

2021-06-09

Global biotech startup: the K2B story

J. Kim. 2021. "Global Biotech Startup: The K2B Story."

<https://hdl.handle.net/2144/44233>

"Downloaded from OpenBU. Boston University's institutional repository."

해외창업 성공사례 "The K2B Story"

GRaND-K 창업학교

June 9, 2021

김종성 Jay S. Kim, Ph.D.
Boston University
Questrom School of Business
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Visiting Scientist @ KIST





Disclaimer

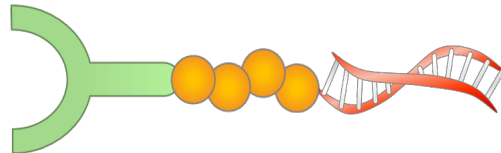
K2B Therapeutics 는
일단 창업하는데는
성공하였습니다

K2B Therapeutics 가
성공적인 창업인지는
아직 모릅니다

혁신신약개발 스타트업, K2B를 소개합니다

Introducing K2B Therapeutics

“Pre-clinical stage therapeutics discovery startup
to commercialize a game-changing protein-RNA conjugate technology in the immuno-oncology space,
now with \$2 million seed funding closed, **looking forward to joining the LabCentral community**”



V.5.2. June 9, 2021

For more information, contact jkimjr@k2btx.com

대한민국 최고의 바이오연구기관 KIST의 기술을
글로벌 바이오혁신 허브 보스턴에서 사업화합니다

To Commercialize **Korea's** Breakthrough Science
in the Global Biotech Innovation Hub **Boston**

"incorporated in Dec 2020 as Delaware C-Corp"



Breakthrough science from
Korea's leading science &
technology institute



Game-changing therapeutic
products developed in the global
biotech innovation epicenter



KIST의 과학기술과 보스턴의 창업역량을 연결하는 창업팀
The K2B Founders
"Cross-disciplinary and Cross-border Team"

KIST: Globally renowned scientists in multiple biomedical fronts



Ick-Chan Kwon,
Ph.D.
SAB
Drug Delivery
Currently DFCI



In-San Kim,
MD, Ph.D.
Clinical Biology
& Oncology



Yoo-Soo Yang,
Ph.D.
Membrane
Biology

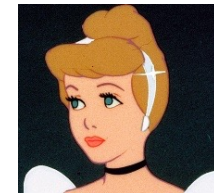


Sun-Hwa Kim,
Ph.D.
Gene & Cell
Therapy

Boston: Scientific entrepreneurs with global reach and experiences



HoWon Kim,
Ph.D.
CSO
Cell Therapy



Cinderella,
Ph.D.
SAB
Founding CEO,
DreamBiotech



Hi-Kyu Lee,
Ph.D.
COO
Founding CEO,
Softlinx



Jay S. Kim,
Ph.D.
CEO
Professor of
Management
BU



Why Boston?





Boston Bio Innovation Ecosystem

Known Secrets and Hidden Secrets

1. The News - “Global #1 Bio Cluster”
2. Questions from around the world
3. Elementary Studies – **Known Secrets**
4. Best Practice Studies – **Hidden Secrets**
5. Theories of Bio Innovation – Entrepreneurs & Ecosystem
6. **What will I do differently?**

The News

Boston is now Global #1 Biopharma Cluster



		NIH Funding	VC Funding	Patents	Lab Space (mil sq ft)	No. Bio Jobs
1	Boston/ Cambridge	\$519 million	\$2.0 billion	5,634	16.77	82,075
2	San Francisco Bay Area	\$230 million	\$2.7 billion	9,559	16.36	63,158
3	New York / New Jersey	\$366 million	\$0.3 billion	3,522	14.19	127,651
4	Maryland / DC Metro	\$221 million	\$0.3 billion	3,959	9.5	38,189

*Source: <http://www.genengnews.com/the-lists/top-10-us-biopharma-clusters/77900646> (May 2016)

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Continuing News

Global #1 Biopharma Cluster Is Accelerating



		NIH Funding	VC Funding	Patents	Lab Space (mil sq ft)	No. Bio Jobs
2016	Boston/ Cambridge	\$519 million	\$2.0 billion	5,634	16.8	82,075
2017	Boston/ Cambridge	\$1.06 billion	\$3.1 billion	6,496	19.9	86,235
2018	Boston/ Cambridge	\$2.46 billion	\$6.2 billion	7,565	26.8	90,566

*Source:

<http://www.genengnews.com/the-lists/top-10-us-biopharma-clusters/77900646> (May 2016)

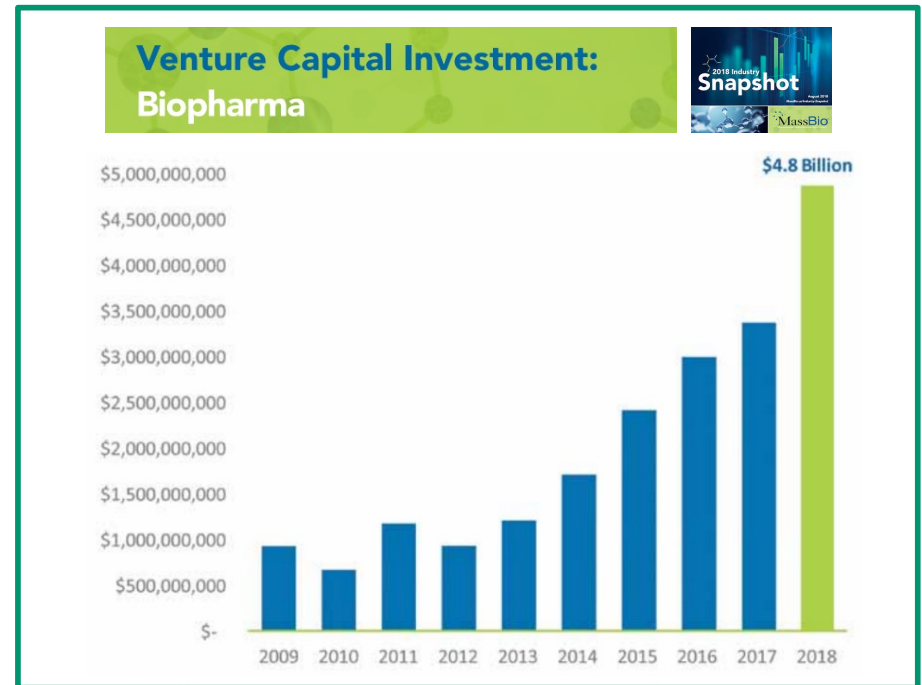
<https://www.genengnews.com/lists/top-10-u-s-biopharma-clusters-5/> (June 2017)

<https://www.genengnews.com/lists/top-10-u-s-biopharma-clusters-6/> (September 2018)



The Boston Phenomenon

“Attracted by burgeoning biotech startups around Kendall Square, global pharmaceuticals move into the crowded space.”



Questions from around the world

How did Boston build such a flourishing bio innovation ecosystem?

How can we build one in our country?
In our city?



Known
Secret
#1

Mass Governor Deval Patrick (2007-15)

May 8, 2007, BIO International Convention

“There is no place in the world with as much talent in life sciences and biotech as here in Massachusetts.

Now is the time for us to invest in that talent and bring together the resources of our unparalleled research universities, teaching hospitals, and industry to work toward a common goal, to grow ideas into products, to create cures and jobs.”



10 years

\$1 billion

MASSACHUSETTS
LIFE SCIENCES CENTER

 **MassBio**
MASSACHUSETTS BIOTECHNOLOGY COUNCIL



Known
Secret
#2



Since 1782



Known
Secret
#3

MIT

Massachusetts Institute of Technology

President Susan Hockfield
(2004-12)



KOCH INSTITUTE
for Integrative Cancer Research at MIT

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The Elements

“Five Essential Elements for Growing Biotechnology Cluster”

1

Abundance of high quality, adequately funded academic research

2

Ready resource of seasoned and experienced biotechnology entrepreneurs

3

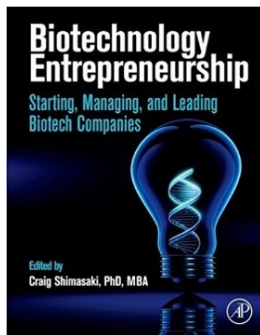
Ready access to high-risk, early development-stage capital willing to fund startup concepts

4

Adequate supply of technically skilled workforce experienced in biotechnology industry

5

Availability of dedicated wet-laboratory and specialized facilities at affordable rates



2014

Elementary Studies

	Scientific Research	Seasoned Entrepreneurs	Early-stage Funds	Skilled Workforce	Wet-lab Facilities
Boston					
San Francisco					
New York					
Singapore					
Shanghai					
홍릉특구					

$$\textit{Bio Innovation Ecosystem} = \mathbf{f}(E_1, E_2, E_3, E_4, E_5)$$



We have had similar research experiences before – with Silicon Valley

How did Silicon Valley
build such a flourishing
startup ecosystem?

How can we build one
in our country?
In our city?

- A Japanese research team conducted a very extensive and systemic research to find out the secrets of Silicon Valley success
- Determined the “six” essential elements of flourishing tech startup ecosystem
- Discovered that the Japanese government has been working on those elements for decades, but without any substantial progress in startups
- Concluded “since it appears to be impossible to transfer the Silicon Valley ecosystem to Japan, the government may be better off by supporting the move of Japanese tech startups to Silicon Valley so that they can benefit from the rich environment.”

Source: Dasher et al (2015) "Institutional Foundation for Innovation-Based Economic Growth," prepared for National Institute for Research Advancement, Japan



To answer questions from around the world

How did Boston build
such a flourishing bio
innovation ecosystem?

We need more than a
snapshot!

We need to understand
the trajectory!

How can we build one
in our country?
In our city?

We need to understand the
mechanism that pushes and
pulls those elements toward
the development of a
dynamic ecosystem!

Hidden
Secret
#1

“The mechanism that pushes and pulls those elements toward the development of a dynamic ecosystem”

Best Practice Study to discover Hidden Secrets

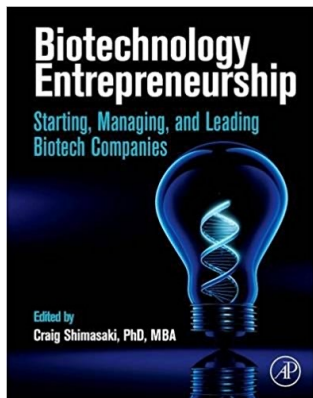
1

2

3

4

5



Abundance of high quality, adequately funded academic research

Ready resource of seasoned and experienced biotechnology entrepreneurs

Ready access to sources of high-risk, early and development-stage capital willing to fund startup concepts

Adequate supply of technically skilled workforce experienced in biotechnology industry

Availability of dedicated wet-laboratory and specialized facilities at affordable rates



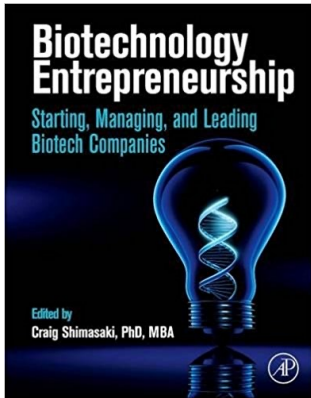


Hidden Secret #1

“The mechanism that pushes and pulls those elements toward the development of a dynamic ecosystem”

Best Practice Study to discover Hidden Secrets

1

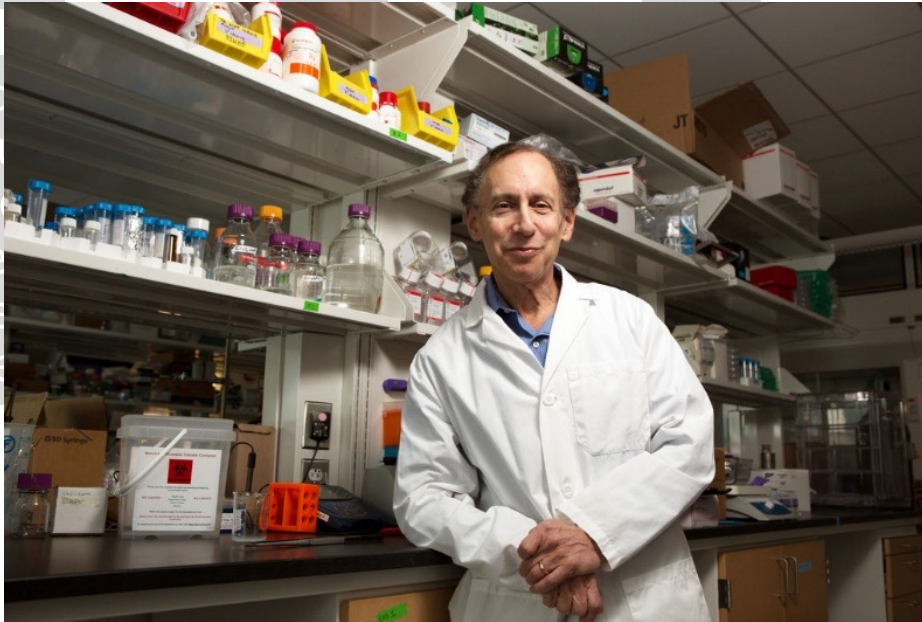


Abundance of high quality, adequately funded academic research

2

Readiness of resources, experienced biotech entrepreneurs

3



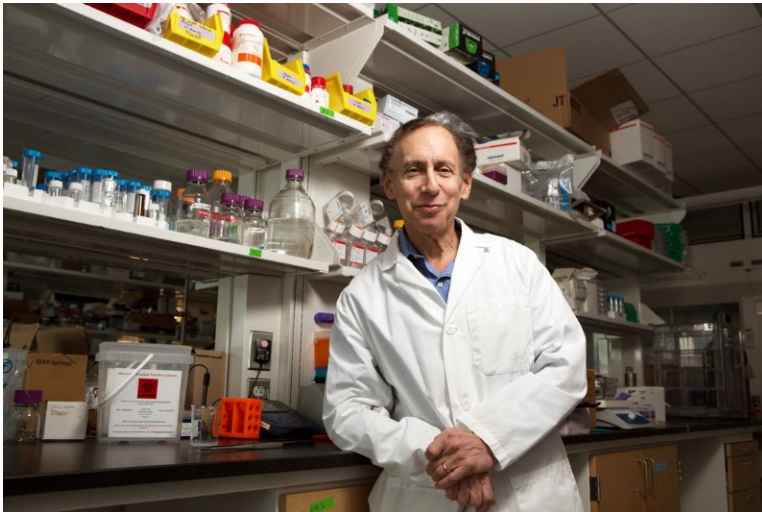
4

5

Availability of dedicated wet-laboratory and specialized facilities at affordable rates



Dr. Robert Langer MIT



Robert S. Langer is the David H. Koch Institute Professor (there are 11 Institute Professors at MIT; being an Institute Professor is the highest honor that can be awarded to a faculty member). Dr. Langer has written over 1,250 articles. He also has nearly 1,050 patents worldwide. Dr. Langer's patents have been **licensed to over 250 pharmaceutical, chemical, biotechnology and medical device companies**. He is the most cited engineer in history.



Bob Langer Companies
"40 companies since 1987"



1987

Advanced
Inhalation
Research

1997

••••



2001

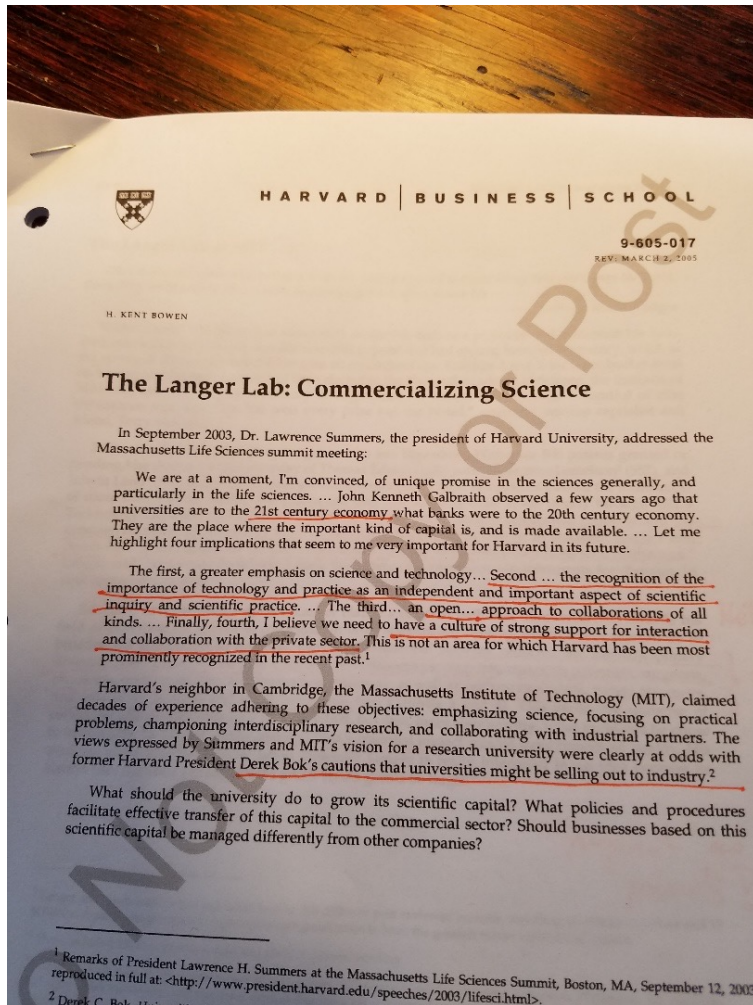


2011

"estimated market value of \$23 billion"

(Source, HBR 2017)

Bob Langer – How does he do it?



Questions

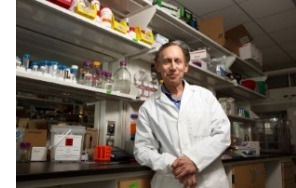
- How does Langer Lab successfully commercialize science?
- What should the university do to grow the scientific capital?
- What should the government do to facilitate the transfer science to industry?
- How should the businesses based on the scientific capital be managed?

Harvard Business School Case Study



Bob Langer – How does he do it?

Langer's Own Words



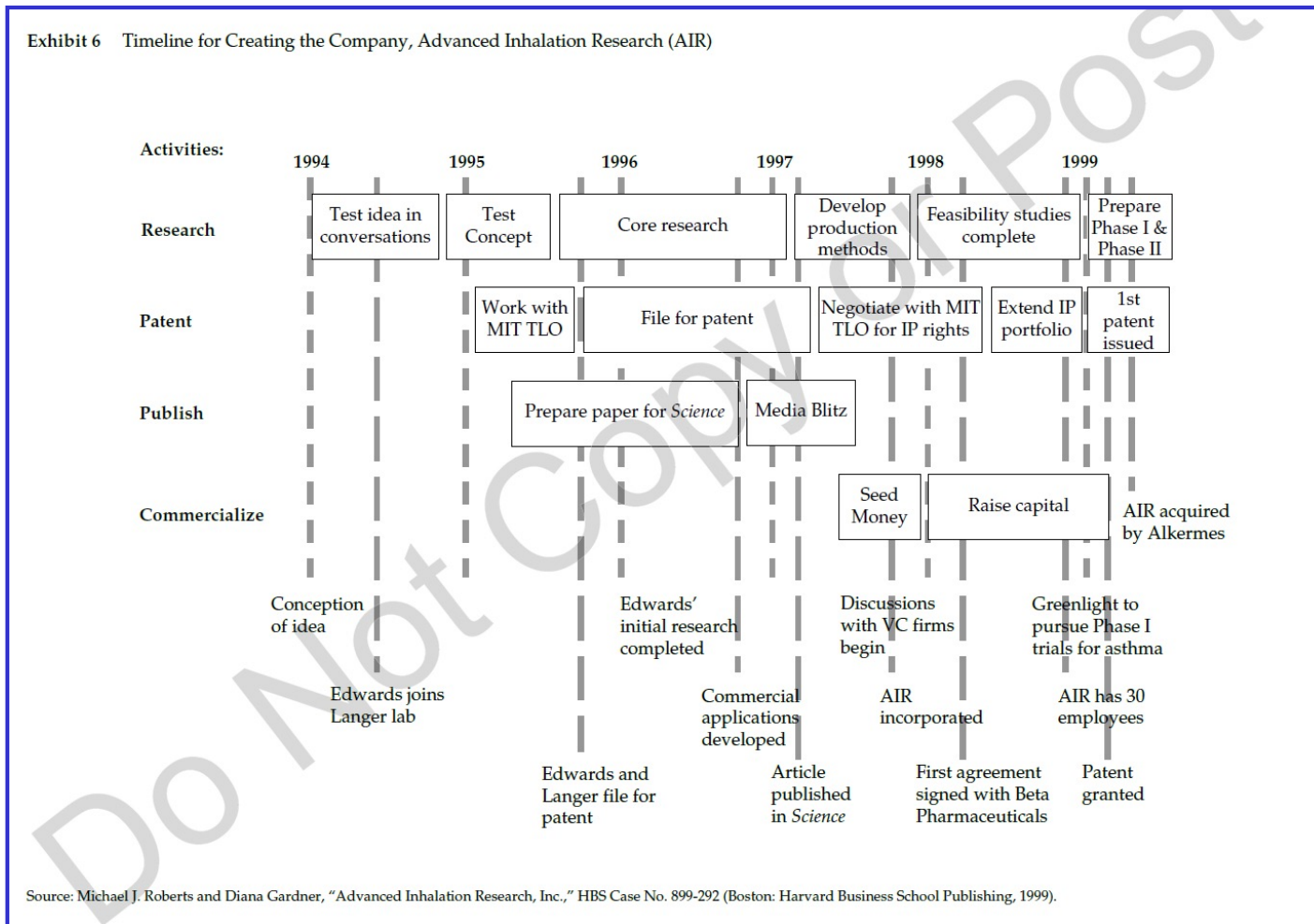
Ideal Research Project
(for the symbiotic relationship between
science and science-based business)

1. A huge idea
2. A seminal paper
3. A blocking patent
4. Preliminary *in vivo* studies in animals

“There is very little that is really impossible.”

“My goal has always been not just to write the scientific paper or file a patent, but to really push some of these ideas to the point where they will affect people's lives in a positive way.”

Bob Langer - How does he commercialize research outcome?



Bob Langer – How does he do it?

Langer's Network

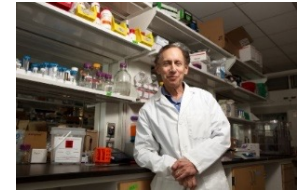
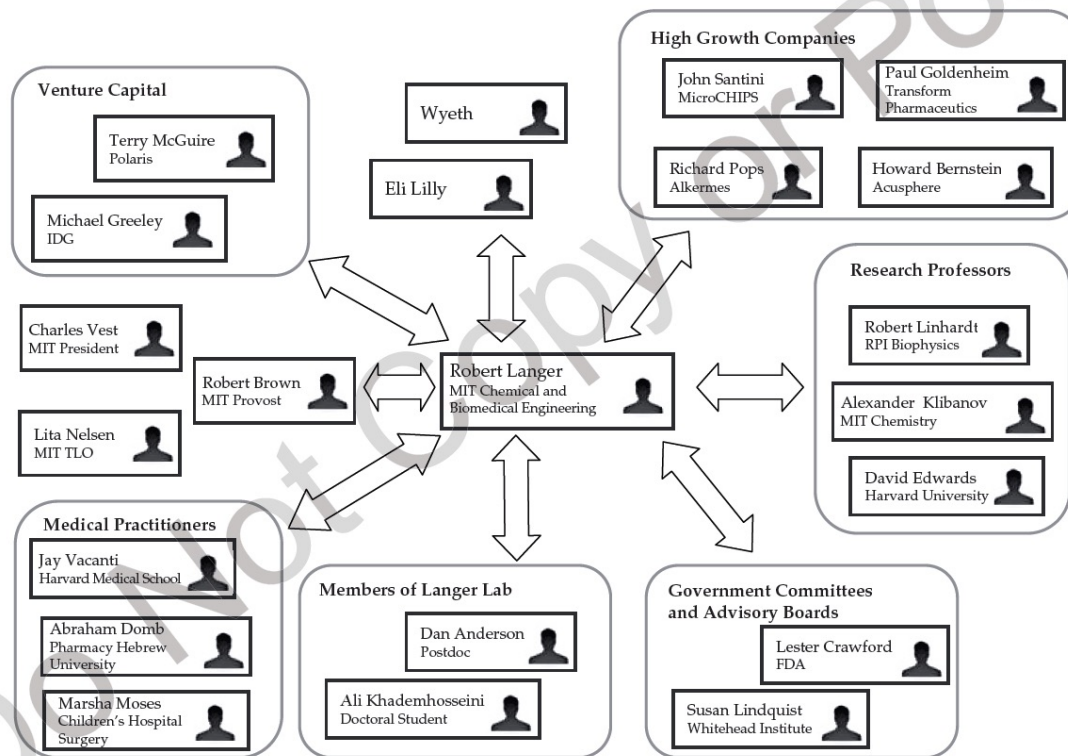


Exhibit 3 Representative Sketch of Professor Langer's Professional Network



Source: Casewriter

School of Business, jkimjr@bu.edu



Bob Langer – How does he do it?

Not everyone can do this!



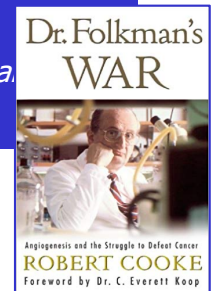
“This style of research should be encouraged and enabled, but not expected.”

Charles Vest,
President of MIT



“There are all kinds of geniuses in the Harvard area, so we classify them. There are standard geniuses, and you can follow how they got from here to there, once they show it to you. But with a magician genius, you have no idea how he did it. Langer is that kind of genius – like an Einstein or a Feynman.”

Dr. Judah Folkman, in Robert Cooke, *Dr. Folkman's War: Angiogenesis and the struggle to defeat cancer*, 2001



Can we train scientists to be like Bob Langer?

A hint for a dynamic ecosystem



I-CORPS at NIH

SBIR.CANCER.GOV/ICORPS

NATIONAL CANCER INSTITUTE

I-Corps at NIH Entrepreneurship Program

8 Weeks with I-Corps at NIH by SBIR-funded NERx BioSciences



IBE CERTIFICATE PROGRAM - MARCH 2018

The IBE Certificate Program can be used for anyone having an idea and much, little or no pre-existing entrepreneurial experience.

[Apply Now](#)

Overview

Biomedical Innovation and Entrepreneurship Certificate Program

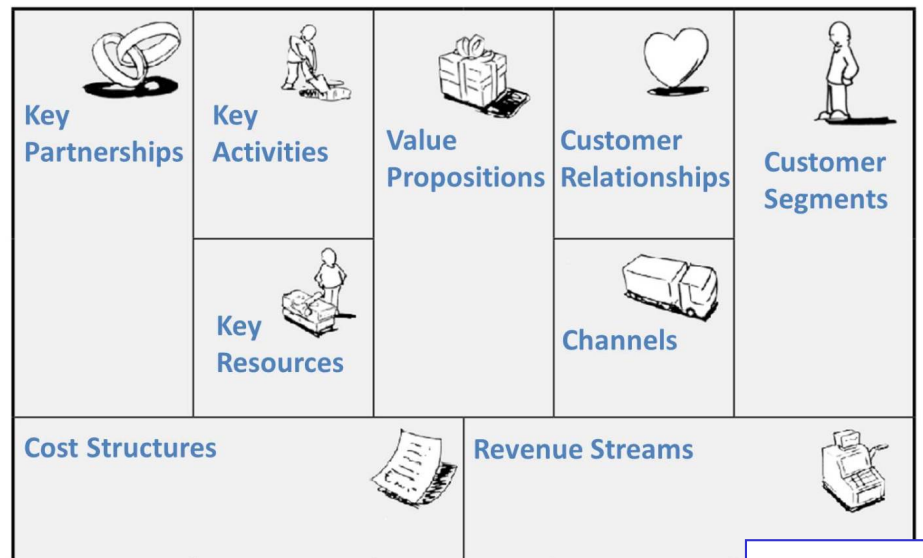
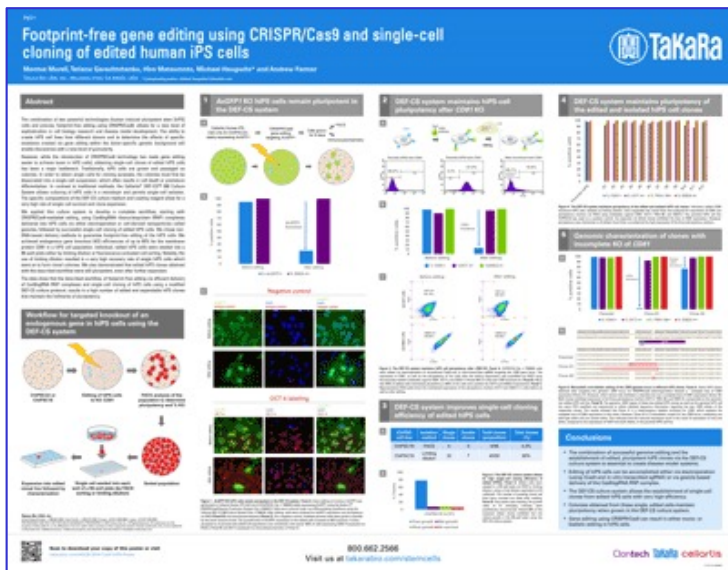
The Institute for Biomedical Entrepreneurship (IBE) develops and delivers a variety of formal and informal educational programs for researchers and other innovators which will:

- Provide an understanding of the execution processes involved in developing ideas into commercial successes, the major components of full-cycle development of an idea into a successful enterprise.



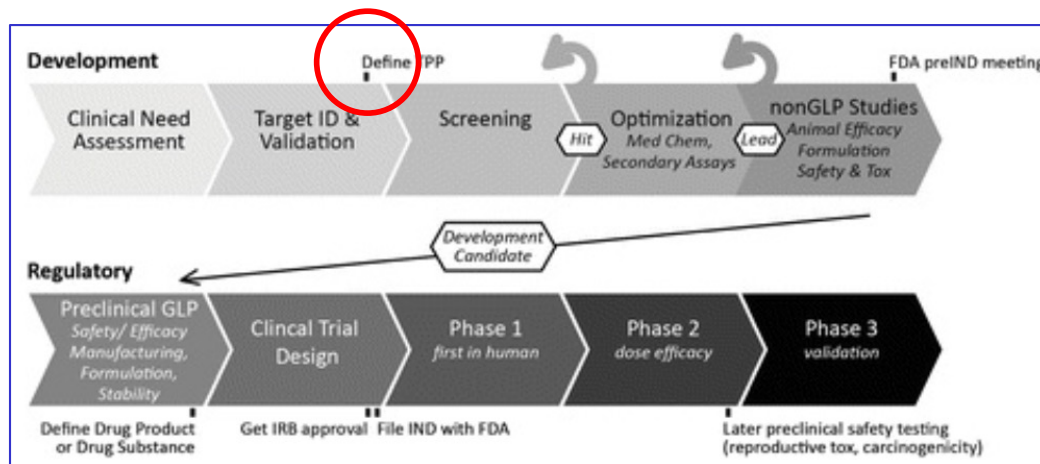
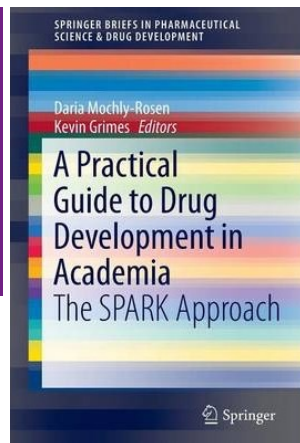
Can we train scientists to be like Bob Langer?

A hint for an effective training/development program



Can we train scientists to become like Bob Langer?

A hint for an effective training/development program

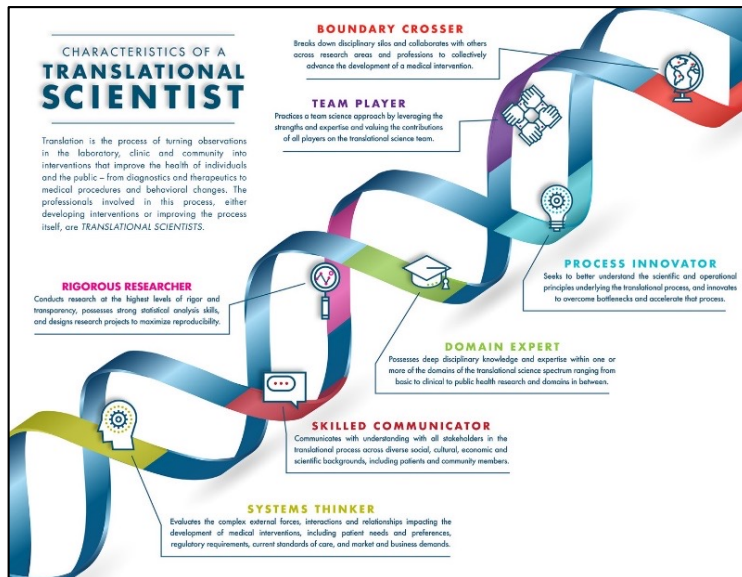


TPP (Target Product Profile)

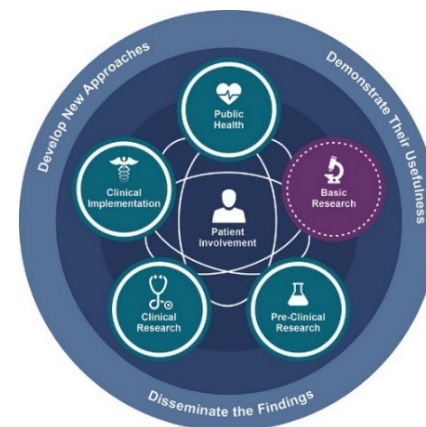


Can we train “translational scientists” like Bob Langer?

Now a US National Agenda



NIH National Center for Advancing Translational Sciences



Dr. Christopher Austin



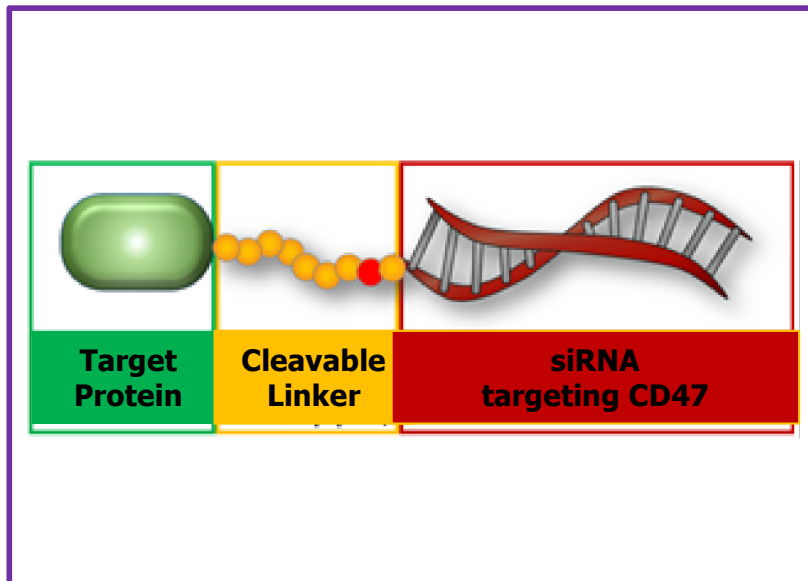


Back to K2B

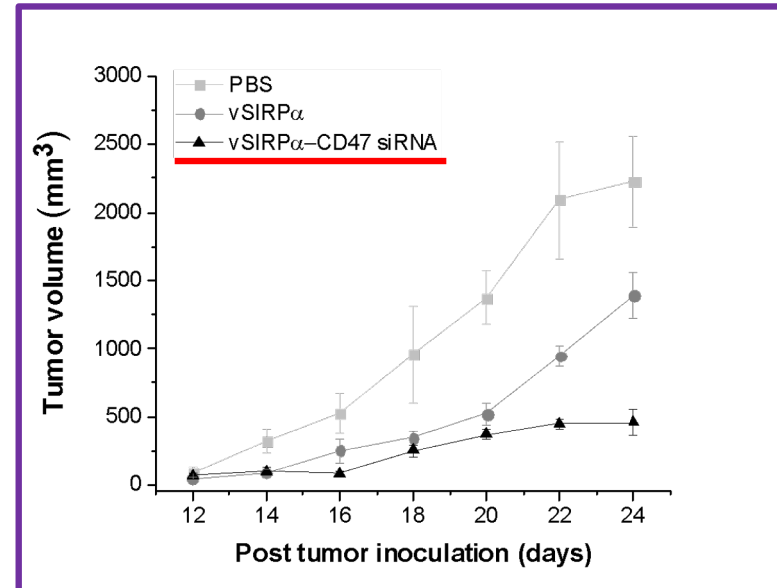
What is the science?
Who are the entrepreneurs?

KIST 바이오메디컬 연구팀이 세계최초로 발명한 첨단기술 Introducing a Breakthrough Science from KIST

“First-in-class” Protein-siRNA Conjugate (PRC)



“Best-in-class” Anti-tumor effects



Ko, JY et al, “Versatile activatable vSIRP α -probe for cancer-targeted imaging and macrophage-mediated phagocytosis of cancer cells”
Journal of Controlled Release, Volume 323, 10 July 2020, Pages 376-386

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K2B의 혁신신약은 현대의학 최첨단에서 각광받는 면역항암제분야를 타겟으로 합니다
 “First-in-class” PRC technology with “Best-in-class” Anti-Tumor Effect
 in the Hottest Immuno-Oncology Domain

Domain: Immuno-oncology

- The hottest domain for innovative therapeutic research and development
- Substantial global market opportunities + yet still in early stage of science and product discoveries

Therapeutic Target: CD47

- One of the most promising therapeutic targets recognized in all cancer indications
- Rapidly growing number of firms entering with various scientific possibilities
- Increasing collaboration interests from major pharmaceutical companies

Commercial Opportunities: Companies and Deals

THE WALL STREET JOURNAL.

English Edition | Print Edition | Video | Podcasts | Latest Headlines

Gilead Sciences to Buy Forty Seven for \$4.9 Billion

Biopharmaceutical company says deal will deepen its pipeline of cancer drugs

ALX
ONCOLOGY

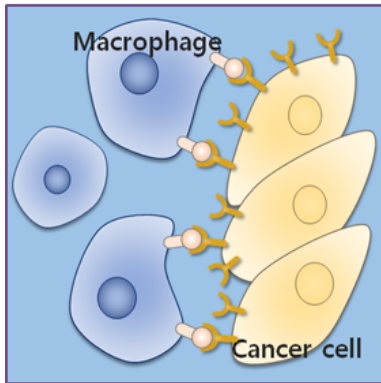
Founded 2015
Market Cap \$2.8B

K2B

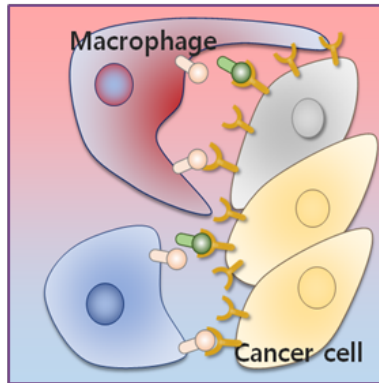
- First-in-class PRC
- Best-in-class anti-tumor effect

과학적 우위성 #1: 암세포내부에 RNA를 투입하여 면역관문의 생성을 근본부터 제거
 Science Advantage #1
 Our PRC delivers **"One-Two Punch"** and induces Enhanced Phagocytosis

The CD47 problem -
 "Don't eat me"
 signal to evade
 macrophage

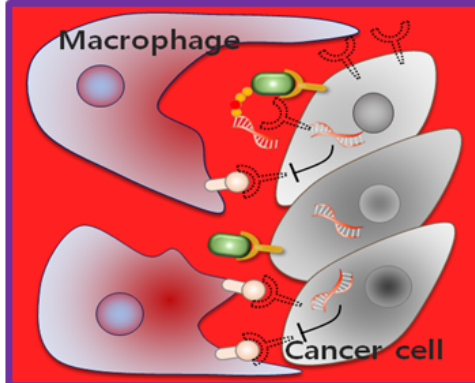


CD47 blocking –
 existing approach
 pursued by
 competitors

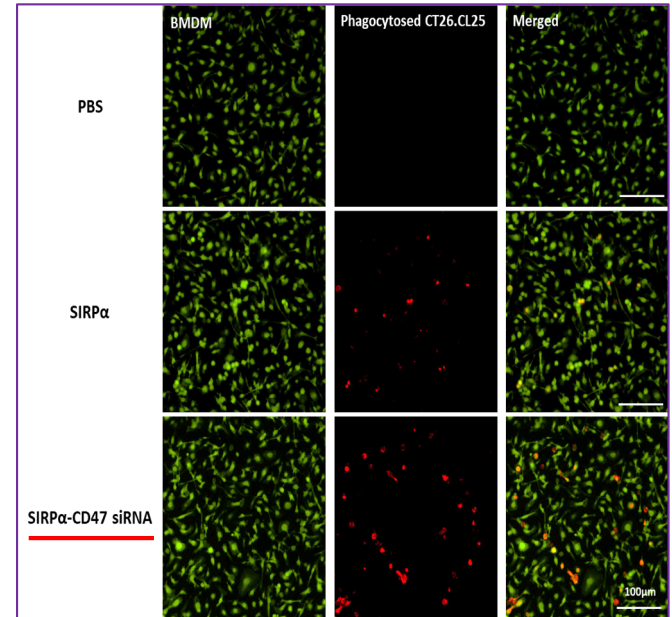


Barriers – Limited
 anti-tumor effect
 from "single
 punch" blocking

Protein-siRNA conjugate
 knock down CD47 for
 double blocking –
 K2B approach



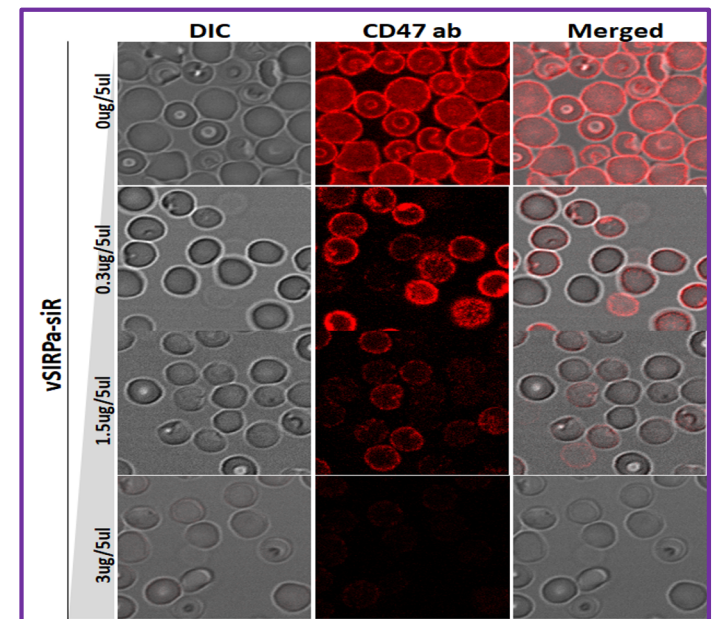
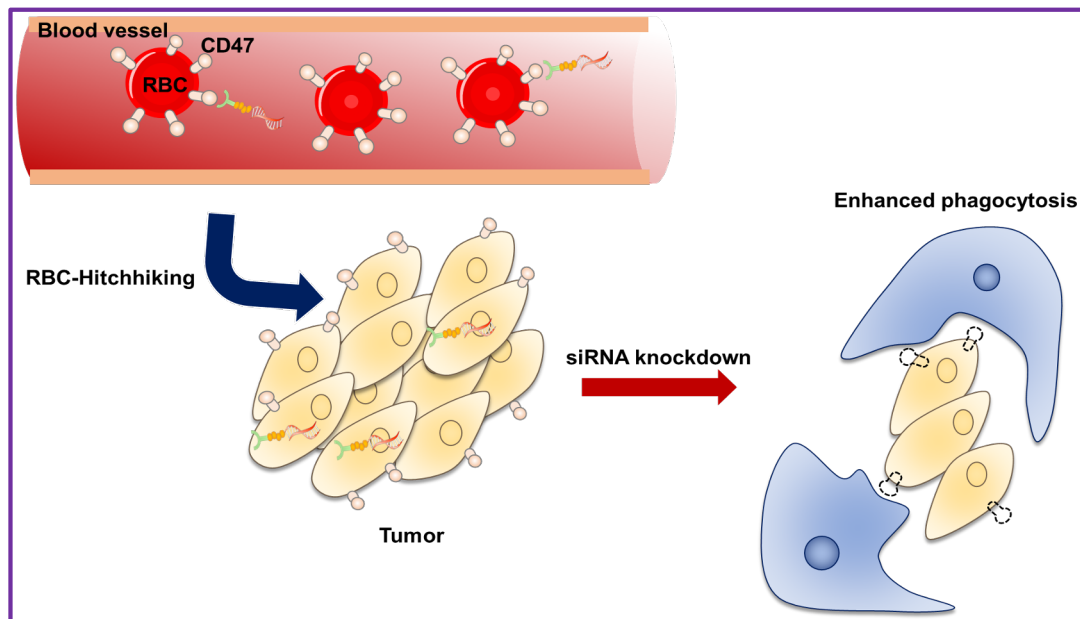
Our PRC solution –
 siRNA "knocks down"
 CD47 creation and
 delivers "one-two punch"



"Enhanced Phagocytosis from One-Two Punch"

과학적 우위성 #2: K2B 후보물질은 적혈구에 붙어서 암세포에 효율적으로 전달
 Science Advantage #2

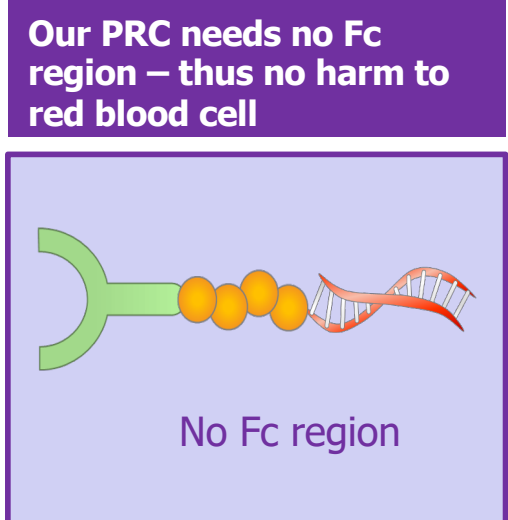
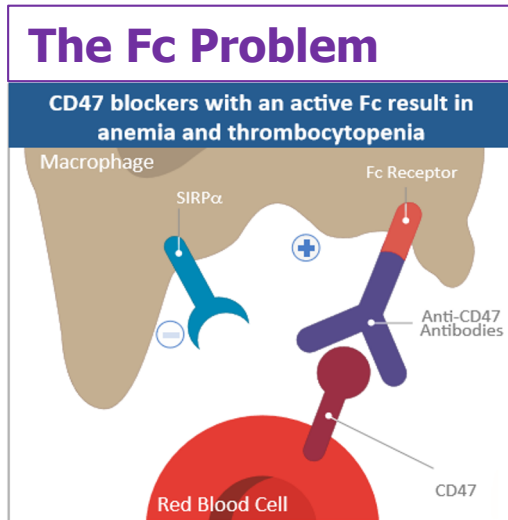
Our PRC allows **"RBC Piggy Backing"** and provides Efficient Drug Delivery



Our PRC binds with RBC better than existing CD47 antibodies
"One can run, or one can fly. We piggyback."

과학적 우위성 #3: 혁신적 결합매체기술로 경쟁제품들이 겪는 의료부작용 회피
 Science Advantage #3

“Fc-less linker design” eliminates side effects like Anemia and Thrombocytopenia



Hemagglutination Study

Control

CD47 Ab

vSIRPa-siR

Normal Red Blood Cell

RBC with CD47 Ab

RBC with our PRC



So, how good is the science?

What would Bob Langer say?

Bob Langer – How does he do it?

Langer's Own Words



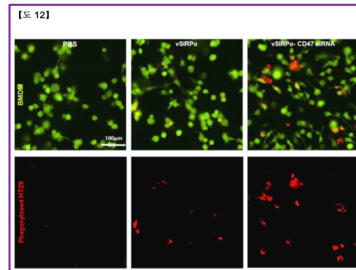
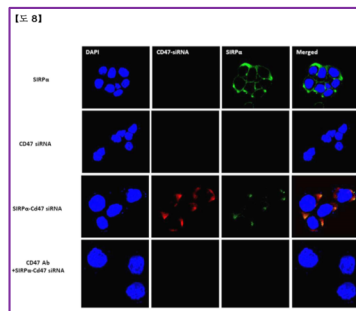
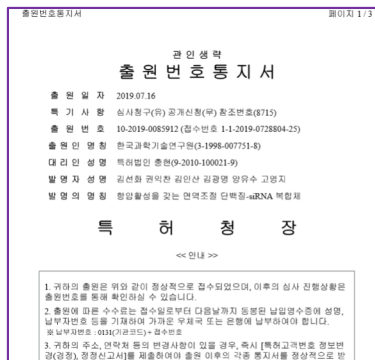
Ideal Research Project
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1. A huge idea
2. A seminal paper
3. A blocking patent
4. Preliminary *in vivo* studies in animals

“There is very little that is really impossible.”

“My goal has always been not just to write the scientific paper or file a patent, but to really push some of these ideas to the point where they will affect people's lives in a positive way.”

KIST를 공동창업자로 모셔서 전세계 특허출원을 이전받았습니다
 Patents filed by KIST for worldwide rights - Licensed Exclusively to K2B

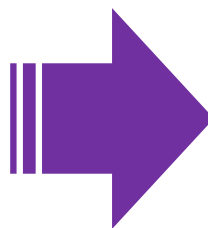


No.	Application No. (Application Date)	Patent Title	Country
1	10-2019-0085912	항암활성을 갖는 면역조절 단백질-siRNA 복합체	Korea
2	16/573351 Now published!	Immunoregulatory Protein-siRNA Complex Having Anticancer Activity	US
3	PCT/KR2020/010897 (2020.08.14)		PCT

K2B의 플랫폼기술은 면역항암제 부문에서 "Game Changer"가 될수 있습니다
 "Game Changer in Immuno-Oncology"
 The K2B Vision

**Leveraging & Expanding KIST
 Science Advantages**

vSIRP α -siRNA conjugate (PRC) enables a differential one-two punch to knock down CD47 and induce maximal anti-cancer phagocytosis with reduced side effects



K2B aims to

1. Develop best-in-class anti-tumor therapeutic products
2. Establish globally strong first-in-class technologies and IP portfolio
3. Expand the PRC platform to become a game changer in the immuno-oncology field

From KIST Science
 "Dedicated long-term research agenda"

To Boston Business
 "Accelerated translation & development"

Game Changer로 발전하기 위한 빠른 속도의 연구, 개발, 사업모델 3대전략
 “Accelerate Translational Research & Therapeutic Development”
 The Three-Pronged Strategy

1. Research Strategy

Create expansive IP portfolio for stable and robust PRC candidates

- Extensive collaborative research programs with KIST biomedical centers
- Leverage national government translational research fund
- Multidisciplinary technology fronts – bionics, bio materials, theragnosis, chemical kinomics, and nano technologies – for competitive advantage

2. Product Strategy

Accelerate therapeutic development to build product portfolio and technology platform

- Scale up and speed up with global CMO & CRO in Boston
- Leverage the protein-RNA conjugate to attack additional immune checkpoint targets (BRCA, KRAS, CD24)
- Expand clinical applicability and product markets to various cancer indications

3. Business Strategy

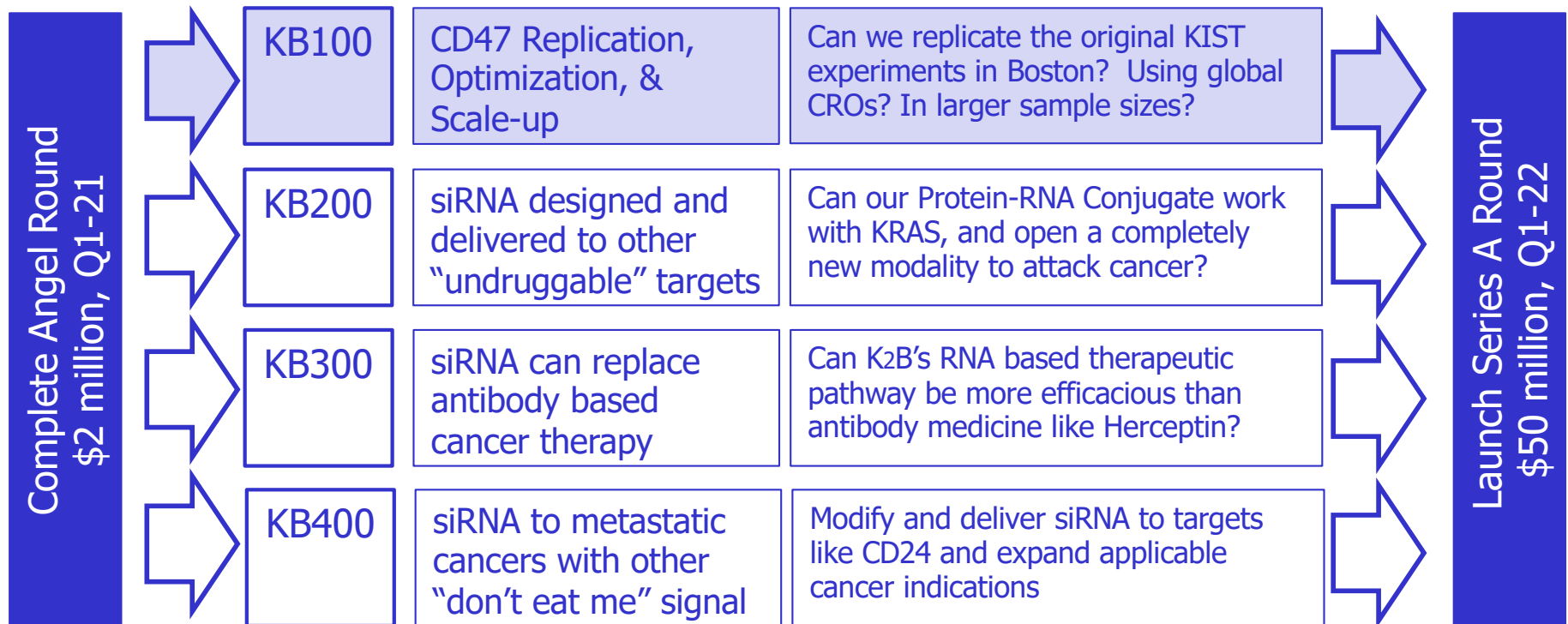
Aggressively promote business development (BD) initiatives to enable funding and growth

- Leverage Boston biotech ecosystem to maximize opportunities for
- Opportunities to license-out to & collaborate with global pharmaceuticals and biotech companies
 - Early-stage and high-risk capital
 - Build base for global exit and/or IPO

“빠른속도” 전략과 면밀한 추진계획
 “Rapid Translation From Science to Business”
 K2B Milestones

	Q1 2021	Q2 2021	Q3 2021	Q4 2021	Q1·2 2022	Q3·4 2022
Translational Research & IP Development	w·vSIRP α - siRNA-CD47 in vitro & in vivo “Reproducibility”	vSIRP γ -siRNA- CD47 in vitro & in vivo “Stability”	wt·vSIRP α · γ - siRNA-CD47 in vivo “Optimization”	Target expansion In vitro “Expandability”	Target expansion in vitro	Target expansion in vivo
API & Drug Development	PK analysis	vSIRP α -siRNA- CD47 Conjugate PK analysis	vSIRP γ -siRNA- CD47 Conjugate PK analysis	Analysis, TPP, design transfer to CRO	Pharmacology study PK/PD study Safety study	Pharmacology study PK/PD study Safety study First IND filing
Company Development	Strengthen IPs; Hire CSO	Build leadership team CEO, CTO; Organize SAB; Enter LabCentral	Expand IPs; Begin business development (BD) initiatives	Expand IPs; Identify business development (BD) opportunities		
Funding Plans	Complete Angels Seed \$2 mm				Complete Series A \$50 mm	

Series A (Q1-22)에 필요한 Portfolio를 구축해갈 초기 12개월 사업계획
 “Aggressive Translational Experiments for Portfolio Development”
 The Fast-Track 12-Month Plan from Angel to Series A Round



“Identify promising applications, build credible data, and establish strong IP”

초기자금을 투자하셔서 우리 K2B의 파트너가 되시길 기대합니다
 Successful Closing of Angel Round Investment

Needed **\$2 million** for critical translational research and IP management in FY2021

K2B secured early-stage angel investors who will own **28.57%** equity (2 million shares @ \$1.00)

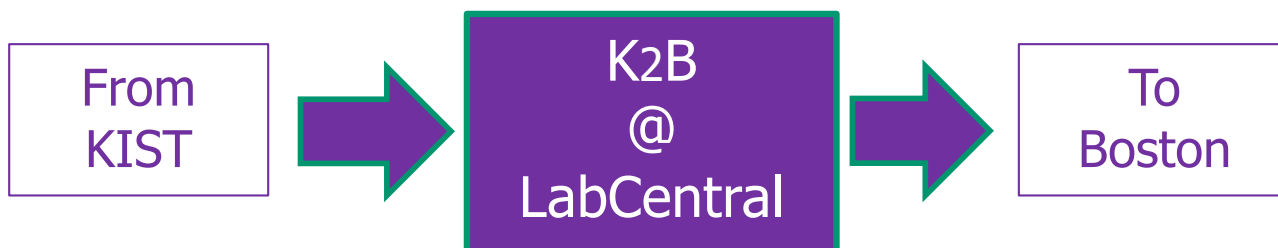
K2B plans to launch \$50 million Series A round in the Q1-22

Post-Angel Capitalization

	Valuation (€)	Per Share Price (€)	# of Outstanding Shares	% of Total	Ownership
Amount Raised in Angel Round	\$2,000,000	\$1.00	2,000,000	28.57%	Angel Investors
Post-Money Valuation	\$7,000,000	\$1.00	7,000,000	100.00%	

The angel round was successfully closed on April 27, 2021, with \$2 million invested by MJK2B Johab, a Korean angel group.

전세계 바이오타트업 꿈의 실험실, LabCentral에 입주선정되어 글로벌 첫발
“K2B Advantages through Cross-Border Innovation and Entrepreneurship”



Advance
Breakthrough
Science & Technology
Innovation



Accelerate
Innovative
Product & Business
Development



What is so special about LabCentral?



Hidden
Secret
#2

“The mechanism that pushes and pulls those elements toward the development of a dynamic ecosystem”

Best Practice Study of Hidden Secrets

1

Abundance of high quality, adequately funded academic research

2

Ready resource of seasoned and experienced biotechnology entrepreneurs

3

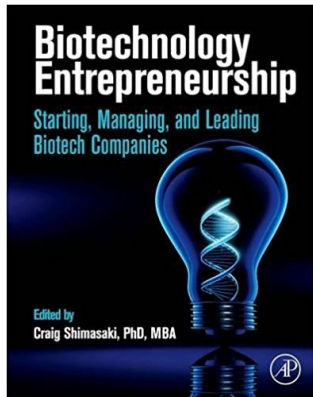
Ready access to sources of high-risk, early and development-stage capital willing to fund startup concepts

4

Adequate supply of technically skilled workforce experienced in biotechnology industry

5

Availability of dedicated wet-laboratory and specialized facilities at affordable rates



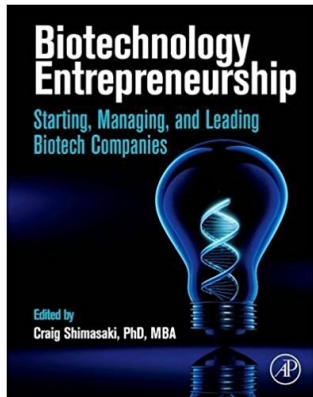
Hidden Secret #2

“The mechanism that pushes and pulls those elements toward the development of a dynamic ecosystem”

Best Practice Study of Hidden Secrets

1

Abundance of high quality, adequately funded academic research



2

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4



5

Availability of dedicated wet-laboratory and specialized facilities at affordable rates





LabCentral



It started from a simple business idea!



*Dr. Johannes Fruehauf,
Founder, Executive
Director*

“When a group of scientists decide to start a company to translate their innovative research findings into a commercial product, the last thing they want to worry about is how to find a lab space and fill it with all the necessary equipment.

Rather than spending the first six months and the first million dollars to set up the physical facility, they would rather want to spend their time to advance their theories and identify collaboration partners.

That is how we founded the concept of a common lab space, completely prepared with all the necessary equipment and regulatory requirements, readily available for an affordable rent.”



Circa 2014



"Beyond the wildest dream" Impact



A signature institution in the Boston Bio Innovation Ecosystem



\$3.68 billion raised in 2020

\$9.15 billion raised by residents and alumni since opening our doors in 2013

201 companies
supported since opening in 2013

1,794 members
in our resident and alumni community

1,200+ participants
in 42 active clinical trials with drugs developed at LabCentral. thousands more scheduled to enroll. Areas of study include:

- ACUTE KIDNEY INJURY
- C. DIFF INFECTION RECURRENCE
- COVID-19
- EPILEPSY
- FSHD
- ONCOLOGY
- PNEUMOCOCCAL DISEASE
- SCHIZOPHRENIA
- TRAUMATIC BRAIN INJURY
- TYPE 1 DIABETES

patents granted
113
to LabCentral companies since 2013

"we help them move faster"
"we help them improve the probability to succeed"
"we help them discover better commercial opportunities"
"by building a dynamic innovative community"





How does LabCentral do it?

“pushes and pulls innovation elements”



How does LabCentral do it?

“pushes and pulls innovation elements”



Sponsors

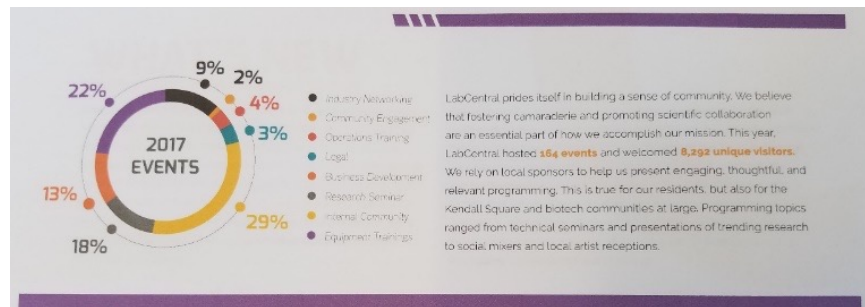


Alumni



How does LabCentral do it?

“pushes and pulls innovation elements”



The number of delegations we welcomed broad to visit our facility. In 2017, we welcomed guests from every habitable continent on Earth!

8,292

The number of unique visitors to LabCentral in 2017

The number of artists that displayed their work at Gallery 1632

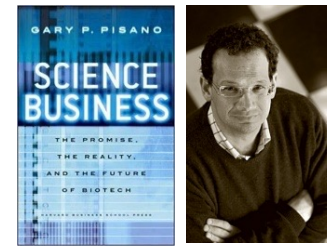
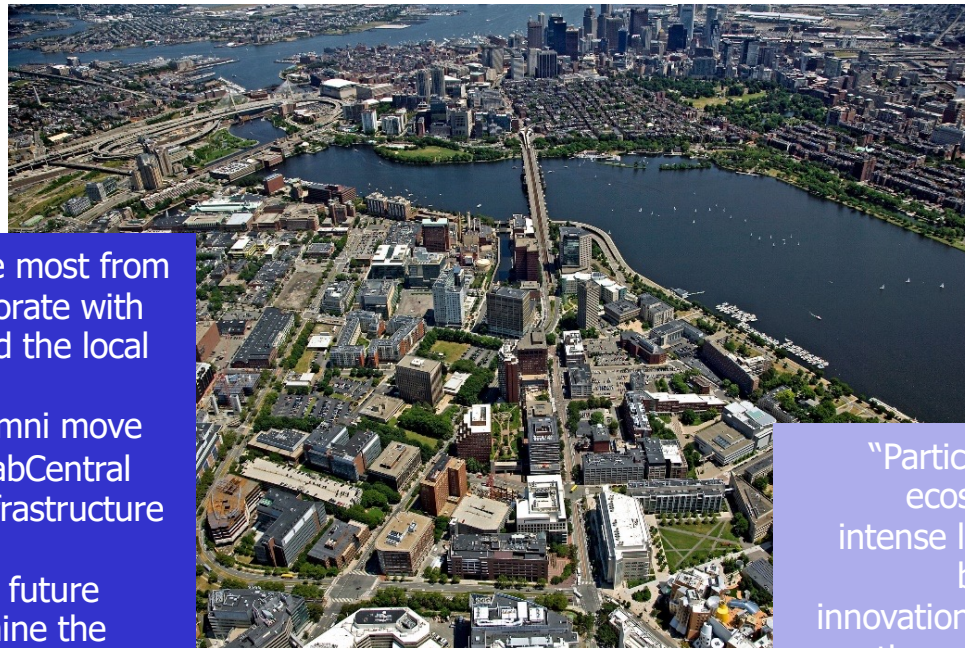
“164 Events in 2017”

- 29% internal community
- 22% equipment training
- 18% research seminar
- 13% business development
- 9% industry networking
- 4% operations training
- 3% legal
- 2% community engagement



How does LabCentral do it?

“pushes and pulls innovation elements”

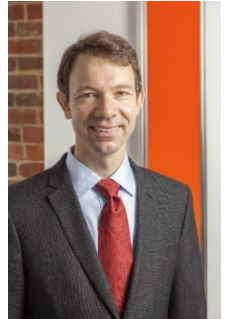


- “Our residents benefits the most from the opportunities to collaborate with co-residents, sponsors, and the local community in general.
- After graduating, most alumni move to another location near LabCentral with similar culture and infrastructure for collaboration.
- Indeed, when we evaluate future residents, we closely examine the team’s ability and willingness to collaborate with others.”

“Participants in the new bio innovation ecosystem need to establish a more intense long-term partnership, that goes beyond the current rush to open innovation or licensing model and enables them to assess confusing results from every discovery endeavor.”



Key "software" words from Johannes



Capital
Efficiency

Operational
Efficiency

Transparency

Proximity

Lab Central

Variety

Adaptability

Intentionality
In Design

Reduce Frictions,
Increase Collisions

K2B Therapeutics 는
일단 창업하는데는
성공하였습니다

K2B Therapeutics 가
성공적인 창업인지는
아직 모릅니다

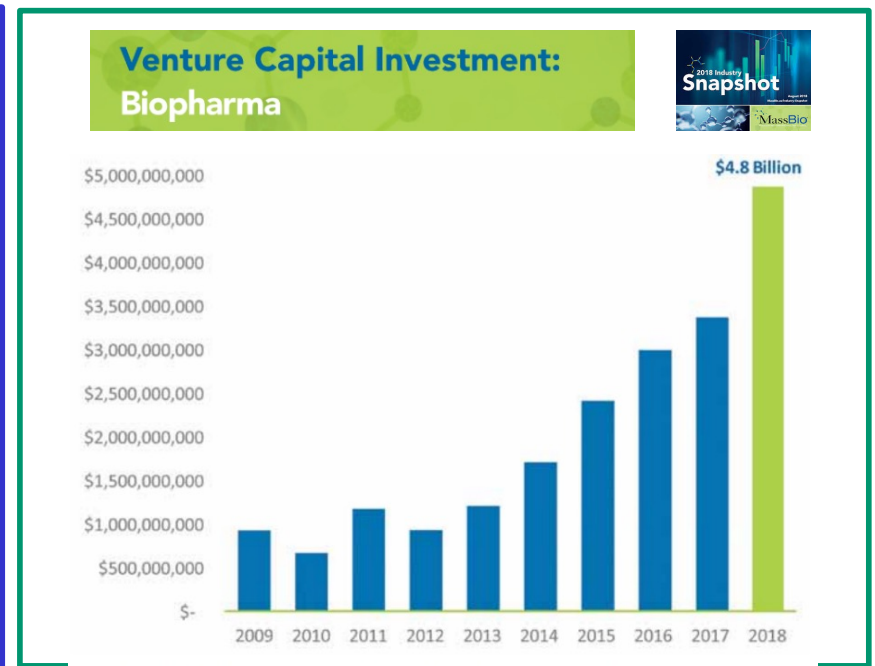
When would you know K2B is a success?

1. Series A Funding
2. Revenue
3. Exit

Hidden Secret #3

“Global pharmaceuticals move into the crowded space in Kendall Square, primarily attracted by burgeoning biotech startups.”

Why?



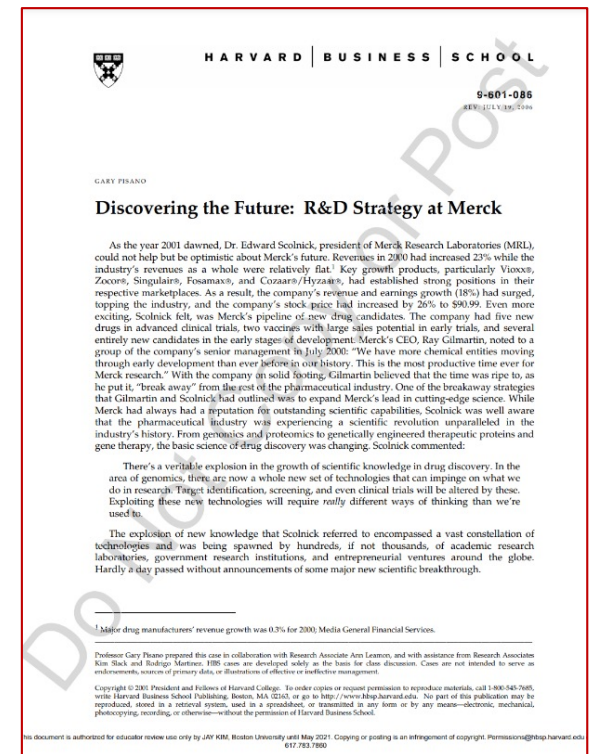
Merck's R&D Strategy 2006



"The basic science for drug discovery would require more collaboration with outside research partners to keep pace with changing technology"

Open Innovation

1. Aggressively recruit top scientific talent
2. Decentralize research facilities
3. Leverage in-house capabilities through external alliances



Pfizer's Center for Therapeutic Innovation (CTI 2010)



Small research labs where Pfizer researchers can collaborate with academics

Located in the biotech hotspots of Boston, New York, San Diego, and San Francisco

Built in close proximity to Academic Medical Centers

Staffed with Pfizer scientists including engineers, chemists, and project managers to bring CTI projects closer to their end goal of developing a new drug

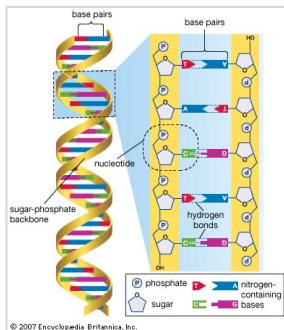
Open
Innovation



“The Biotechnology Revolution(s)”

“In the mid-1970s, stunning biological breakthroughs set the stage for the modern biotechnology industry.”

Genentech
A Member of the Roche Group



1976

Scientists could now cut and paste snippets of deoxyribonucleic acid (DNA), the blueprint of life and the longest known molecule in the universe.

By gaining the power to revise DNA and create new protein products, biologists in the laboratory could more precisely manipulate the primary biological molecules of life.

Part of the excitement stemmed from the fact that the traditional way of finding cures for diseases was extremely effort-intensive and expensive.



“Deep Dive into the Molecular Biology Revolution”

*Technological innovations are happening
in three interrelated processes of drug discovery*

1

Search for
therapeutic
targets

2

Synthesis of
potentially
therapeutic
compounds

3

Screening of
compounds on for
the desired
therapeutic activity

"Deep Dive into the Molecular Biology Revolution"

*Technological innovations are happening
in three interrelated processes of drug discovery*

Search for therapeutic targets

Historically, drug compounds had been found, not designed. Now the search begins with an attempt to understand the underlying biology of the disease.

Currently 500 molecular targets.
Potentially 5,000-10,000 targets.

Genomics; functional genomics;
systems biology

"The problem is that nobody is
trained in this stuff."

Synthesis of therapeutic substances

Historically, isolated from natural sources or chemically synthesized. Now, vastly expanded techniques.

Recombinant DNA (rDNA) – "large molecules" like recombinant insulin; Genentech and Amgen

Monoclonal antibody (MAb) – "magic bullets" targeting specific "marker"

Gene therapy – correct the basic problem by altering the genetic information of patient's cells

Structure-based design

Combinatorial chemistry

Screening compounds on targets

Slow & labor-intensive; Bottleneck in the discovery process

High Throughput Screening (HTS) – automated, robotic-based technology for testing vast number of new compounds against a large number of assays

"Synergistic Effect" = HTS +
Structure-based design +
Combinatorial chemistry

©

chool of Business, jkimjr@bu.edu



“Deep Dive into the Molecular Biology Revolution”

*Technological innovations are happening
in three interrelated processes of drug discovery*

Search for therapeutic targets

Historically, drug compounds had been found, not designed.

It is not a story of one major new technology.

Currently 500 molecular targets.
Potentially 5,000-10,000 targets.

Genomics; functional genomics;
systems biology

“The problem is that nobody is trained in this stuff.”

Synthesis of therapeutic substances

Historically, isolated from natural sources or chemically synthesized.

Rather, a vast number of technologies were fundamentally altering the ways in which new drugs were discovered.

Gene therapy – correct the basic problem by altering the genetic information of patient’s cells

Structure-based design

Combinatorial chemistry

Screening compounds on targets

Slow & labor-intensive; Bottleneck in the discovery process

We have not seen all possibilities, yet!

compounds against a large number of assays

“Synergistic Effect” = HTS +
Structure-based design +
Combinatorial chemistry



Molecular Biology Revolution & Emerging Strategies for Businesses and Startups

"Scientific Revolution"

It is not a story of one major new technology.

Rather, a vast number of technologies were fundamentally altering the ways in which new drugs were discovered.



"Business Challenges"

"The problem is that nobody is trained in this stuff."

A massive scale of R&D would be necessary to exploit the vast opportunities offered by the molecular biology revolution



"Entrepreneurship Opportunities"

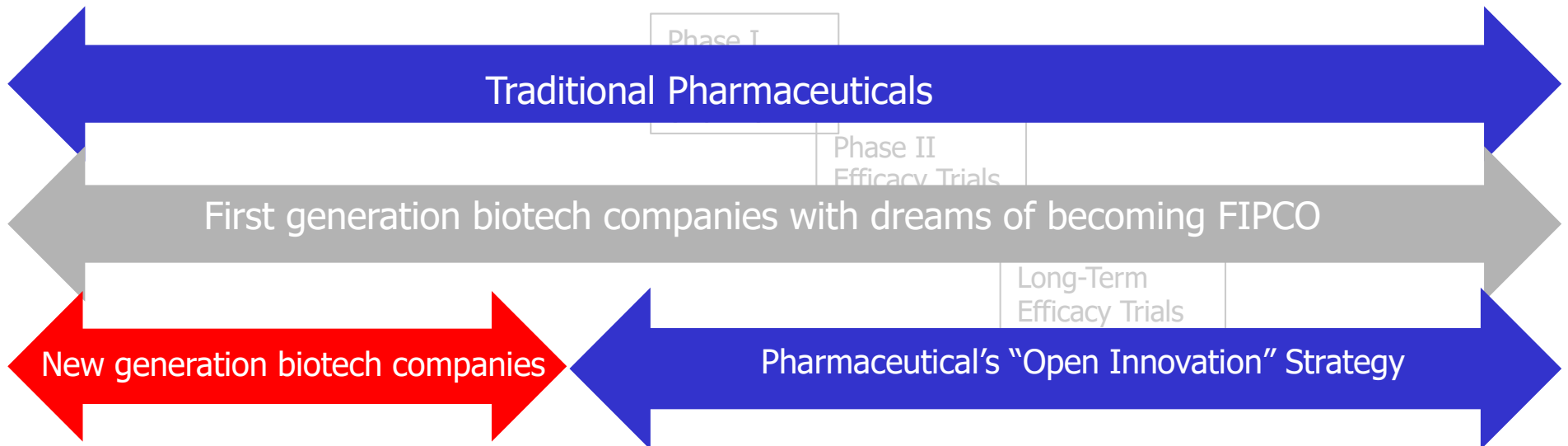
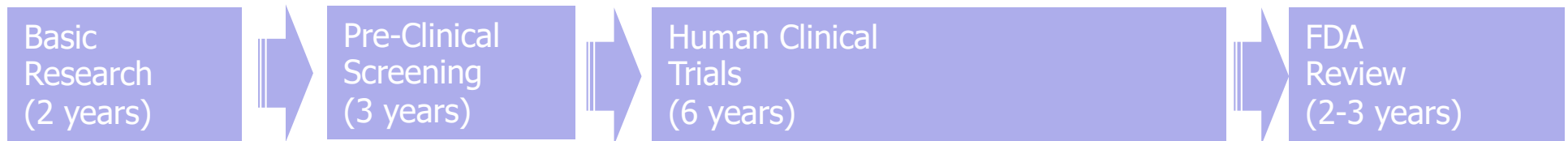
Different companies are making different technological "bets" on the future.

Organizations can follow many different strategies in drug discovery.

Successful drugs come from collaborations among many innovative research and development institutions.

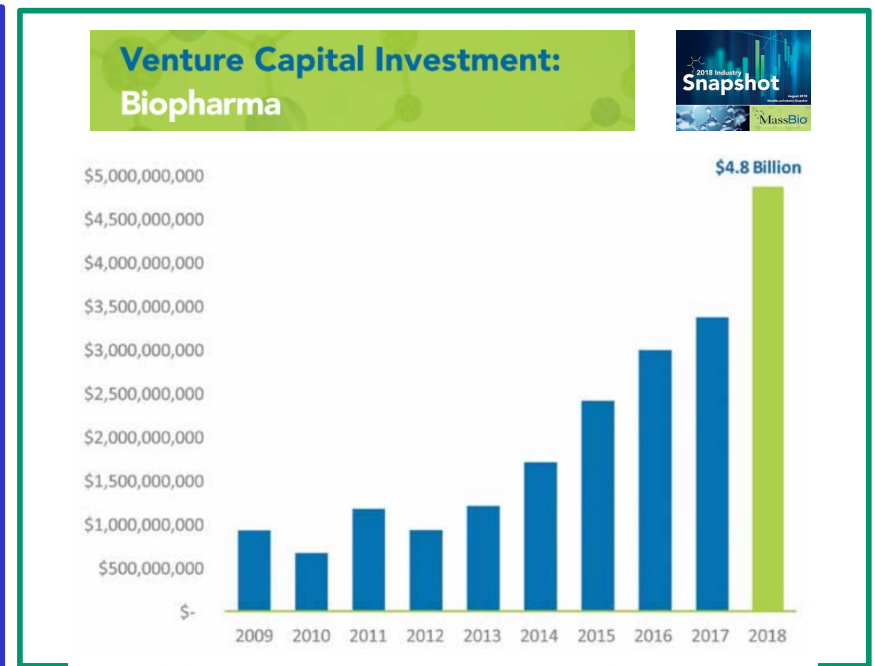
Dividing Roles between Pharmaceutical Companies and Biotech

"Value Chain Disintegration" Through Open Innovation



Hidden Secret #3

“Global pharmaceuticals move into the crowded space in Kendall Square, primarily attracted by burgeoning biotech startups.”



Lessons from K2B and Boston for **GRaND-K** 창업학교 경쟁팀
What will you do differently?

How good is
your science?

“Determine why
your science is a
breakthrough, and
where”

How good is
your team?

“Breakthrough
science plus
innovative
entrepreneurs”

How good is
your plan?

“Angel round?
Series A?
Revenue?
Exit?”

And do all of these
with a keen eye on
global competition &
collaboration

“보스턴 가서 창업할수
없다면,
보스턴 생태계의
성공원칙을
홍릉에서 실현해보자”

K2B



Thank You!

Good Luck!

Join Us In Boston!

For more information,
jkimjr@k2btx.com



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