CRISPR Patents: An ELSI Review

Jacob S. Sherkow
Associate Professor
Innovation Center for Law and Technology
New York Law School

KEI
KNOWLEDGE ECOLOGY INTERNATIONAL

Sept. 15, 2017

WE ARE NEW YORK'S LAW SCHOOL

NEW YORK LAW SCHOOL 125 YEARS

CRISPR Patent Licenses

- CRISPR: The Technology & Patent Interference
- Profit & Collaboration In the CRISPR Era
- For-Profit Surrogate Licensors
- Ethical Gatekeeping

NEW YORK LAW SCHOOL


Photo Credit: ScienceSource © A Barrington Brown 1953

Photo Credit: Getty Images © Kimberly White 2013

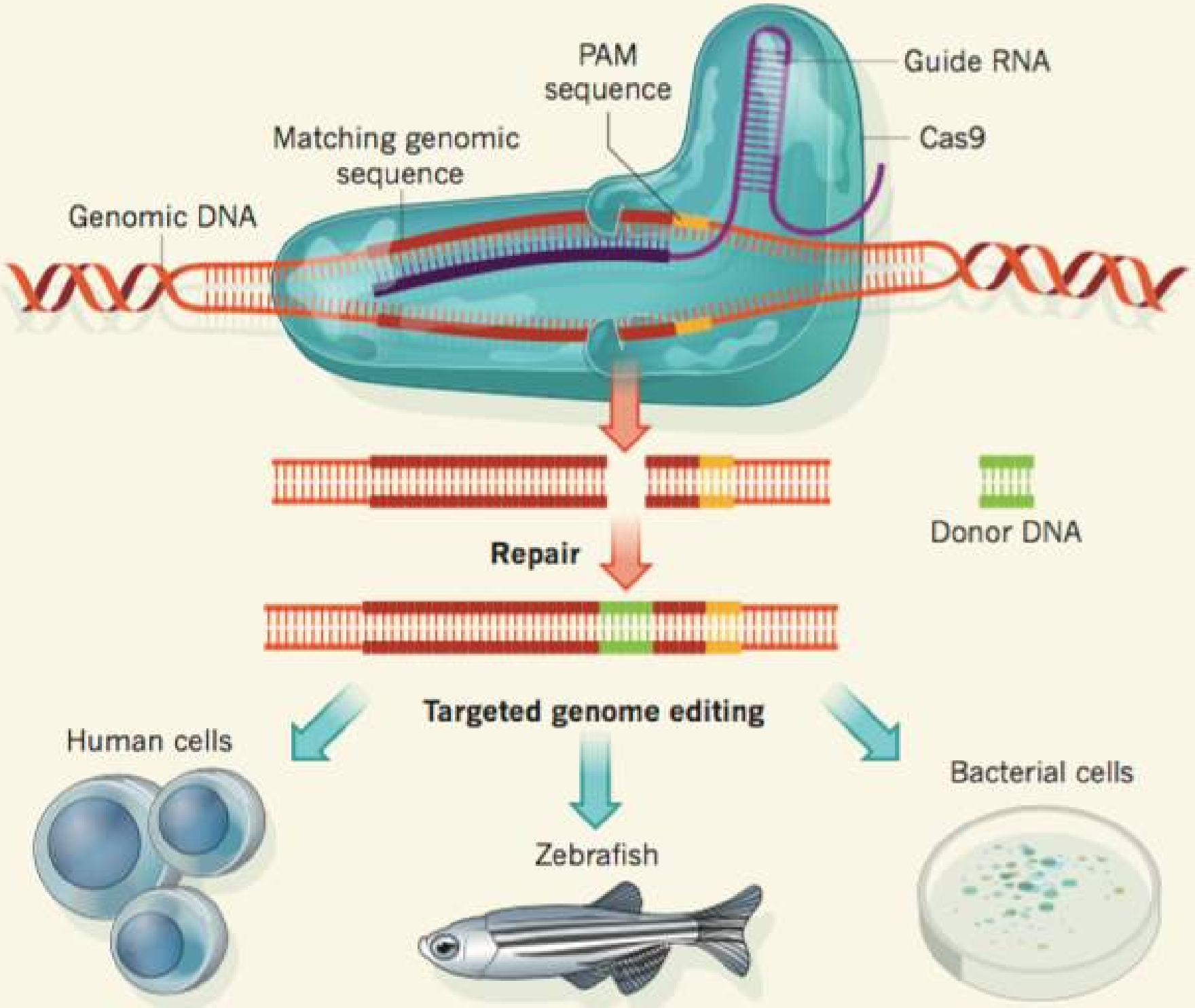


Photo Credit: Nature © Doudna/Charpentier 2013

Multiplex Genome Engineering Using CRISPR/Cas Systems

Le Cong,[1,2]* F. Ann Ran,[1,4]* David Cox,[1,3] Shuailiang Lin,[1,5] Robert Barretto,[6] Naomi Habib,[1] Patrick D. Hsu,[1,4] Xuebing Wu,[7] Wenyan Jiang,[8] Luciano A. Marraffini,[8] Feng Zhang[1]†

Functional elucidation of causal genetic variants and elements requires precise genome editing technologies. The type II prokaryotic CRISPR (clustered regularly interspaced short palindromic repeats)/Cas adaptive immune system has been shown to facilitate RNA-guided site-specific DNA cleavage. We engineered two different type II CRISPR/Cas systems and demonstrate that Cas9 nucleases can be directed by short RNAs to induce precise cleavage at endogenous genomic loci in human and mouse cells. Cas9 can also be converted into a nicking enzyme to facilitate homology-directed repair with minimal mutagenic activity. Lastly, multiple guide sequences can be encoded into a single CRISPR array to enable simultaneous editing of several sites within the mammalian genome, demonstrating easy programmability and wide applicability of the RNA-guided nuclease technology.

Precise and efficient genome-targeting technologies are needed to enable systematic reverse engineering of causal genetic variations by allowing selective perturbation of individual genetic elements. Although genome-editing technologies such as designer zinc fingers (ZFs) (*1–4*), transcription activator–like effectors (TALEs) (*4–10*), and homing meganucleases (*11*) have begun to enable targeted genome modifications, there remains a need for new technologies that are scalable, affordable, and easy to engineer. Here, we report the development of a class of precision genome-engineering tools based on the RNA-guided Cas9 nuclease (*12–14*) from the type II prokaryotic clustered regularly interspaced short palindromic repeats (CRISPR) adaptive immune system (*15–18*).

Photo Credit: STAT News © Catherine Taylor 2015


Photo Credit: K. Vanago © V. Siksnys 2017

CRISPR Patent Licenses

- CRISPR: The Technology & Patent Interference
- Profit & Collaboration In the CRISPR Era
- For-Profit Surrogate Licensors
- Ethical Gatekeeping

NEW YORK LAW SCHOOL

UNITED STATES
SECURITIES AND EXCHANGE COMMISSION
Washington, D.C. 20549

FORM S-1
REGISTRATION STATEMENT
Under
The Securities Act of 1933

EDITAS MEDICINE, INC.
(Exact name of registrant as specified in its charter)

Delaware	**2836**	**46-4097528**
(State or other jurisdiction of incorporation or organization)	**(Primary Standard Industrial Classification Code Number)**	**(I.R.S. Employer Identification No.)**

Editas Medicine, Inc.
Notes to Financial Statements (Continued)

(Information as of September 30, 2015 and for the nine months ended September 30, 2014 and 2015 is unaudited)

with the President and Fellows of Harvard College ("Harvard") and The Broad Institute, Inc. ("Broad") to license certain patent rights owned or co-owned by, or among, Harvard, Massachusetts Institute of Technology, and the Broad (collectively, the "Institutions"). Consideration for the granting of the license included the payment of an upfront license issuance fee of $0.2 million, the issuance of 1,459,988 shares of the Company's common stock, which was equal to 4.2% of the Company's outstanding stock on a fully diluted basis and, the future issuance of shares of common stock to maintain the Institutions' ownership following the third tranche of the

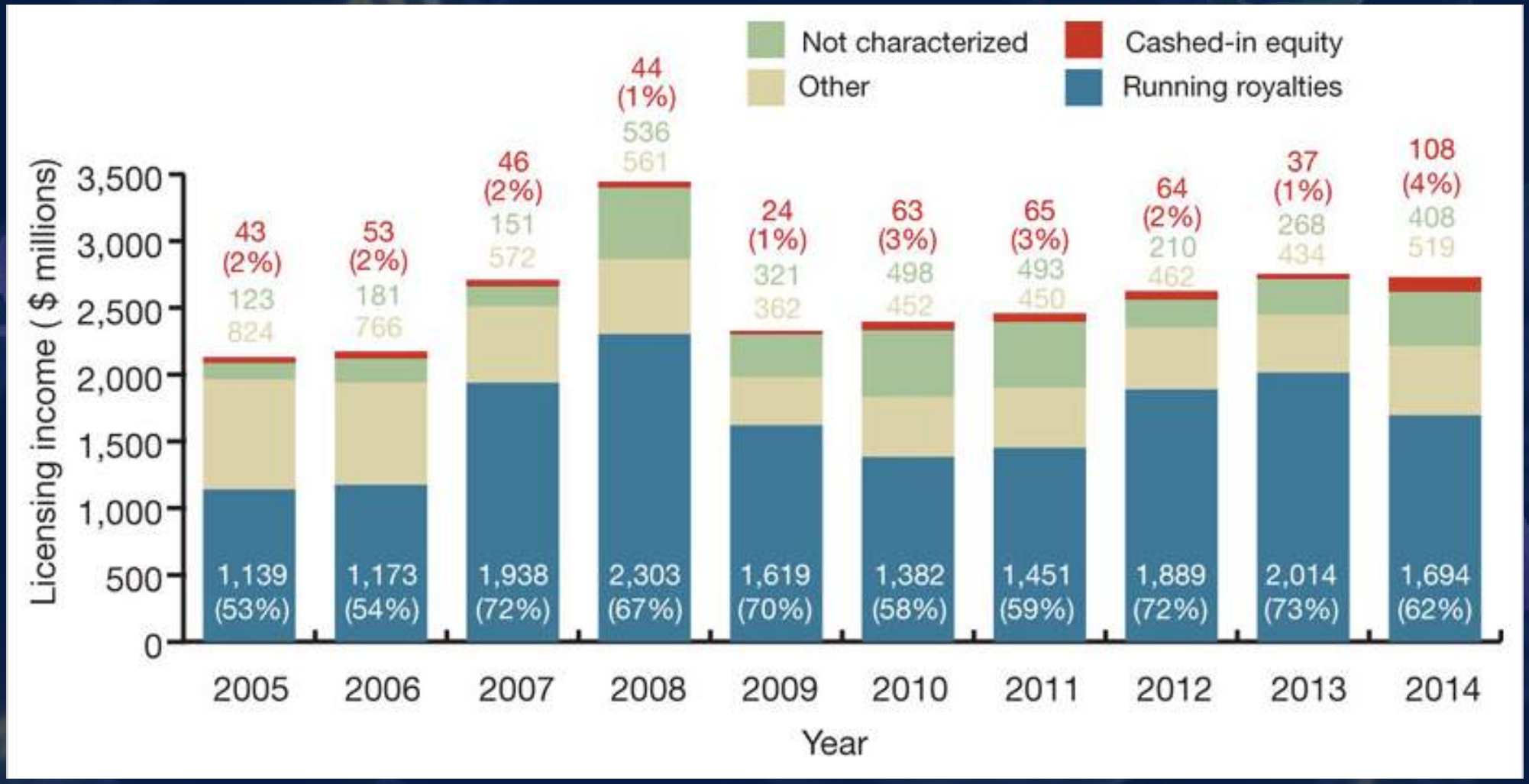


Photo Credit: Nature Biotechnology © Reslinkski & Wu 2016

NEW YORK LAW SCHOOL

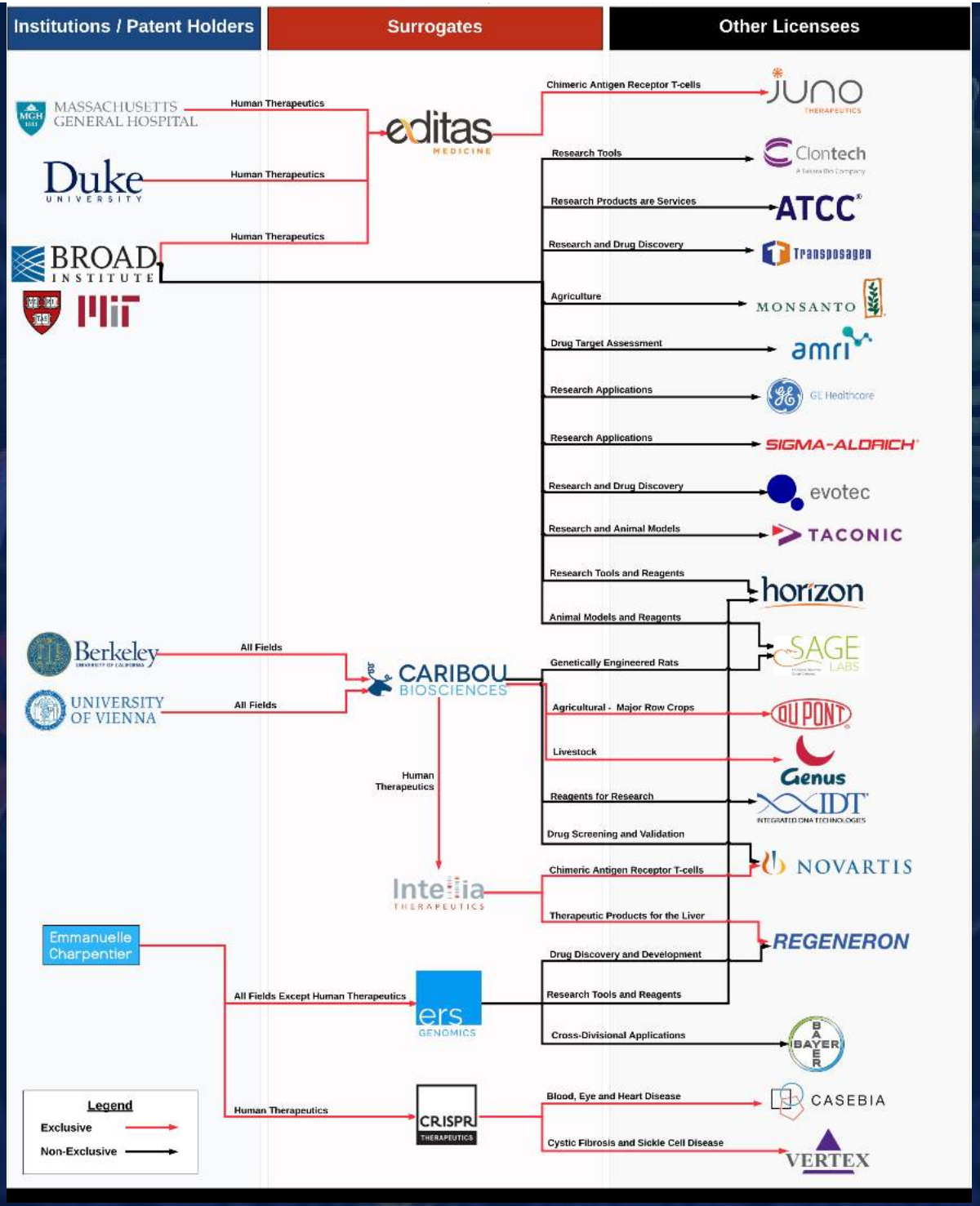
Photo Credit: Science Cloud

NEW YORK LAW SCHOOL

CRISPR Patent Licenses

- CRISPR: The Technology & Patent Interference
- Profit & Collaboration In the CRISPR Era
- For-Profit Surrogate Licensors
- Ethical Gatekeeping

NEW YORK LAW SCHOOL



CRISPR Patent Licenses

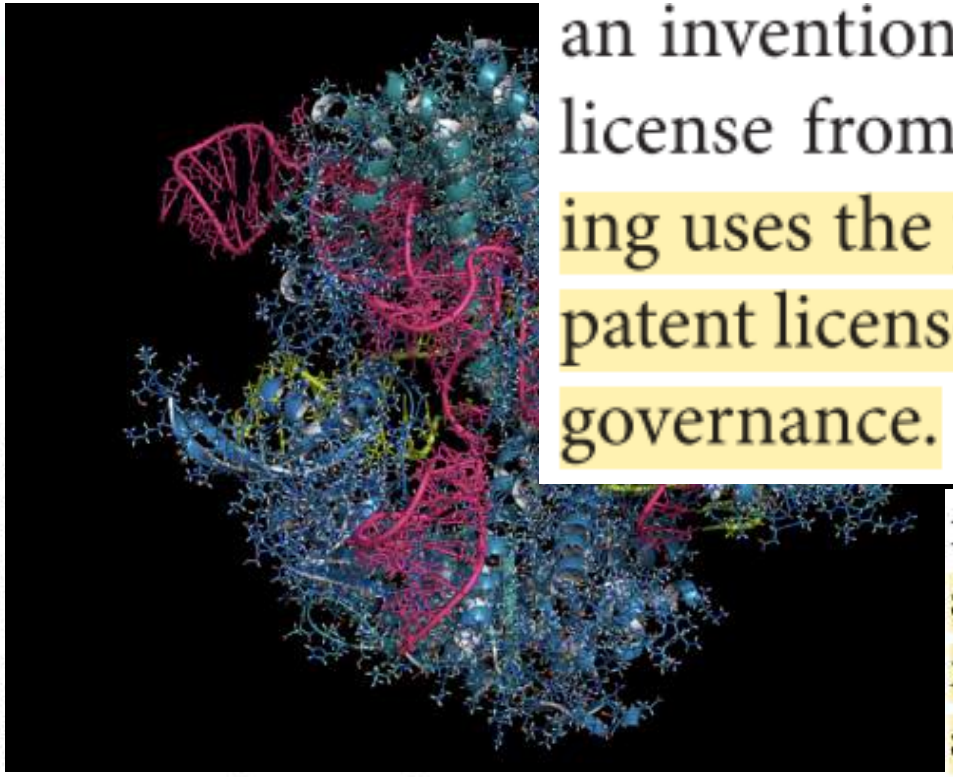
- CRISPR: The Technology & Patent Interference
- Profit & Collaboration In the CRISPR Era
- For-Profit Surrogate Licensors
- Ethical Gatekeeping

NEW YORK LAW SCHOOL

The rise of the ethical license

Christi J Guerrini, Margaret A Curnutte, Jacob S Sherkow & Christopher T Scott

The Broad Institute's recent licensing of its gene editing patent portfolio demonstrates how licenses can be used to restrict controversial applications of emerging technologies while society deliberates their implications.



an invention claimed in the patent without a license from the patent holder. By prohibiting uses the patent holder deems unethical, a patent license can function as a tool of private governance. And because the patent right is

ing and standard setting. First, this private solution is more efficient than formal policy making because it does not require consensus among many stakeholders but only the commitment of a single entity: the patent owner. And because the patent owner is frequently the original developer of the technology, it can be in the best position to anticipate controversial applications. Second, unlike most

NEW YORK LAW SCHOOL

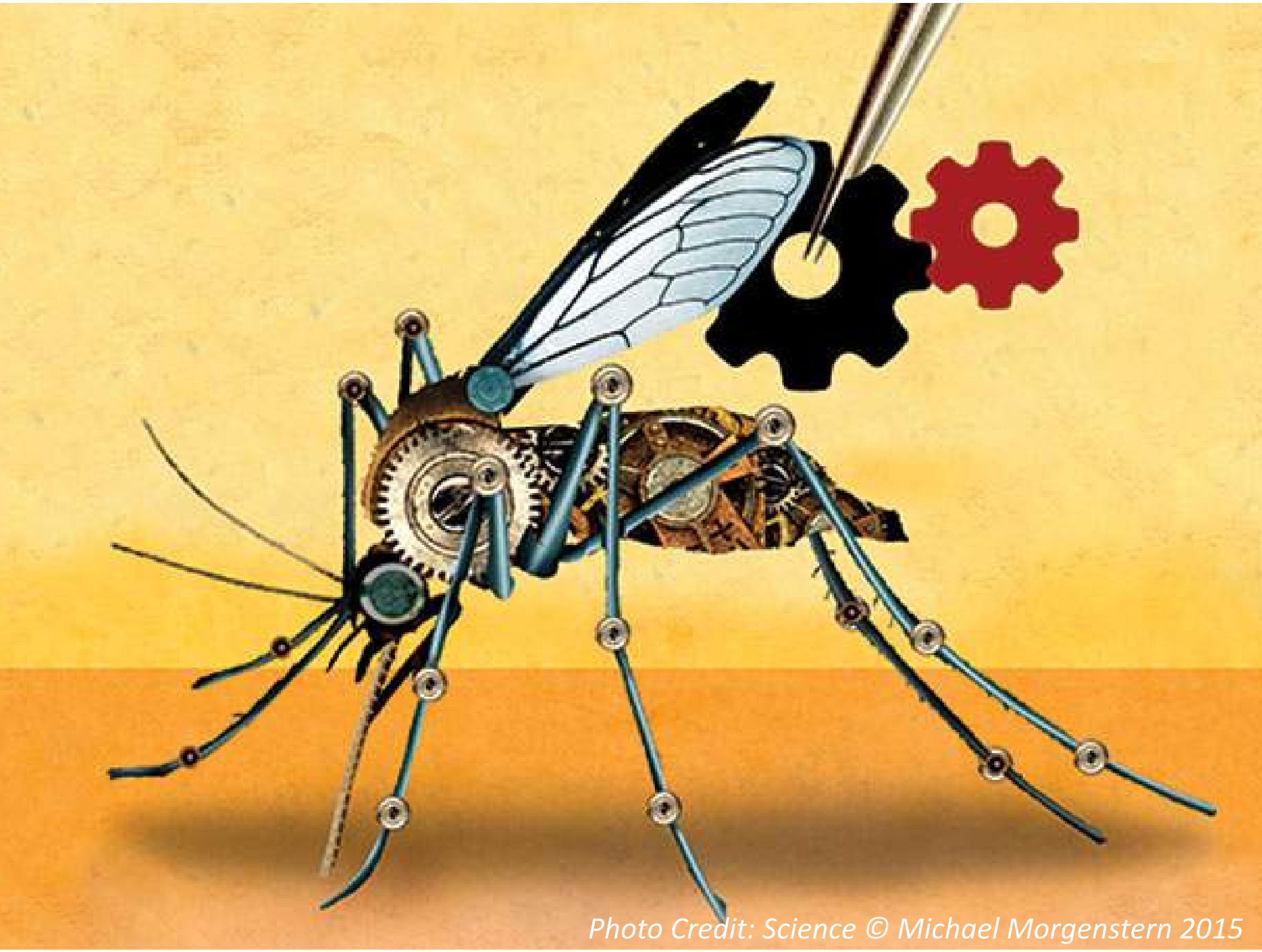


Photo Credit: Science © Michael Morgenstern 2015


NEW YORK
LAW SCHOOL