





## US RESEARCH FUNDING AND THE IMPORTANCE OF PUBLIC SUPPORT

A legacy of support for science to secure our nation's future



## The Origins of Federal Support BACKGROUND

# World War II demonstrated the need for a robust scientific enterprise

- Basic research creates a foundation for economic development
- -A healthy population is essential to national security
- With many skilled scientists, researchers can be rapidly deployed to address national emergencies

 Since then, support for a broad range of scientific research has been an important part of the federal budget



## Why Is Federal Funding Still Important?

- The U.S. government supports critical research areas where there is little commercial incentive
  - Basic research is necessary for future innovation, but it is a very risky private investment
  - Some applied and clinical research creates a public good but not a salable product
  - Sponsored research provides hands-on laboratory experience for students and postdocs
- More than half of life science research expenditures at U.S. universities are federally-funded



BACKGROUNE



## THE RETURN ON INVESTMENT OF FEDERALLY FUNDED RESEARCH

Improving Health, creating Public Good, and strengthening the Economy





## **Healthier Babies**

#### Federally funded research on:





HEALTH



#### Vaccines

#### Preventing disease and death

 Vaccines have prevented more than 100,000,000 cases of disease in the U.S.

 They continue to prevent 2,500,000 deaths worldwide each year



 Federally-funded, basic research is fueling advances in vaccine development to protect against HIV, malaria, Ebola, and Zika



HEALTH

## **New Medicines**

#### Enabling drug discovery

- Federally funded research contributed to the science underlying <u>all</u> new, FDA-approved medicines from 2010– 2016
- Most of this supported research focused on the biological targets for drug action, creating a foundation for subsequent drug development

#### Developing much-needed medicines

 New drugs discovered at public-sector research institutions are more than twice as likely to receive priority review by the FDA (period studied: 1990-2007)



HEALTH

## **Longer Lives**

#### Federally funded research on:





HEALTH

#### **Longer Lives**





HEALTH

## Valuable Knowledge & Patents PUBLIC GOOD

#### Federally-funded research generates patents

- Nearly 10% of National Institutes of Health (NIH)
   research grants are cited by patents (direct)
- More than 30% of NIH grants produce scientific papers that are later cited in private-sector patents (indirect)

 Economists estimate that an additional \$10 million in NIH funding would generate ~2.3 private-sector patents



## **The Human Genome Project**

**PUBLIC GOOD** 

# The government-funded HGP sequenced all the genes in the human body

- To speed this work, the HGP also supported research to improve DNA sequencing technologies
- All of the data generated by the HGP was deposited into databases for public use and continues to result in scientific discoveries
- Genetic sequencing is rapidly being integrated into patient care to provide individualized treatments





## **New Commercial Sectors**

- The human genome sequencing projects created new economic opportunities
- In just the first 15 years (1998-2012), genomics R&D and commercial activities generated:
  - -Nearly \$1 trillion in total economic impacts
  - -More than 4.3 million job-years
  - -\$54.8 billion in tax revenues

#### • And the genomics sector continues to grow!



### **New Companies**

**ECONOMICS** 

#### All of these U.S. biomedical companies trace their roots to federally-funded academic research:

3PrimeDx, Inc. Acomni, LLC Acoustic Magic, Inc. Aculon, Inc. Adarza Biosystems, Inc. Adenosine Therapeutics, LLC Advaita Corporation Advanced Diamond Technologies (ADT), Inc. Advaxis, Inc. Aeglea Biotherapeutics Agensys, Inc. Agile Sciences, Inc. Agilis Biotherapeutics AGTC Akamai Technologies, Inc. Akrivis Technologies ALEKS Corporation Allegro Diagnostics Allylix, Inc. Amati Communications Corporation American BioOptics Amyris, Inc. AnswerDash, Inc. Aortica Corporation Applied Dexterity, Inc. AptaMatrix Arbor Networks ArmaGen Technologies, Inc. Arvinas AsclepiX Therapeutics LLC Athenex Audyssey Laboratories Aurrion Aursos, Inc. Autonomic Materials, Inc. Auxadyne, LLC Avid Radiopharmaceuticals, Inc.
 Axogen
 Axonia Medical, Inc.
 Ball Aerospace & Technologies Corp.
 Banyan Biomarkers, Inc.
 Beta Bionics, Inc.
 BioFront Technologies BioMarck Pharmaceuticals, Ltd. BioNano Genomics BioResource International, Inc. Blackrock Microsystems BluHaptics, Inc. Buffalo BioBlower Technologies, LLC Cadence Design Systems Caribou Biosciences, Inc. CartoFusion Technologies, Inc. Cell Biologics Cell Habitats CELLMIC Cellular Dynamics International (CDI), Inc. Cerulean Pharma, Inc. Chromatin, Inc. Cisco Systems, Inc. Clearside Biomedical, Inc. Clerio Vision, Inc. Codapillar Inc. Codelucia, LLC Cognex Corporation ColdQuanta, Inc. CollabWorx Conidio Tec, LLC ContraFect Corporation Core Quantum Technologies, Inc. CREE, Inc. Crossbar, Inc. Crystal IS, Inc. CyDex Pharmaceuticals, Inc. CytomX Therapeutics, Inc. CytoVas, LLC Dataware Ventures, LLC 

Diagnostics for All (DFA) 
Directed Vapor Technologies International, Inc. 
DoseOptics, LLC 
Dysonics Corporation 
ECM Technologies, LLC 
Eden Park Illumination, Inc. • eFFECTOR Therapeutics • Emotient • Emu Solutions Inc. • EpiBone, Inc. • Epicrop Technologies, Inc. • EPIR Technologies • Eucalyptus Systems • FAST Biomedical ■ FastBridge Learning, LLC ■ FluGen, Inc. ■ Food Chain Safety ■ FORGE Life Science ● framergy™ ■ FreshAir Sensor LLC ● Galaxy Diagnostics, Inc. ■ gel-e Life Sciences ● Gemstone Biotherapeutics, LLC · Genentech, Inc. · General Sentiment · Genocea Biosciences · Genomatica, Inc. · Genome Profiling, LLC · GeoVax Labs, Inc. · Google Inc. · GPB Scientific, LLC · Graphene Frontiers Ground Fluor Pharmaceuticals, Inc. Guavus Inc. HaloSource, Inc. Hexatech, Inc. Hiperwall Inc. HistoSonics, Inc. Hummingbird Nano Inc. HylaPharm iCardiac Technologies IDx, LLC Image Sensing Systems, Inc. ImagineOptix Immersive Touch ImmuneWorks ImmuNext Infinity Pharmaceuticals Inhibikase Therapeutics, Inc. InkTank Integrated DNA Technologies (IDT), Inc. Integrated Genomics IntelliCyt Corporation InterSeeder Technologies, LLC iRobot Corporation Itaconix Corporation J.A. Woollam Co., Inc. KAI Pharmaceuticals Kapteyn-Murnane Laboratories Inc. Kionix, Inc. Klogene Therapeutics, Inc. Kolltan Pharmaceuticals, Inc. Koning Corporation Language Weaver & LI-COR Biosciences & LineRate Systems, Inc. & Liquid Biotech USA, Inc. & Liquid Light & LiquiGlide, Inc. & Lodo Therapeutics Corporation & Lycera Corp & Lyncean Technologies, Inc. M3 Biotechnology MacuCLEAR, Inc. Maroon Biotech Melanovus Oncology Mersive Technologies MesoScribe Technologies Inc. Metamagnetics Inc. Mobitrac, Inc. Modulated Imaging, Inc. Molecular Imaging, Inc. Molecular Imprints, Inc. Momenta Pharmaceuticals, Inc. Moterum, LLC Myriad Genetics, Inc. Nabsys Nanofiber Solutions™ Nanopharma Technologies, Inc. NanoPhotonica NanoSonic, Inc. Nanosys, Inc. Natura Therapeutics, Inc. Naurex Inc. NemaMetrix Inc. Network Perception Nexgenia, Inc. NimbleGen Systems, Inc. Novesentis Novobiotic Octagen Corporation OmniSpeech, LLC ONY, Inc. Open Water Power, Inc. Orbital ATK Inc. Organovo Holdings, Inc. OrthoAccel Technologies Inc. Pacific Biosciences Paper Battery Company Personalis, Inc. PhageTech, Inc. Pharmacyclics Pharmasset, Inc. Phoebus Optoelectronics LLC PhotoniCare, Inc. Physcient, Inc. Picarro, Inc. PLS 3rd Learning Polyera Corporation Praxis Biologics Preora Diagnostics Inc. Promentis Pharmaceuticals Inc. Prommune, Inc. Protea Biosciences. Inc. Psikick O-State Biosciences, Inc. Quantitative Radiology Solutions, LLC Quantum Signal, LLC RainDance Technologies, Inc. Reactive NanoTechnologies, Inc. RemoteReality RightCare Solutions, Inc. SAGE Therapeutics Sample6 Technologies Sand9 Saneron-CCEL Therapeutics, Inc. SAS Science Take Out Scipher Semma Therapeutics Semprius Senomyx, Inc. Sensorygen, Inc. Sharklet Technologies, Inc. Silatronix Sinmat SLIPS Technologies, Inc. SOAIR, LLC Solarmer Energy, Inc. SomaLogic, Inc. SoundCure Spheryx, Inc. Spin Transfer Technologies Stasys Medical Corporation Steady State Imaging, LLC Stratatech Sun Microsystems, Inc. SunPower Corporation SynchroPET Inc. Syntermed, Inc. SyntheZyme Tableau Software TAG Optics Inc. TerraCOH, Inc. TetraLogic Pharmaceuticals TetraVitae Bioscience Therametric Technologies, Inc. Thermal Expansion Solutions, LLC ThermoAnalytics, Inc. Tivorsan Pharmaceuticals TomoTherapy Incorporated Tonus Therapeutics Topera, Inc. Trak Surgical, Inc. Transgenex Nanobiotech, Inc. Transphorm Transposagen Biopharmaceuticals, Inc. Tri Alpha Energy Inc. Triangle Pharmaceuticals Tribogenics TriFusion Devices Tule Technologies LLC TYRX, Inc. Universal Cells, Inc. Universal Display Corporation Vaccinex, Inc. Valtari Bio Inc. Verenium Corporation Veriflow VGX Pharmaceuticals Virent, Inc. Virtual Incision Corporation Virtually Better, Inc. Vorbeck Materials, Inc. Watchstander Wellness & Prevention Inc. Wisegene WiTricity Corporation Xenogen Xerion Advanced Battery Corp. Zymetis, Inc.



## **High-Quality Jobs**

#### U.S. bioscience industry outperforms the total private sector in creating well-paid, skilled jobs

	Bioscience Industry	Total Private Sector
Percent Employment Change (2001-14)	9.7%	5.4%
Percent Change in Real Average Annual Wages (2001-14)	19%	6%
Average annual wage (2014)	\$94,543	\$51,148



**ECONOMICS** 



## LOOKING FORWARD: CHALLENGES AND OPPORTUNITIES

Sustaining research and discovery in the U.S.



## **New Opportunities**

#### With recent breakthroughs, there are:

- -More ways than ever to study human health
- More methods and strategies for developing new therapies
- New technologies
- CRISPR/Cas gene editing
- 3D bioprinting

- New fields of research
- Human microbiome
- Cancer vaccines















The National Institutes of Health (NIH) is the nation's primary medical research agency. More than 80% of its funding is distributed through competitive grants to investigators around the country



### The U.S. is Failing to Keep Pace OUTLOOK with Growing Foreign R&D Investments







### A New Path Forward

OUTLOOK

#### First steps toward restoring federal science budgets:

FY 2016 In both years, Congress increased the NIH budget
& 2017\* by \$2 billion, allowing NIH to award more research grants

FY 2018\* Congress increased the NIH budget by \$3 billion!

**FY 2019** Congressional champions for biomedical research aim to keep the momentum going with another \$2 billion increase

\* Including targeted funds from the 21<sup>st</sup> Century Cures Act

Continued growth will support more research to improve the nation's health and quality of life



## **Take Action!**

#### Get the word out!

- Contact your member of Congress
  - Describe why research is important to you (and your state)
  - Ask them to support increases to federal research budgets
- -Write a letter to your local newspaper
- Tweet about science funding
- -Volunteer at a local science museum

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