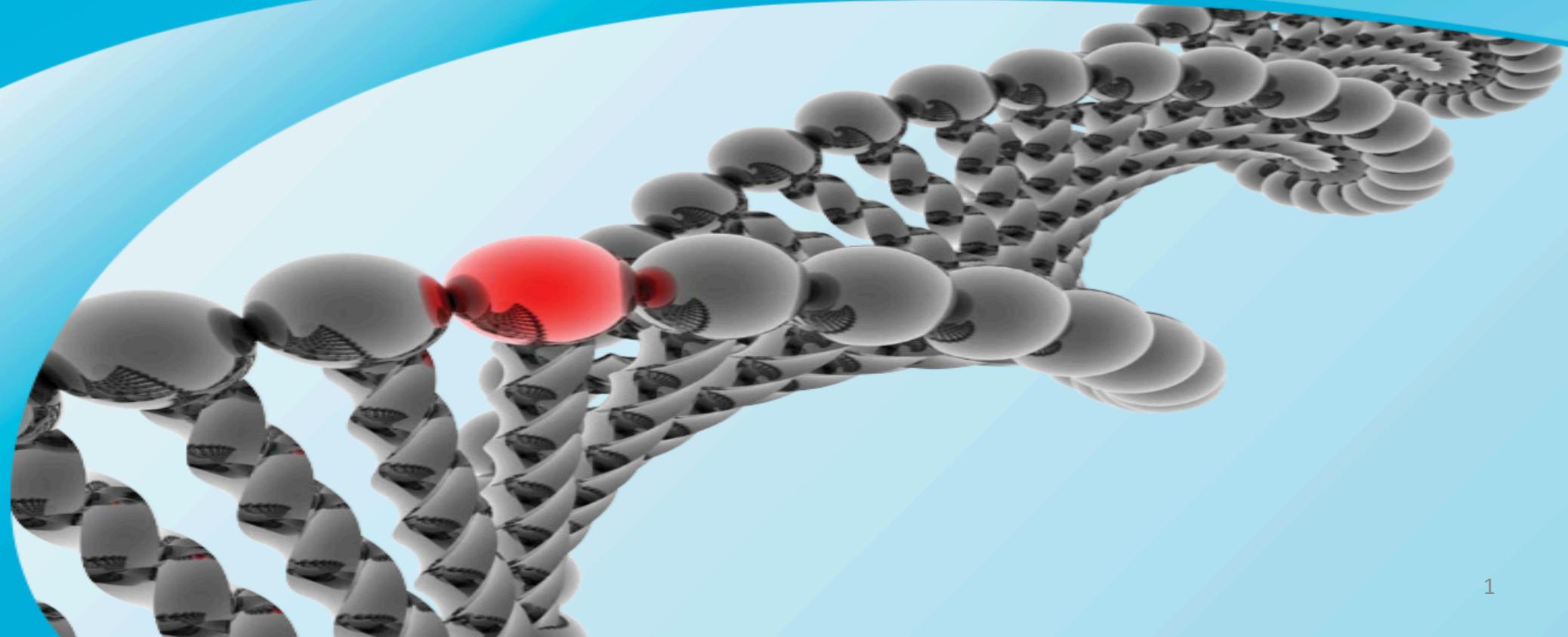
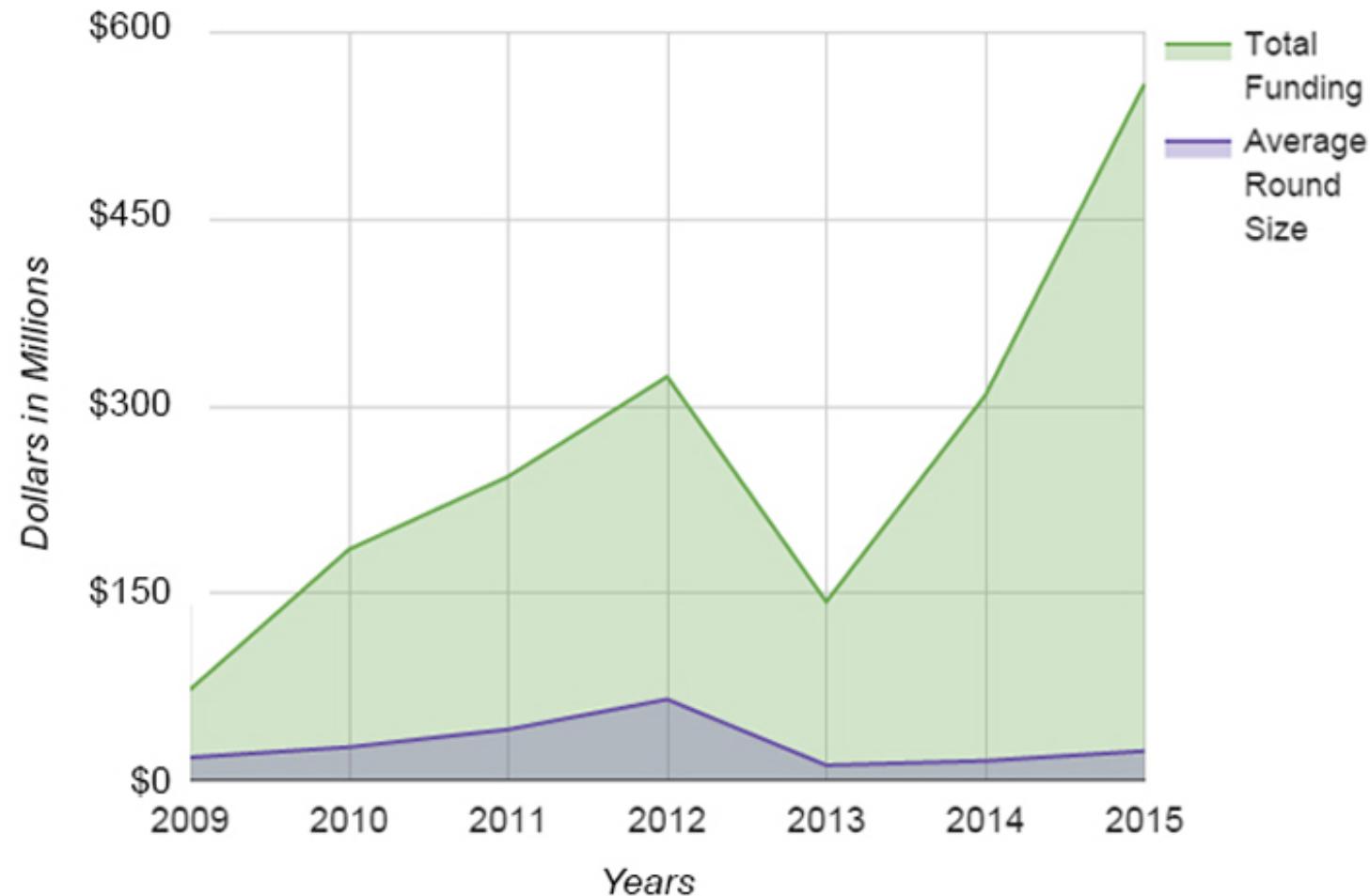


# Synthetic Biology Report

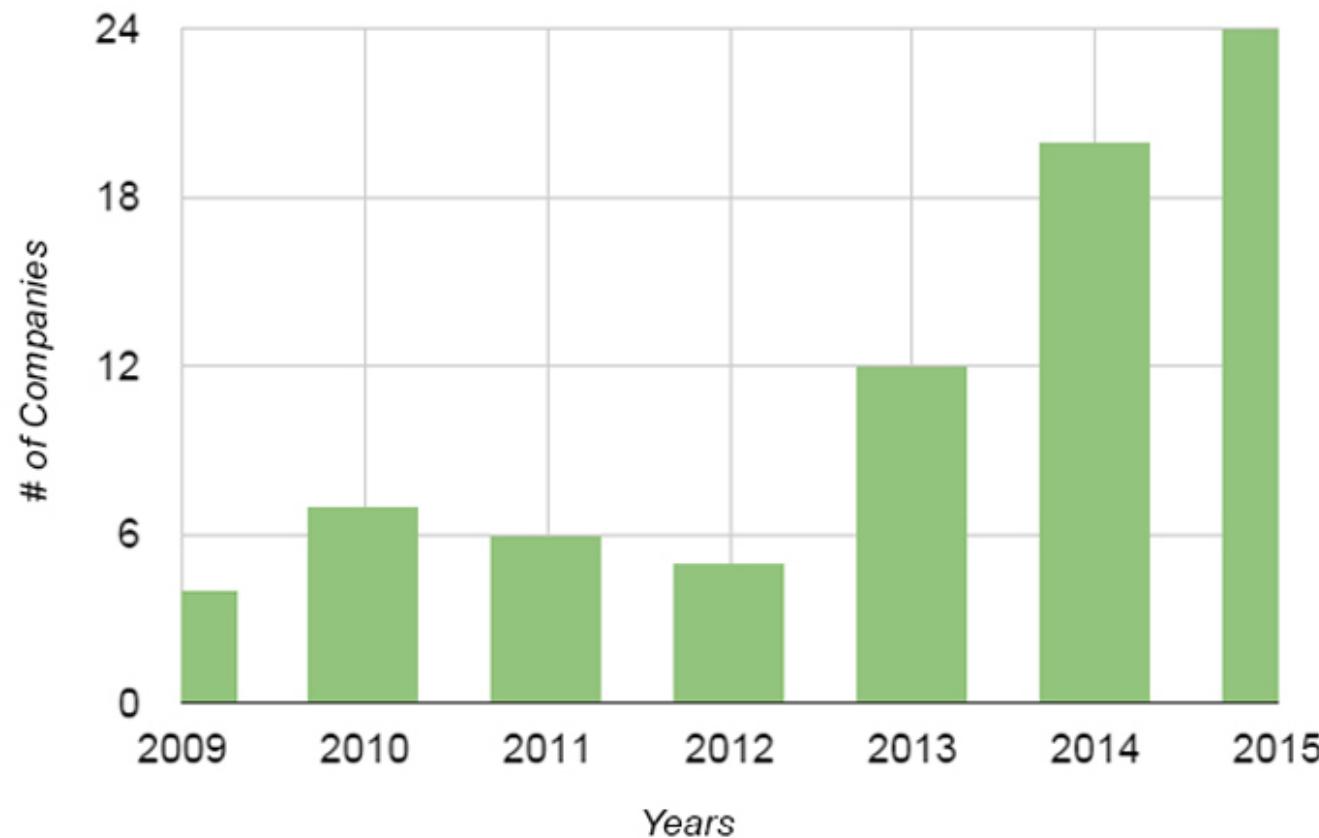
Elkington



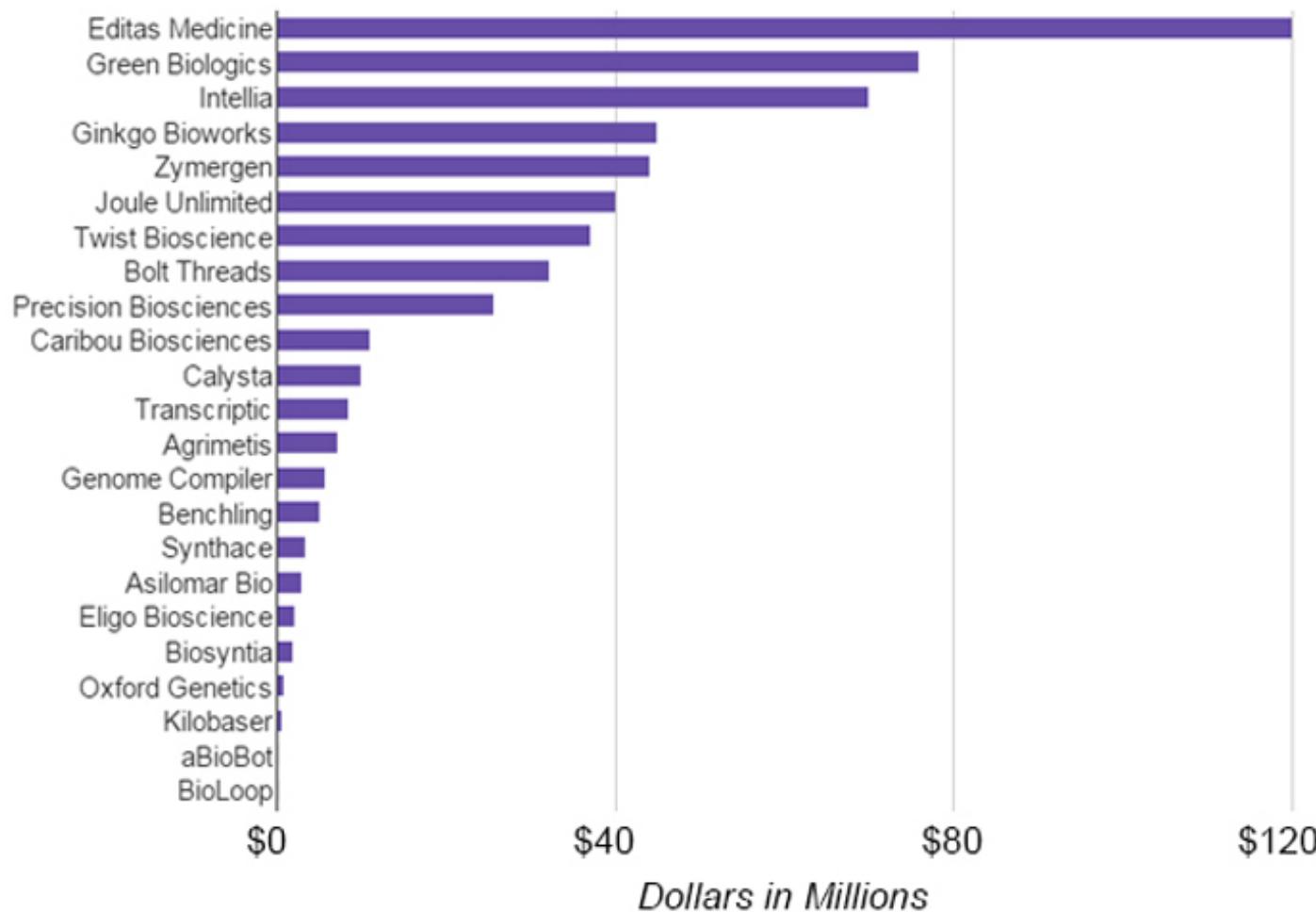
# 2009-2015: Investments in Synthetic Biology Companies



# 2009-2015: Number of Synthetic Biology Companies Funded

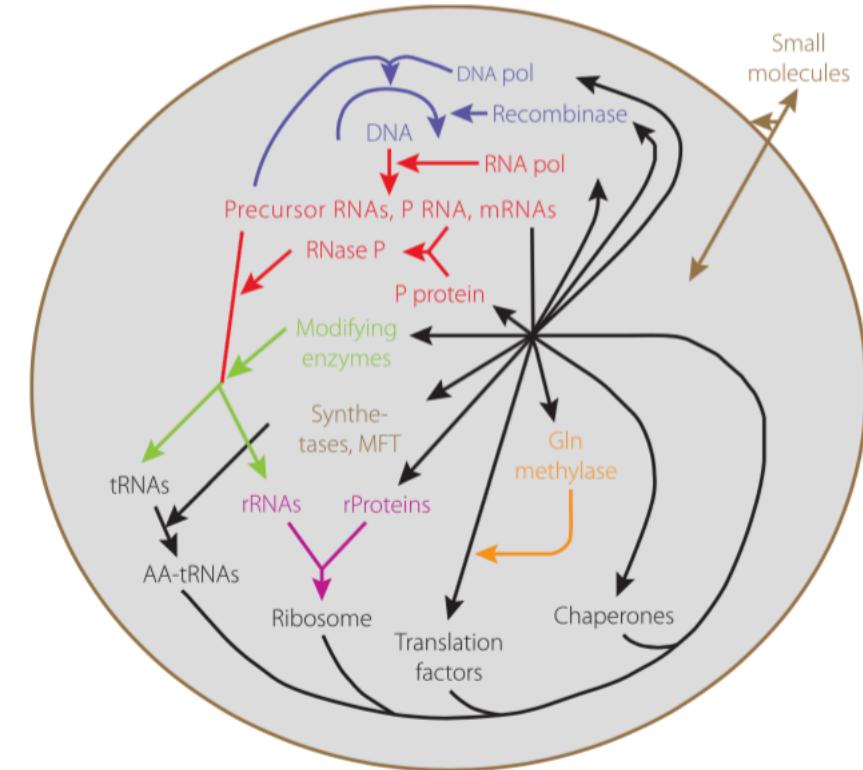


# 2015: Investments in Synthetic Biology Companies



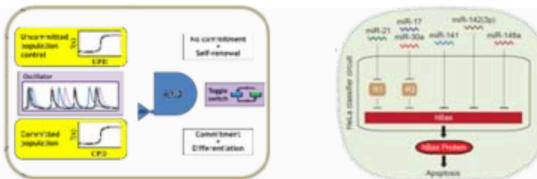
# Current challenges in synthetic biology

- Biology is noisy
- The cell is a complex and non-deterministic machine
- Engineering life requires controls of many dynamic parameters



# The layers needed to engineer biology successfully

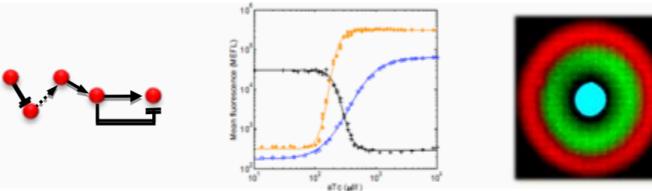
## Applications



## System integration



## Modules

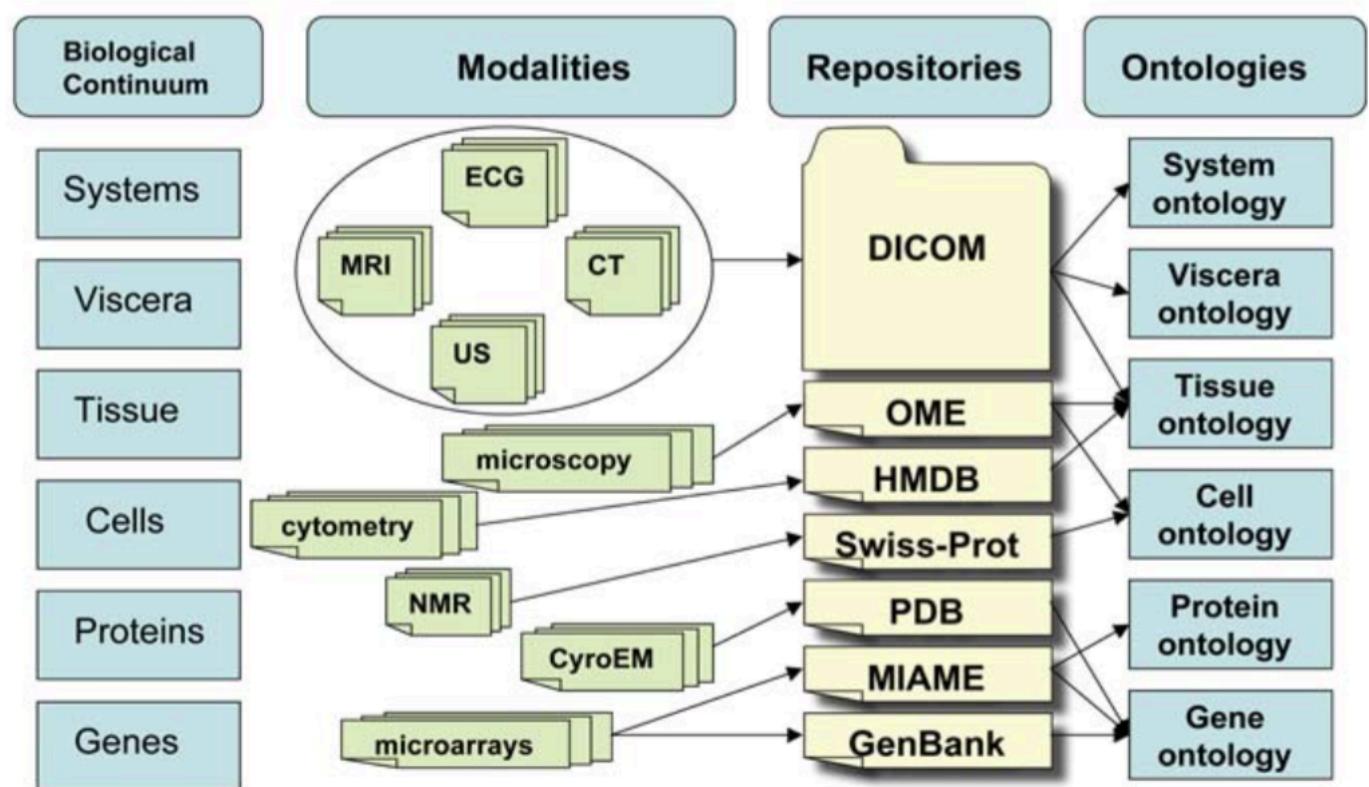


## Genetic parts

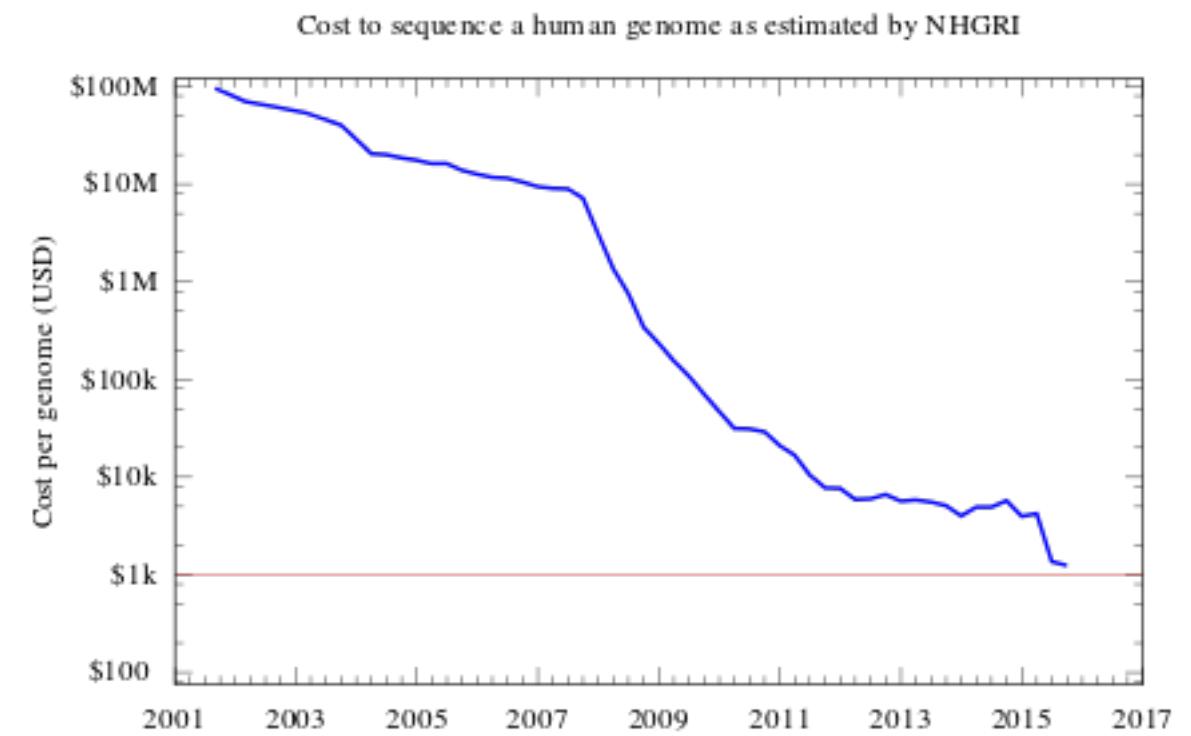
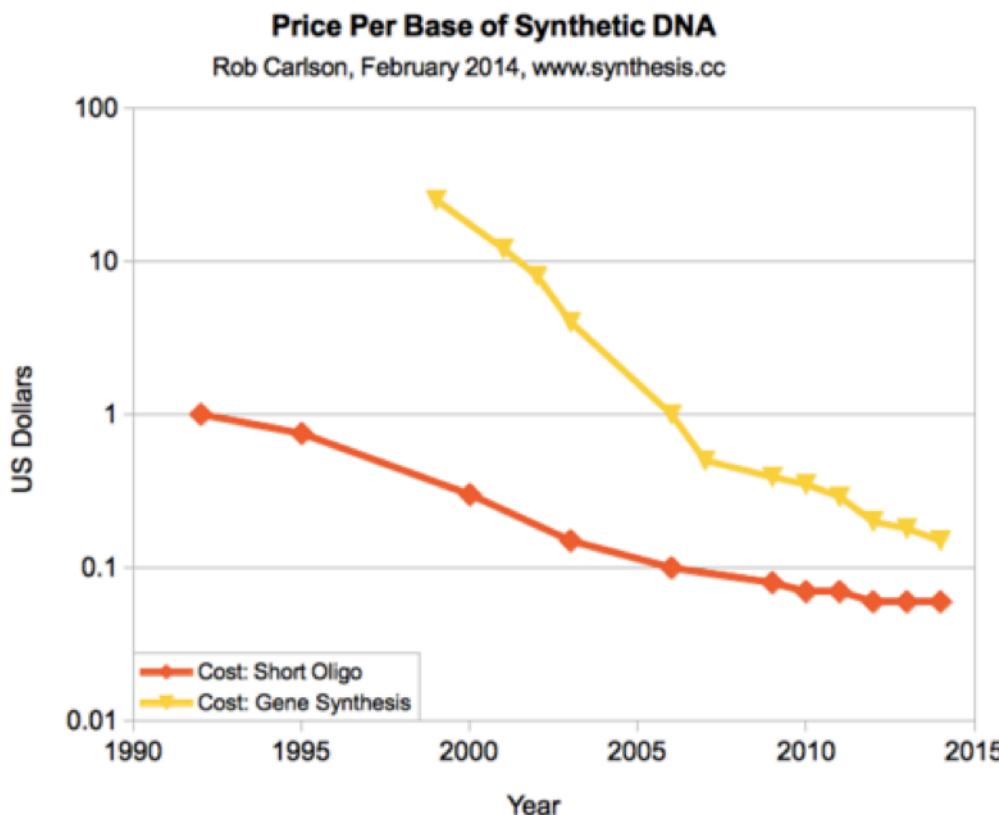


# Example: Standard of Interoperability for Synthetic Biology

- The growth of synthetic biology depends on standards.
- Standards will allow non-experts to interface with biology

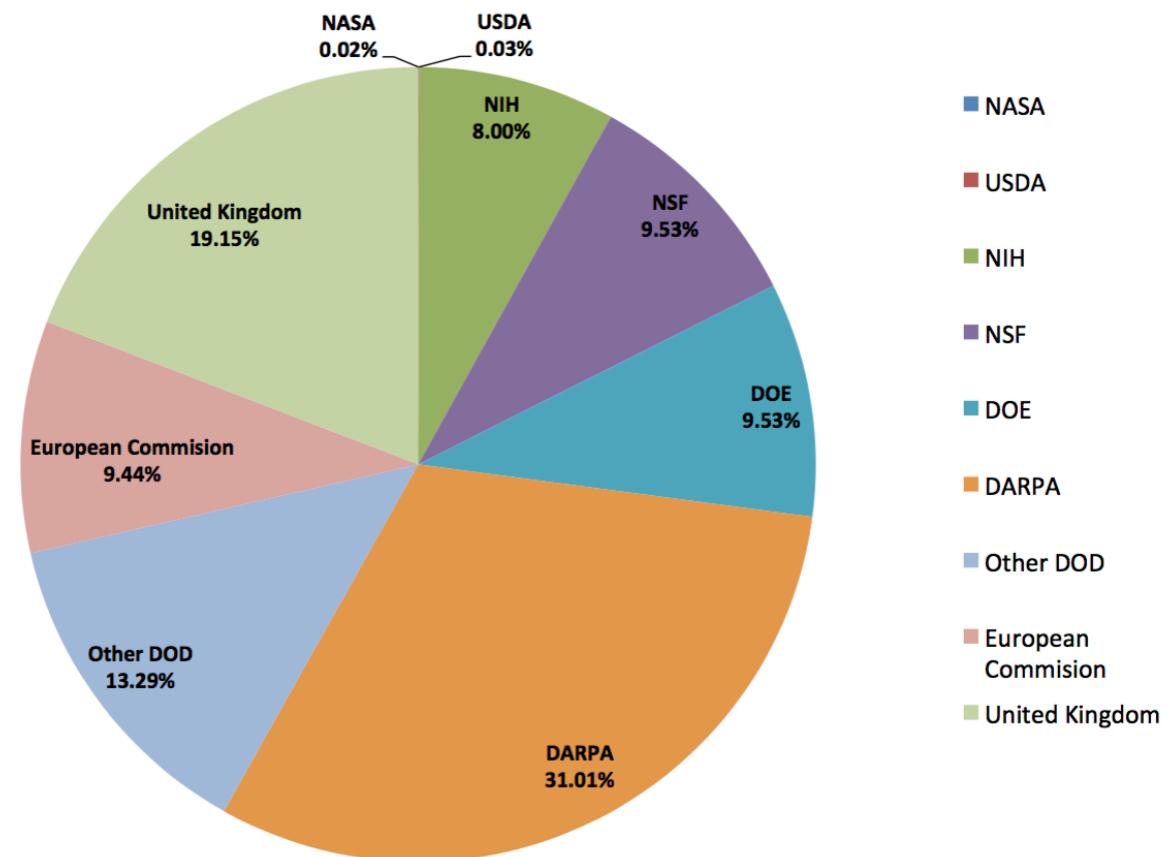


# What's driving advances in synthetic biology

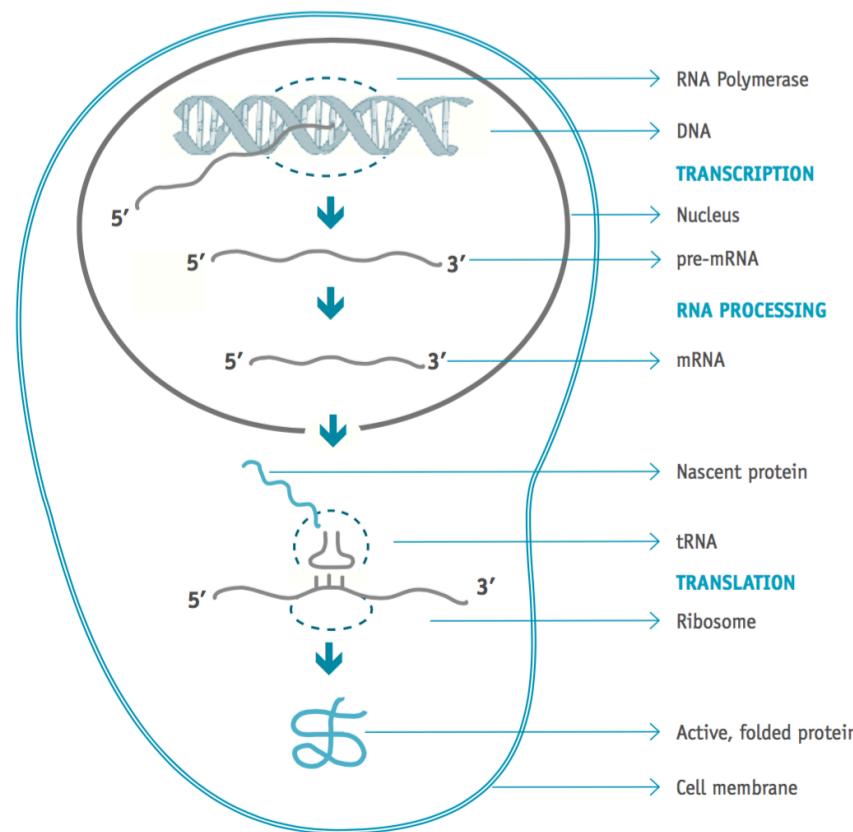


# Who's funding these advances

Total Synthetic Biology  
Funding in 2015

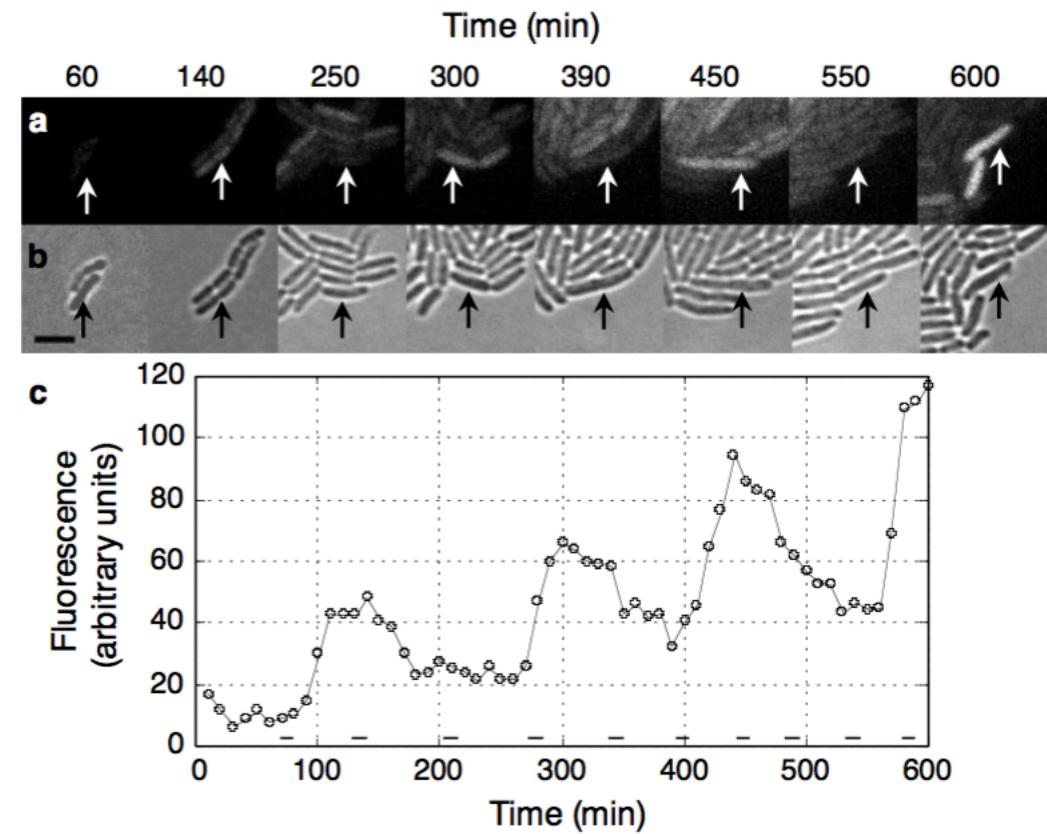
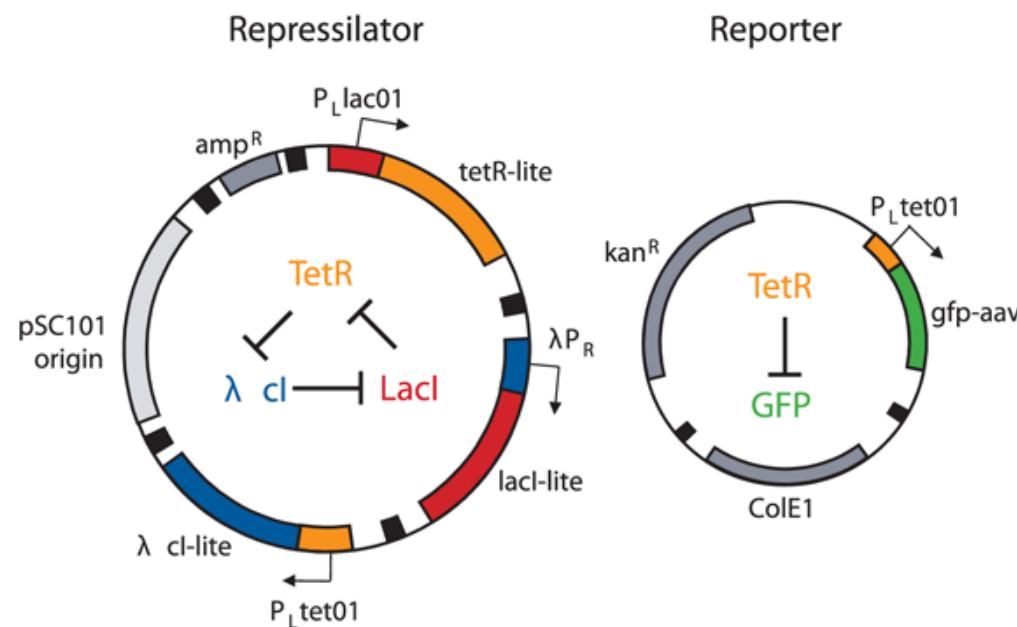


# How these advances allow control of the cell

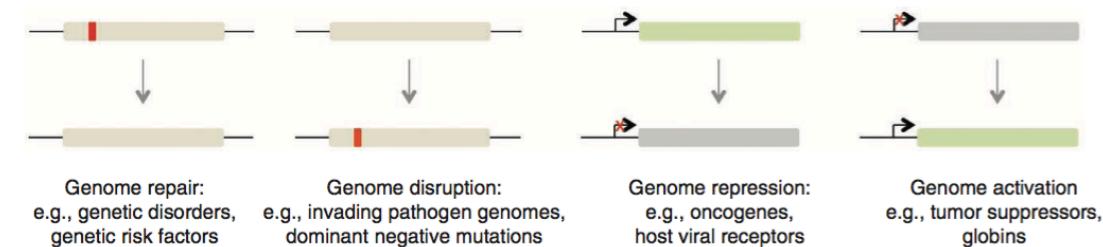
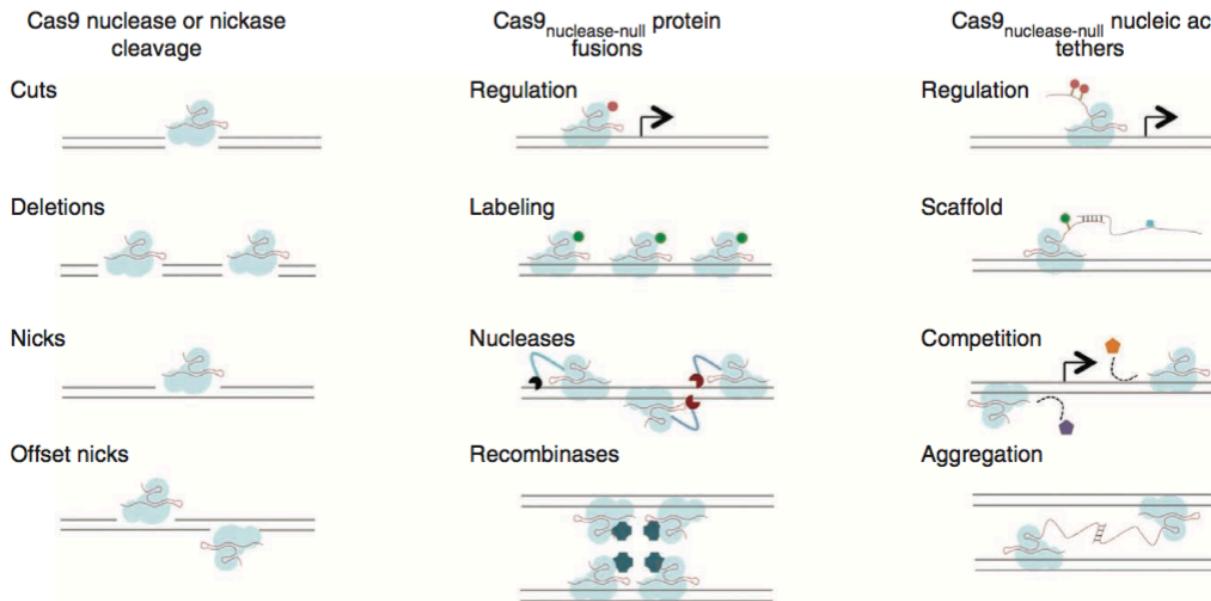


1. Genomics (DNA/RNA)
2. Proteomics
3. 'Omics (measuring other molecules in cells)

# The first example of synthetic biology



# Cas9 has been the next major step in synthetic biology



Key genome-engineering objectives	Potential approaches
Minimize off-target events	Cas9 evolution; cooperativity in effector functions
Maximize HR versus NHEJ in mitotic and postmitotic cells	Coordinate DSBs and DNA editing, e.g., Cas9 recombinases and transposases
Avoid immunogenicity	'Humanize' Cas9 peptide fragments; disrupt trafficking of major histocompatibility complex
Minimize delivery size	Employ small Cas9 orthologs; truncate Cas9

# DIYBio

DIYBio and biohacking  
is a developing market  
of individuals that will  
have a major impact  
on life sciences



# Conclusions

1. Investments in synthetic biology have been increasing over the last 6 years
2. Growth in synthetic biology will rely on development of infrastructure and standards to expand the number of people who can work with biology
3. Funding and fundamental advances are supporting accelerated growth in the synthetic biology market