Gene Editing and Applications

Session Chairs

Dr. Lei (Stanley) Qi
Stanford University (US)

Dr. Oscar Ortiz Sanchez
Merck KGaA (Germany)
Engineering life = engineering DNA

DNA is the program of life

Engineering life = engineering DNA
Our ability to read DNA progressed faster than Moore’s law
Besides reading, how about writing?
Gene editing

A type of genetic engineering in which DNA is inserted, deleted or replaced in the genome of a living organism using engineered molecules, e.g. "molecular scissors."
Genome Engineering Tools: The Force Awakens

CRISPR biology

- 1987: CRISPRs described (34)
- 2005–2006: CRISPRs contain viral sequences, crRNA genes identified, hypothesis (35, 36, 38–40, 43, 44)
- 2010: Type II CRISPR-Cas cuts target DNA (67)
- 2011: Type II CRISPR-Cas includes tracrRNA (66)
- 2011: Cas9 is only cas gene needed for type II defense function (58)
- 2012: CRISPR-Cas9 is RNA-guided DNA endonuclease (64)
- Jan. 2013: Cas9-RNA mediates site-specific genome engineering in human cells, other eukaryotes (75, 85, 86)

Genome editing

- 1979: Gene replacement in yeast (1)
- 1985–1986: Human genome editing by HDR (3–5)
- 1989–1994: Genome break repair by NHEJ, HDR (2; 6–9)
- 2003 onward: Expanded use of ZFNs for genome engineering
- 2009–2010: TAL effectors; TALE nucleases (31–33)
- 2010 onward: Increasing use of TALENs for genome engineering

Source: Doudna & Charpentier, 2016
Genome Engineering Tools: The Force Awakens
Patent Dispute in the CRISPR Field

Bitter fight over CRISPR patent heats up
Unusual battle among academic institutions holds key to gene-editing tool’s future use.
Heidi Ledford
12 January 2016

Titanic clash over CRISPR patents turns ugly
Accusations of impropriety feature in escalating dispute.
Heidi Ledford
21 September 2016

CRISPR heavyweights battle in US patent court
The University of California, Berkeley, and the Broad Institute are vying for lucrative rights to the gene-editing system.
Sara Reardon
08 December 2016

by Lee McGuire
Chief Communications Officer, Broad Institute of MIT and Harvard
Updated February 15, 2017

February 15, 2017: PTAB issues decision declaring ‘no interference-in-fact’
On February 15, 2017, the Patent Trial and Appeal Board declared that the patents granted by USPTO to the Broad Institute, MIT and Harvard concerning CRISPR editing of eukaryotic genomes do not interfere with patent claims filed by UC Berkeley and the University of Vienna.
Big Pharma is Joining the Game

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Our Speakers

Dr. Montse Fernandez
Takara Bio
CRISPR Gene Editing of Human Stem Cells

Dr. Jamal Alzubi
University of Freiburg
Gene Editing for Curing a Disease

Dr. Luisa Bortesi
RWTH Aachen University
Tailor-Made Plants Using Molecular Scissors

Dr. Joseph Bondy-Denomy
University of California San Francisco
Bacterial Viruses Thwart CRISPR-Cas9