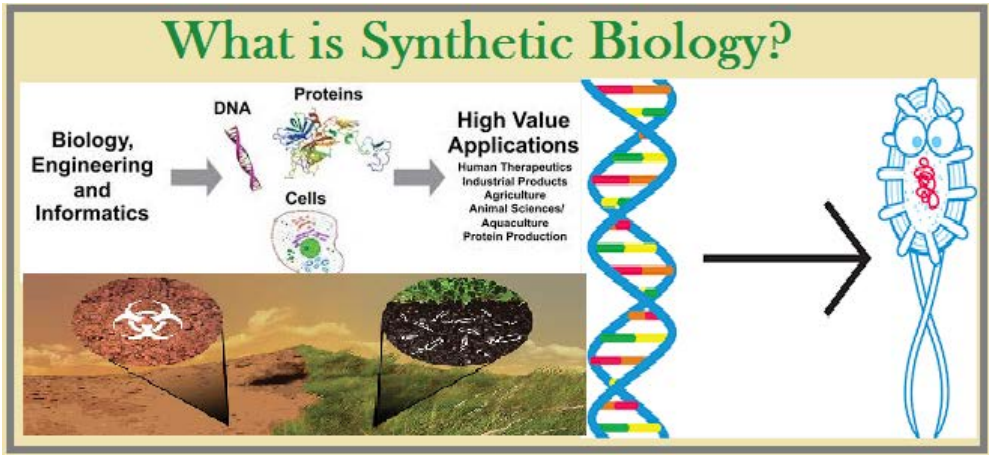
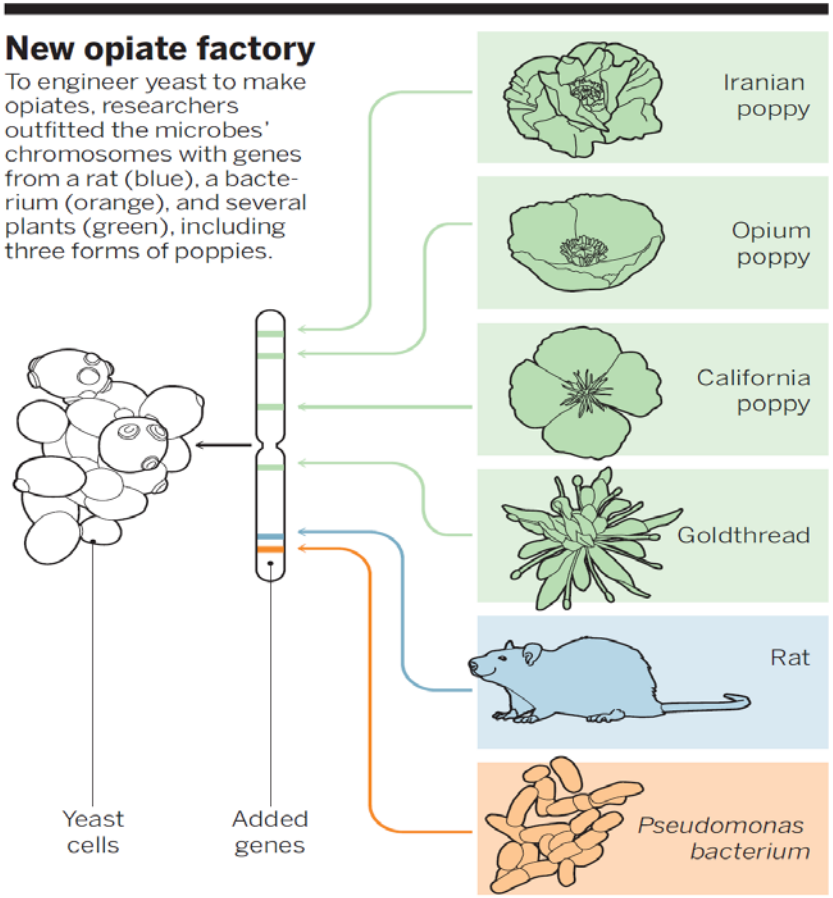
Synthetic Biology: Designing and redesigning organisms



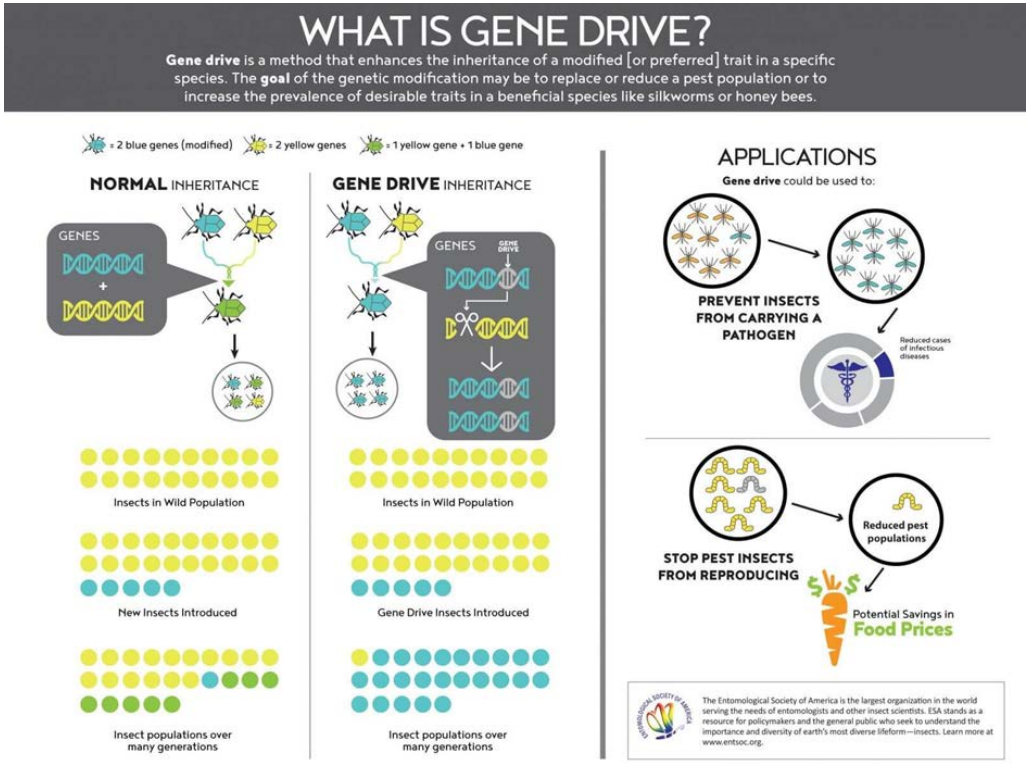
Shikha Goyal, jagranjosh.com

Applying engineering principles to biology; redesigning organisms for useful purposes by engineering them to have new abilities



R. Service, Modified Yeast Produces Opiates from Sugar, Science Aug. 2015

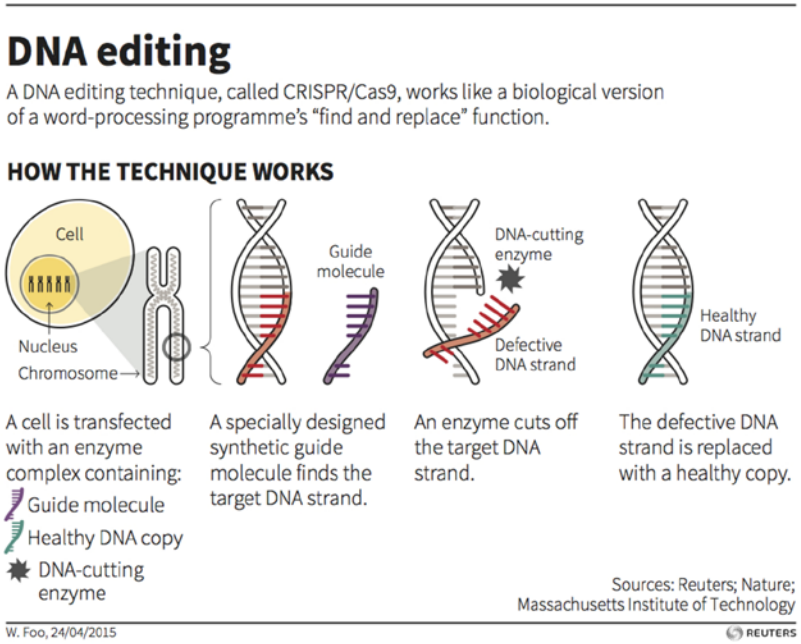
Enhancing inheritance of traits to reduce a pest population or increase prevalence of desirable traits

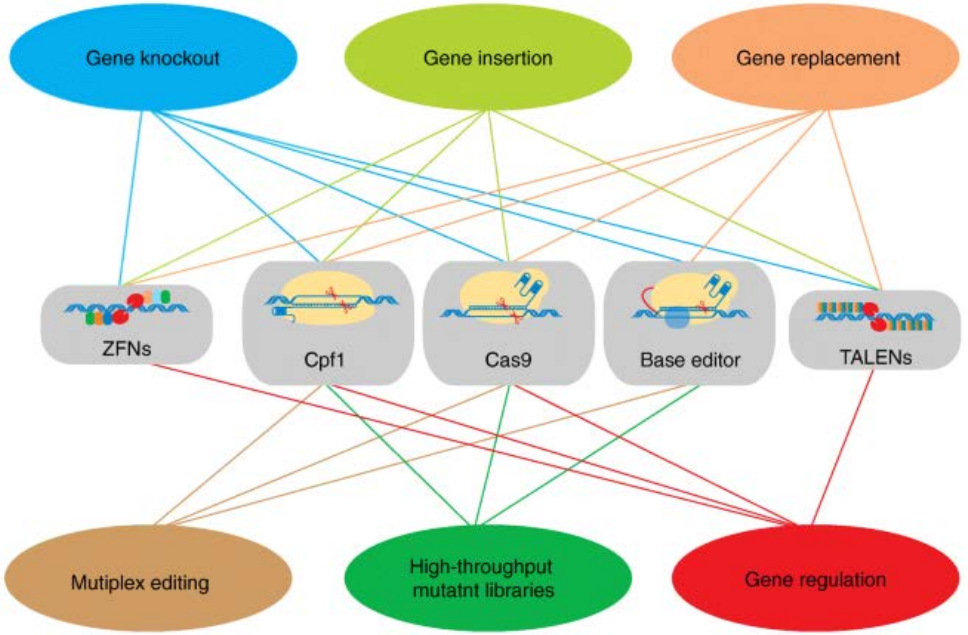


Genetic literacy project

EMORY UNIVERSITY

Genome editing tools: CRISPR-Cas and more





Manipulating an organism's genetic material (deleting, inserting, or replacing a DNA sequence)
To correct a disorder or improve a feature

Zhang, et. al., *Applications and potential of genome editing in crop improvement* (Genome Biology, Nov 2018)

EMORY UNIVERSITY

Draft
International Legal Instrument Relating to Intellectual Property, Genetic Resources and Traditional Knowledge Associated with Genetic Resources

Prepared by Mr. Ian Goss
Chair, WIPO Intergovernmental Committee on Intellectual Property and Genetic Resources, Traditional Knowledge and Folklore

April 30, 2019

- **ARTICLE 9**
- **REVIEW**
-

- The Contracting Parties commit to a review of the scope and contents of this instrument, addressing issues such as the possible extension of the disclosure requirement in Article 3 to other areas of IP and to derivatives and **addressing other issues arising from new and emerging technologies that are relevant for the application of this instrument**, no later than four years after the entry into force of this instrument.

Draft
International Legal Instrument Relating to Intellectual Property, Genetic Resources and Traditional Knowledge Associated with Genetic Resources

Prepared by Mr. Ian Goss
Chair, WIPO Intergovernmental Committee on Intellectual Property and Genetic Resources, Traditional Knowledge and Folklore

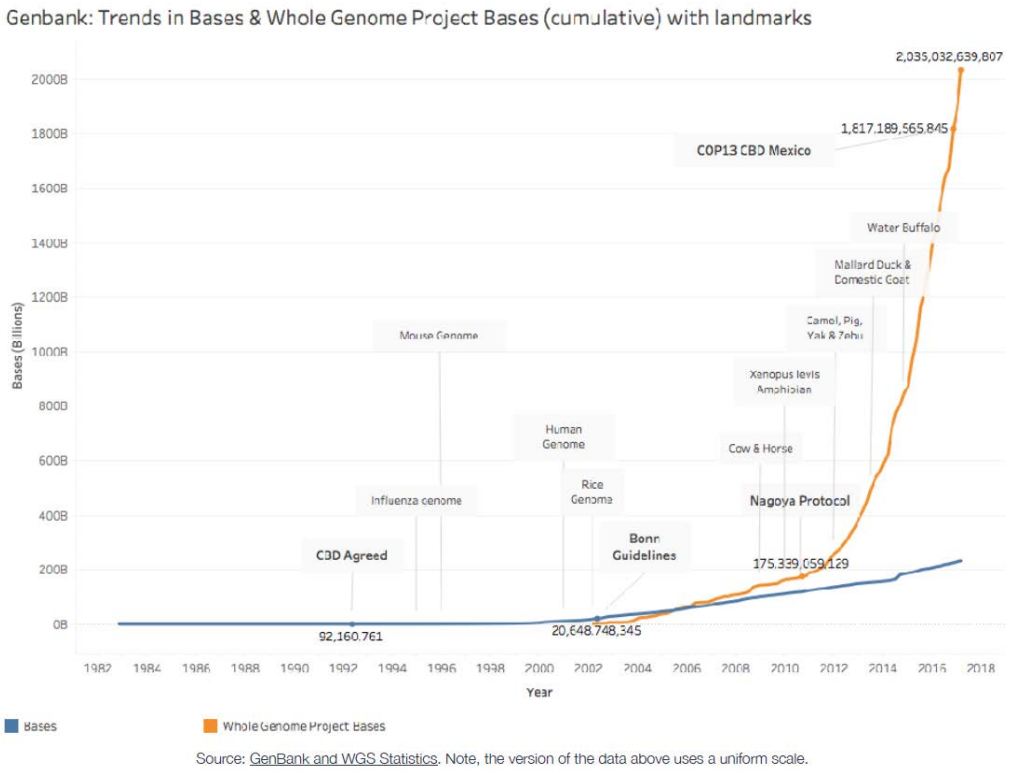
April 30, 2019

- Notes on Article 9
- 1. This article is a compromise text developed to address the view of some members that the scope of the instrument should include other IP rights **and issues**. Notwithstanding this view, members also recognised that the primary commercial use of GRs within the IP system is within the patent system and that further work is required to determine the applicability to other IP rights. In addition, this article attempts to reconcile differences of view regarding the inclusion of derivatives within the scope of the instrument. **This would appear to be prudent noting ongoing discussions in other international forums.**
- 2. This approach enables the instrument to be progressed as a foundation instrument with an in-built mechanism to address additional issues within a predetermined time-frame.

Vast amounts of sequence data is being sequenced, stored, and accessed publicly accessible databases

It cost between $500 million and $1 billion to sequence the reference human genome in 2000, by 2006, the cost had dropped to ~$14 million and by late 2015 to below $1,500. *National Human Genome Research Institute*

low cost of genome sequencing +
high value of aggregated sequences for screening & alignment searching =
more sequences being uploaded to publicly accessible databases and thus to less need to access physical genetic material.



Paul Oldham

EMORY UNIVERSITY

An example of using sequence homology and publicly accessible DSI for crop improvement

OsERF922 knockout to enhance rice blast resistance:

1. Guo *et al.* found that the tobacco OPBP1, an ERF transcription factor is involved in disease resistance
2. Dongfeg Liu *et al.* searched for a similar gene in oryza using BLAST (Genbank's **B**asic **L**ocal **A**lignment **S**earch **T**ool) and found OsERF922 and characterized it as an ERF type gene that increases rice disease susceptibility
3. Fujun *et al.* used CRISPR to mutate (using NHEJ) OsERF922 resulting in increased oryza disease resistance

- **"BLAST** finds **regions of similarity** between biological sequences. The program **compares nucleotide or protein sequences to sequence databases** and calculates the statistical significance." https://blast.ncbi.nlm.nih.gov/Blast.cgi

Some international fora where “DSIand genetic resource (GR) discussions are underway

- UN Bodies:
- **Convention on Biological Diversity (CBD) and its Nagoya Protocol (NP)**
- Food and Agriculture Organization (FAO) International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA)
- FAO Commission on Genetic Resources for Food and Agriculture (CGRFA)
- World Health Organization (WHO) Pandemic Influenza Preparedness (PIP) Framework
- **World Intellectual Property Organization Intergovernmental Committee on Intellectual Property, Genetic Resources, Traditional Knowledge, and Folklore**

•Other Bodies:

- International Union for Conservation of Nature (IUCN)
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)