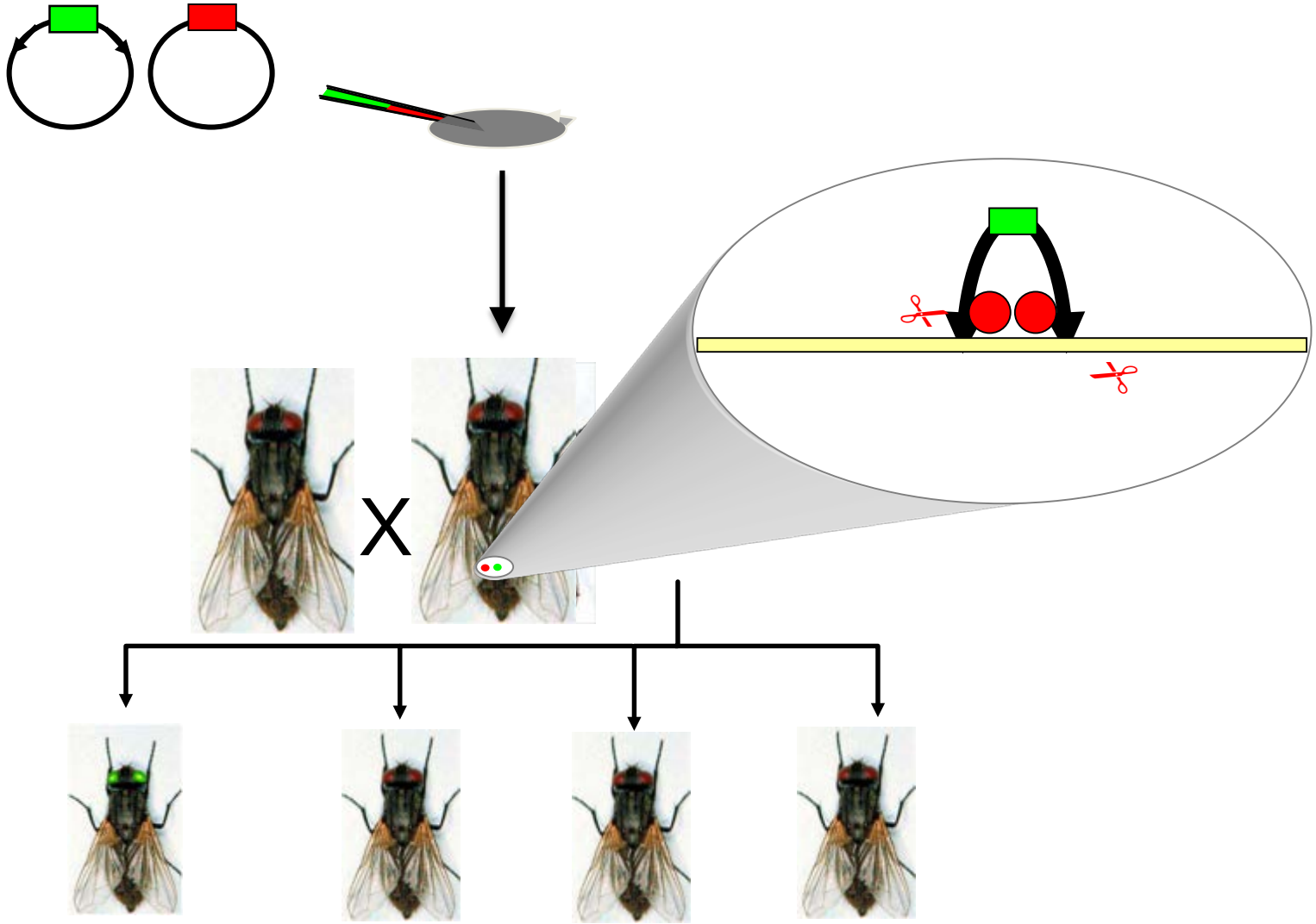
Technical Challenges Limiting the Use of Insect Genetic Technologies



Delivery

Rearing
Genetics
Screening
Line Establishment

General Strategy for Genetically Modifying Insects

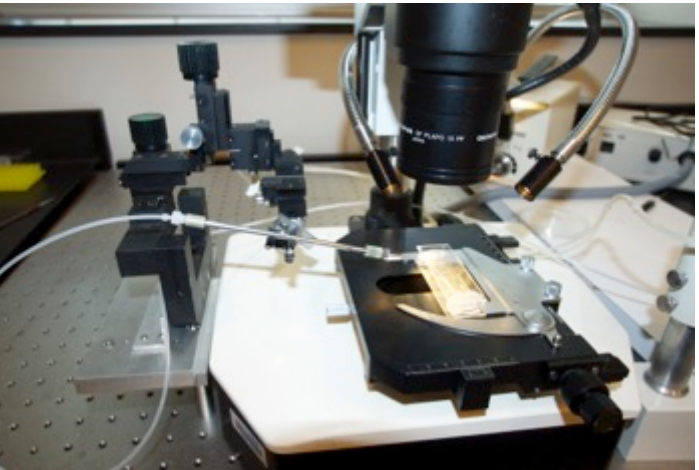


For Most Insect Scientists Insect Genetic Modification is a Heavy Lift

The Insect Transformation Facility

UNIVERSITY OF MARYLAND | NIST
INSTITUTE FOR BIOSCIENCE
& BIOTECHNOLOGY RESEARCH

Since 2006



The Insect Transformation Facility

UNIVERSITY OF MARYLAND | NIST
INSTITUTE FOR BIOSCIENCE
& BIOTECHNOLOGY RESEARCH

Since 2006

Insect Genetic Modification Services:

Transposon-based technologies

Site specific recombination technologies

Endonuclease-based 'gene editing'

Training

Consulting

The Insect Transformation Facility

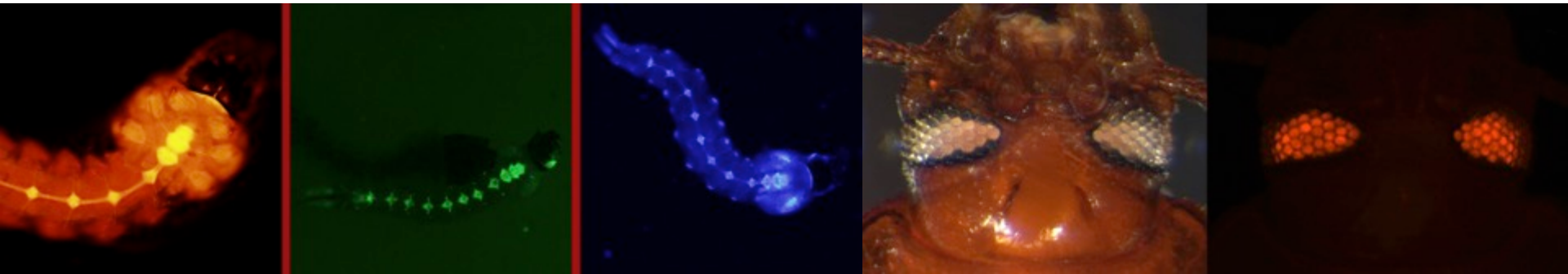
UNIVERSITY OF MARYLAND | NIST
INSTITUTE FOR BIOSCIENCE
& BIOTECHNOLOGY RESEARCH

Since 2006

400+ Projects

55 Projects in FY2017

40+ Species



The Insect Transformation Facility

UNIVERSITY OF MARYLAND | NIST
INSTITUTE FOR BIOSCIENCE
& BIOTECHNOLOGY RESEARCH

Since 2006

Common Species:

Aedes aegypti

Anopheles stephens

Anopheles gambiae

Tribolium castaneum

Drosophila virilis

Drosophila simulans

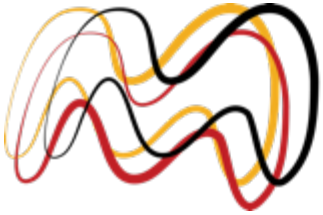
Common Technologies:

Transposons

Site-specific Recombination

CRISPR/Cas

The Insect Transformation Facility



UNIVERSITY OF MARYLAND | NIST
INSTITUTE FOR BIOSCIENCE
& BIOTECHNOLOGY RESEARCH

Since 2006

Recent Species:

Bemisia tabaci

Phlebotomous papatasi

Anopheles arabiensis

Anopheles funestis

Hermetia illucens

Ixodes scapularis

Sitobion avenae

Rhopalosiphum padi

Gryllus bimaculatus

Challenges:

What's Regulated?

Containment requirements?

Shipping requirements?

Insect Genetic Technologies

Why, How

Biosafety Challenges

David O'Brochta, Ph.D.
Institute for Bioscience and Biotechnology Research
Department of Entomology
University of Maryland, College Park
dobrocht@umd.edu

UNIVERSITY OF MARYLAND