SOURCES FROM A SYNTHETIC FUTURE
BY SHOHAM DAS

October 15, 2045
Primer on Biotechnology

Introduction: Synthetic Growth - Primer on Biotechnology

The meteoric rise of synthetic biology has mutated all aspects of the global economy. Morgan Stanley is looking to expand financial holdings to industries that are experiencing this change first hand. This primer will serve as an introduction to the complex field of synthetic biology and how companies are navigating this scientific revolution.

Bioeconomy posed to reach 30 trillion dollars as of 2047. 33% of all companies that IPO'd in 2034 were in Biotechnology. In 2034 alone, 180 billion dollars was invested into companies directly involved or utilizing biotechnology in some aspect. Coupled with US Budget forecasts and national biological expenditure growth rate (representing 1.5 trillion dollars of spending over 2028 - 2034 period), we believe the affordability challenges previously experienced in 2020-2025 to shift to more real cost models for companies in the space.

Passage of the DataBank Accessibility and Consent Act (DACA) in March 2032 will reshape international market relationships.
The follow up to the 2010 ratification of the The Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization (the Protocol) has standardized data access to a cost - effective and efficient process. Source country's genetic resources have largely all adopted standardized infrastructure and procedures for researchers and companies to obtain informed consent of digital genetic data for the pursuit and production of biological materials and research. These national level benefit sharing agreements have brought prosperity and new found wealth to otherwise impoverished countries such as the Nike Jordan's x Senegalese Jumping Spider collaboration. Genetic data now maintains a label for a scarce, but extremely valuable commodity that we believe can be captured by quick moving individuals looking for global partnerships with overseas institutions.

Private-Public partnerships instrumental in deploying capital and key driver in research to market pipeline.
BioHubs are scientific campuses that provide shared instrumentation and machinery for all partnering companies, academic researchers, potentially skilled workers, and the general public. BioHubs typically expand any partner company's bio-manufacturing production capacity with a wide range of support for bio products including but not limited to biomaterials, bioindustrial manufacturing, biologic drugs, and genetically recoded organisms. Collaborations across BioHubs create a network of unique deep science and technical expertise in addition to a skilled workforce at all levels that companies are able to tap into. We believe future investments in this industry will cluster around pockets of Bio-Hub partnerships. Government funding and grants help companies reduce risk in pursuing uncharted scientific territory, greatly reducing total investor capital required for R&D.

Public perception of genetically recoded organisms has been positive, leading to strong market acceptance of products derived from engineered organisms.
We have found the general public to be much more tolerant to GRO's than previous cultural clashes such as the introduction of GMO's in the late 90's to early 2000's. Scientific literacy has increased year after year since the 2019 Covid Pandemic and the 2027 RSV Pandemic. Government efforts in educational campaigns and a more knowledgeable public has led to an increased trust in scientific institutions and scientific communicators. The broad scope of GRO's in consumer industries such as clothing and apparel, home appliances, cosmetics, fragrances and haircare, among others have shown there are plenty of new market opportunities for founders to pursue.

Precision products and services established a foothold in key supply chain forces and will trigger a shift to personalized products in public and private markets.
Products and services tailored to the genetic makeup of individuals have already disrupted the skincare and healthcare industry. Relevant supply chain forces have adapted to shifting specifications in order to handle inputted biological data from even a single customer. These refactors have led to increased visibility of market trends minimizing risk from investors on untested and novel GRO products. Incumbents are already incorporating some level of personalized bio-data aspects into existing offerings.

Monumental changes to market forces in producing high quality synthetic DNA.
The exponential decrease in price of pooled oligonucleotide synthesis into error-free DNA has radically changed the capabilities of the typical genome engineer. Individuals across the world can now engineer thousands of proteins necessary for precise, top-down, high throughput genome modification entirely remotely. This freedom of creation and design has lowered the barrier of entry for non-traditional and diverse founders leading to an explosion in the variety of global market goods and services.

Biological Technician

Kansas City BioHub, MO /
Engineering - Manufacturing - Technician /
Full Time / On-site

Job Description:

We are seeking a skilled and dedicated Biological Operations Technician to join our production team at our bioprocessing facility at the Kansas City BioHub. This talented individual will be assisting across a variety of P&G products ranging from life critical bio-sensors to custom living designer furniture. The ideal candidate will have experience in a bio-based manufacturing or industrial setting and be familiar with interacting with autonomous and protocol driven IDMO's (Integrated Development and Manufacturing Organization). They will be leveraging their technology, software, automation, and instrumentation acumen in building and designing state-of-the-art manufacturing protocols. We are looking for a highly motivated and creative individual who is not afraid to think outside of the box.

Responsibilities:

- Registration and procurement of cell lines from the National Master Cell Bank Registry.
- Assist customer service with using our proprietary AI target identification software to service client orders
- Perform QC on cell cultures harvested from the 10,000 sq ft Biohub Takeda bioreactors facility
- Monitor and report performance of customer hierarchical assembly of engineered cell cultures.
- Coordinate with auditors at the BioProducts Regulatory Experts Commission to navigate requirements for the FDA, EPA, USDA, and GOB.
- Troubleshoot autonomous Hamilton liquid handlers, cell therapy cellular shuttles, and multi-level organoid incubators
- Assist AI project leads developing hypotheses in cutting-edge cell free expression systems.
- Help with validation and freezing of data storage on GPWrite DNA disks
- Work efficiently and safely alongside your managers, teammates, and AI coworkers.

Preferred Experience:

- Prior relevant experience with molecular biology protocols (next generation sequencing, bacteria culturing, DNA modification, gene synthesis, genome engineering, DNA amplification)
- Prior relevant experience troubleshooting autonomous robotic systems hardware and software
- Familiarity with software frameworks and methodologies (Rust, Unix)
- Prior demonstrated work in FMEA and risk analysis

Qualifications:

- Any option below is acceptable for this position:
    - Associate's degree (2 years) or higher in bio-automation, genome engineering, biomedical engineering, synthetic biology; or equivalent work experience
    - Bio-mechanical certification from BioMade partnered community colleges
    - Equivalent coursework for Genome Engineering under the USDA BioTechnology Apprenticeship and Learning Program.
- Note: Candidates might not fit the entire list of Preferred Experience; however, we are dedicated to training and investing in the right candidates for this role.

To learn more about Procter and Gamble, visit www.procterandgamble.bio or check out our press below:

- **P&G doubling down on synthetic organisms in all product manufacturing (Forbes)**
- **P&G CEO on pushing AI into R&D development: "It's our edge" (CNBC)**
- **Longtime Industrial Veteran P&G on its whopping 20B investment into development of "Factory of the Future" (Wall Street Journal)**
- **Aquisition of Genome Designer Firm, Genesis, Bumps P&G Stock (Yahoo Finance)**

DEPUTY SECRETARY OF DEFENSE
1010 DEFENSE PENTAGON
WASHINGTON, D.C. 20301-1010

Following the completion of the NYU Langone Dark Matter Project, the global biotechnology community has discovered that a massive amount of decoding machinery present in cells can be entirely removed. These compressed organisms are now referred to as genetically recoded organisms (GRO). These cell lines contain remarkable properties such as natural viral immunity and heightened visibility and modification. Additionally, the SC4.0 consortium has progressed rapidly with members from academia and industry contributing minimal scaffolding chromosomes. This data of collated quasi-essential genes is entirely open to the public. With this, we are nearing completion of the world's first synthetic eukaryotic genome. Debugging and testing cell viability within synthetic genomes has never been as seamless as it is now. The implications of such genome assembly technology cannot be understated.

The United States of America stands at a pivotal moment in biodefense as it faces an unprecedented number of emergent and disruptive technologies in the synthetic biological space enabled by GROs. Accelerated development of genetic technologies has created a scientific renaissance in genomic engineering globally, ushering in a new era of biological machinery never before seen in human history. However, after the Musk Foundation's Chinook salmon incident where ineffective genetic circuitry contaminated thousands of native species in the Great Lakes ecosystem, administration moved to form the National Genomic BioDefense Implementation Plan. The Presidential Administration laid out a plan for a world free of potential cataclysmic biological incidents pertaining to the release of unregistered and unseen genetic elements into our public space. In support of this strategic implementation, the Department of Defense (DOD) has been tasked with operating in this new synthetic landscape and supporting national interests at home and abroad.

As a part of UN Biodefense Protocol, there has been continued joint coordination with the Russian Federal Research Programme for Genetic Technologies to create a multi national database of genetic circuit designs. This database provides metabolic data, clinical data, genome-wide association study data, chromatin immunoprecipitation sequencing data and chromatin three-dimensional structural data collected by the World Committee on Genomic Design (WCGD). Participating member nations have followed strict protocols in annotating unexplored genomic sequences and registering genomic blueprints to the World Genomic Database (WGD) archives. Significant strides have been made in registering sequences of concern and raising potential flags to global auditing agencies. No biological contamination across national borders have been detected as of yet despite worldly adoption of pathogen terminating gene drive technology.

Regulatory uncertainty has caused confusion leading to unsafe practices for industrial applications of GROs. The recent addendums to the 2017 U.S. Coordinated Framework for Biotechnology Products by the EPA, FDA, and USDA and the 2028 establishment of the Genetics Oversight Bureau (GOB) has alleviated many of the blockers around agency jurisdiction that companies face prior to market entry. GOB positions regulatory staff at BioHub campuses which connect companies developing emerging technologies with agents who can help them navigate mandated legal requirements. By acting as a single regulatory process entry point, GOB can both save time and resources for industrial partners and ensure safety and good communication with the American public.

In this report, the DOD will highlight key initiatives to build and maintain a healthy bio-defense ecosystem. The DOD along with its counterparts across the WCGD will continue to act boldly to meet the challenges and demands set by this new coming era of Synthetic Biology.

Transcription!

From Wikipedia, the free encyclopedia

This article is about the film. For the soundtrack, see Transcription! (soundtrack).

Transcription! is a 2038 American animated action comedy film written by Mark Smith. The film premiered on August 12, 2038 and was released theatrically three days later. It received generally favorable reviews from critics, who praised the simple to understand world building of complex biological concepts. The voice performances were also praised, however critics noted the story to be extremely contrived and filled with obvious plot points and stereotypes. The film was a relative commercial success, grossing $100 million worldwide against a $70 million budget. Pixar studios is following the movie with an animated television series.

Plot [edit]

Raffy is an anthropomorphic release factor protein (RF1) living in Celltopia, a bustling *E.Coli* city where all cellular components live and work together harmoniously. Raffy works in a ribosome where he promotes the hydrolysis of peptidyl-tRNA during the translation termination which is depicted as an office job in an American corporate setting similar to early 2000's Silicon Valley tech companies. His manager Gerry (GTPase RF3) is constantly reprimanding Raffy for his ineffectiveness at completing his work on time. Raffy is unable to pay attention to his work and consistently drifts off, imagining himself being a hero to the city. He looks and acts differently than his coworkers leading to him feeling isolated and left out. His only friend is Tammy, a peppy and wise cracking tRNA, who provides metaphors and timely puns throughout their interactions with Celltopia. One day while pursuing old boxes at his parents attic, he discovers a medical record detailing a unique genetic modification that prevents him from recognizing the UAG stop codon resulting in a badly functioning ribosome. Although his parents and Tammy try to reassure Raffy about his unique qualities and beliefs about his special purpose in the cell, Raffy attempts to chaperone away from Celltopia via the signal peptide train. However at his stop in the ER, he finds Tammy who is being accosted by the Bacto gang (a group of bacteriophages). He barely manages to escape with Tammy and finds that Celltopia has violently changed. The Bacto gang has hijacked cellular machinery, making them produce more and more virus components for export and toxic manipulation. Businesses are forced to either cooperate or be permanently turned if they resist the strong arm of Phage, the leader and biggest of the crew. Celltopia's way of life has changed and the entire cell has become slow and inefficient. While investigating the Bacto gang HQ, Tammy discovers that Phage plans on lysing the cell, fully destroying all inhabitants of Celltopia and shuttling Bacto gang to the next city. Raffy and Tammy want to help but none of the others believe him due to his differences. Together with a rag tag group of supportive cellular components, Raffy begins to transcribe, effectively stopping

the production of viruses. As more and more of the community begins to see Raffy's immunity and bravery, they rally behind him and take on the Bacto Gang. After a chase through the city detailing the different mechanisms of a cell, Raffy and his team manage to defeat Phage and restore peace back to Celltopia. With the Bacto gang neutralized, Raffy is celebrated as a hero and finds the acceptance and belonging that he and all other cellular machinery deserve. Phage and other members of the Bacto gang also find peace within Celltopia and their genetic material has been developed in such a way to help clean and work with the city. As a prophage, Celltopia welcomes Phage and his gang to continue living harmoniously with the rest of the community.