Principles for National Innovation Success

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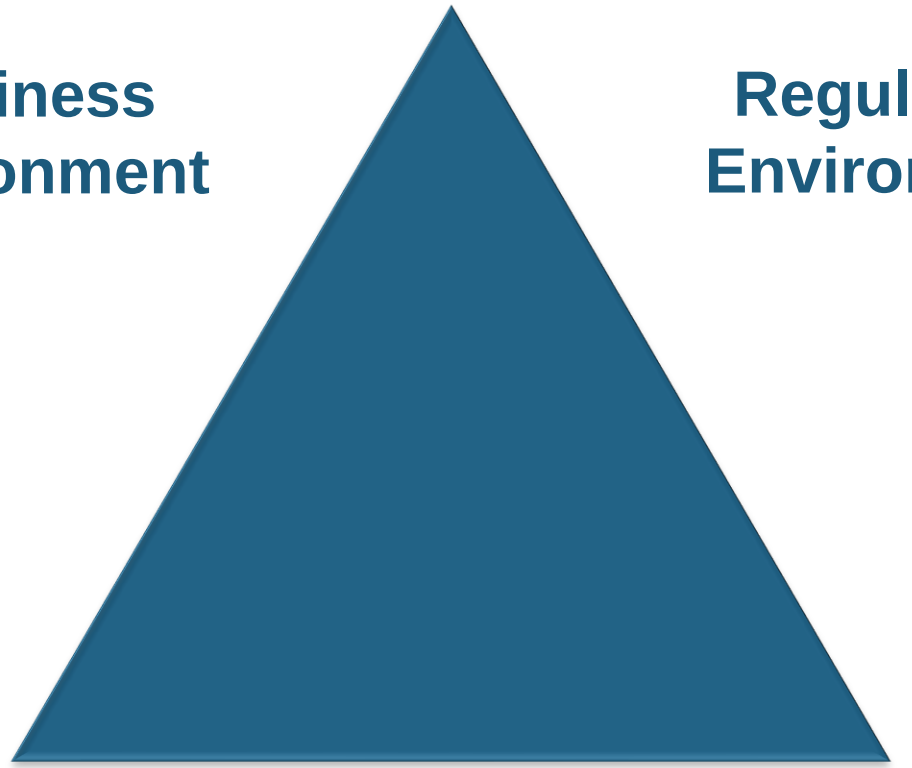
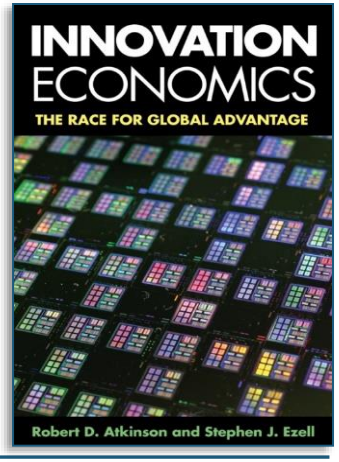
About ITIF

- The world's leading science and technology policy think tank.
- Supports policies driving global, innovation-based economic growth.
- Focuses on issues at the intersection of technology innovation and public policy across several sectors:
  - Innovation and competitiveness
  - IT and data
  - Telecommunications
  - Trade and globalization
  - Clean energy, manufacturing, life sciences, and ag biotech



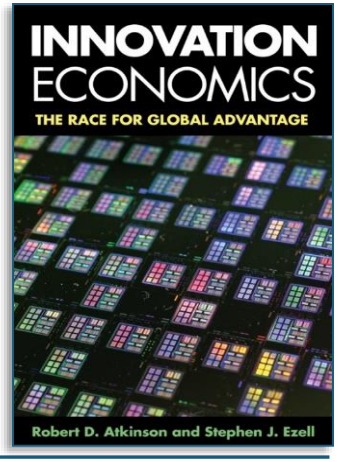
Get the "Innovation Triangle" Right





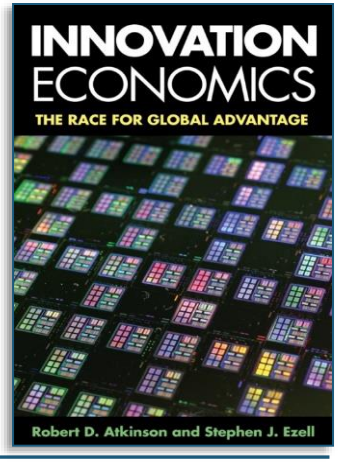
Business Environment

1. High levels of entrepreneurship.
2. Access to risk/venture capital.
3. Embrace dynamic churn and change (e.g., creative destruction).
4. Cultural willingness to experiment and take risks.
5. Strong management skills in enterprises.



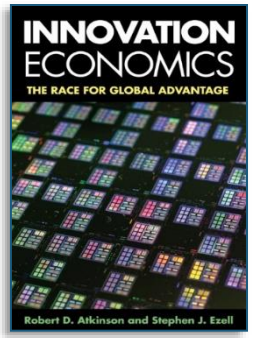
Regulatory Environment

1. Transparency and rule of law.
2. Protection of property rights (including IP).
3. Ease of starting a business.
4. Pro-competition regulatory policies.
5. Flexible labor policies.

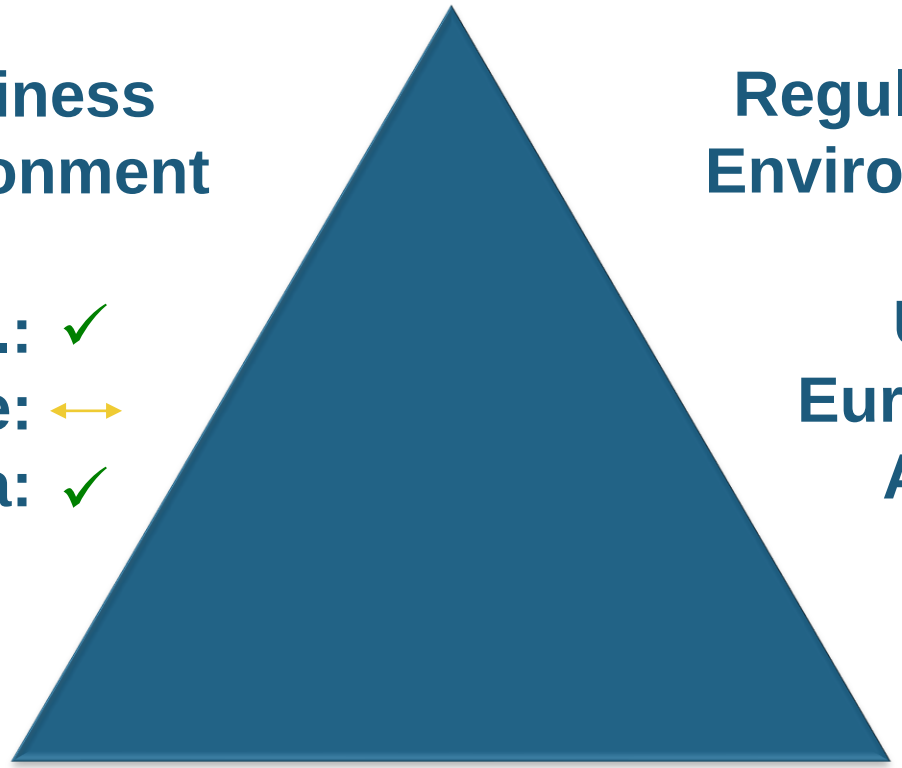


Innovation/Technology Policy Environment

1. Funding for research, especially commercially oriented research.
2. Incentives to invest in R&D, capital equipment, and workforce training.
3. Universities strong not just in liberal arts but engineering.
4. Supporting technology transfer from academia to industry.
5. Strong STEM education system.



Get the "Innovation Triangle" Right



Business Environment

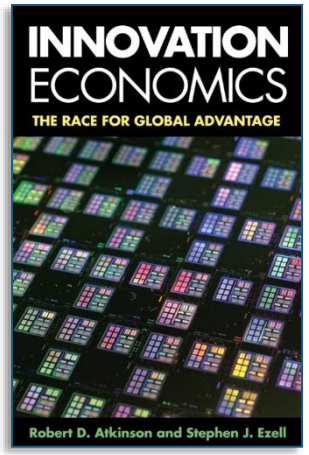
U.S.: ✓
Europe: ↔
Asia: ✓

Regulatory Environment

U.S.: X
Europe: X
Asia: ↔

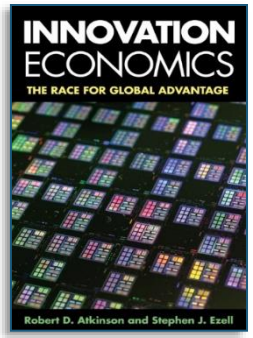
Innovation Policy Environment

U.S.: ↔
Europe: ✓
Asia: ↔



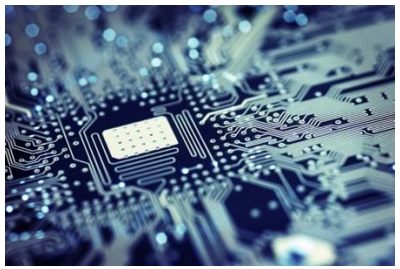
The Eight "I"s of Innovation

1. Inspiration
2. Intention
3. Insight
4. Incentives
5. Institutions
6. Investment
7. Information Technology (IT)
8. Intellectual Property (IP)



Innovation Industries Share Three Distinct Characteristics

1. They compete by inventing next-generation products or services.
2. They are characterized by very high initial fixed costs (e.g., R&D/design), but low marginal costs.
3. They fundamentally embody and depend on intellectual property.







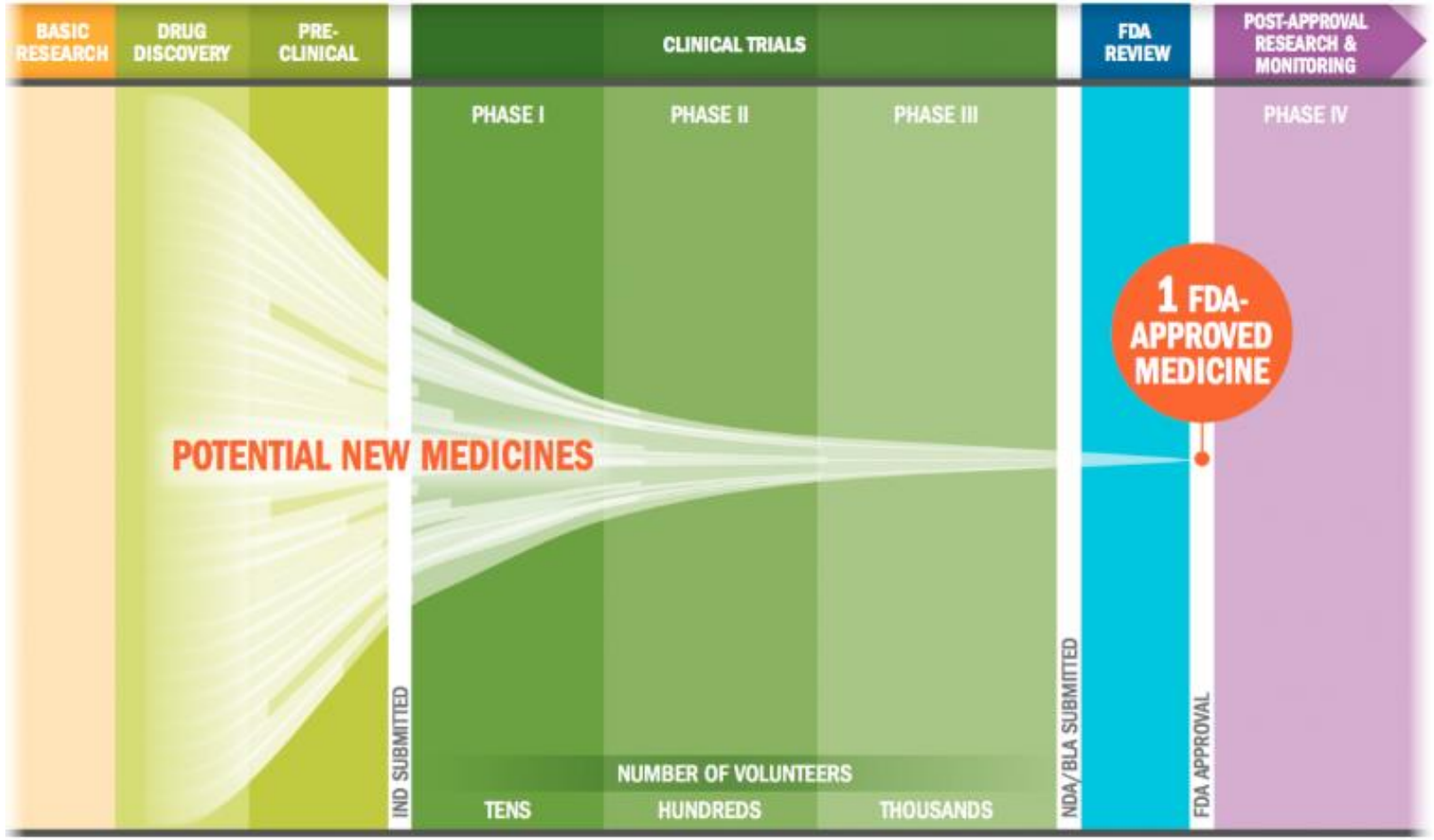
Necessary Conditions for Global Innovation to Flourish

1. Access to large markets (e.g., economies of scale).
2. No excess (e.g., non-market-based) competition.
3. No "forced localization requirements" that unnecessarily fragment global production systems.
4. Robust intellectual property rights and protection thereof.

IPRs Are Vital to Innovation, As They:

1. Create incentives for domestic innovation.

The Biopharmaceutical Research and Development Process



Source: PhRMA, *2015 Biopharmaceutical Research & Development* Report

IPRs Create Incentives for Life-Sciences Innovation

Ryan: “Patents provided incentives for biomedical technology entrepreneurs to make risky investments into innovation in Brazil.”

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Patent Incentives, Technology Markets, and Public–Private Bio-Medical Innovation Networks in Brazil

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Summary. — Contested is whether patent laws promote indigenous technology invention and innovation in developing countries. Brazil reformed its patent laws in 1996 to permit pharmaceutical product patents. Study of five post-patent law reform bio-medical technology invention and innovation projects in the state of Sao Paulo supports the propositions that patents provide incentives to Brazilian bio-medical technology entrepreneurs to make risky investments into innovation and that patents facilitate technology markets among public–private technology innovation networks, both Brazilian collaborations and North–South collaborations. Brazil enacted a technology law in 2005 that encourages public–private technology innovation through patent incentives and patent-facilitated technology markets.
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Key words — technology innovation, technology networks, patents, intellectual property rights, bio-medical technology, Brazil

1. INTRODUCTION

The 1994 World Trade Organization Agreement regarding Trade-Related Intellectual Property Rights obliges all WTO members to meet certain minimum standards of intellectual property law and enforcement and this means that scores of developing countries must provide higher levels of protection than has been their policy and practice in the past. Contested is whether patent laws promote indigenous technology innovation in developing countries. Runge (2006) rejects enclosure through intellectual property protections to promote technology progress in the North and says that the countries of the South have even more to lose from patent-based enclosure. Evans (2005) calls for an open science model for technology progress in developing countries. The development model should be non-proprietary and non-intellectual property-oriented. A developing country-based scholar says that stronger intellectual property rights in countries such as her Colombia will inhibit scientific research (Forero-Pineda, 2006). She argues that developing country scientists should participate in international professional networks to achieve science and technology advancement.

Though these scholars do not provide empirical evidence to support their arguments, they do ask important questions for development studies. Research universities, scholarly journals, and science conferences are the institutions that drive scientific progress (Pyenson & Sheets-Pyenson, 1999), but are these institutions sufficient to drive national technology innovation in developing countries (or developed countries, for that matter)? Technology innovation drives long-run national economic growth (Romer, 1986, 1990). Technology stasis leads to national economic stagnation; technology progress leads to national economic growth (Grossman & Helpman, 1991), so it is important to identify the institutional frameworks that best promote national technological innovation in developing countries. Do patent laws provide incentives to entrepreneurs in developing countries to make risky investments into technology innovation? Do patent laws facilitate the development of technology markets among public–private technology innovation networks? Do patent laws facilitate North–South technology innovation collaborations?

This is a study of invention and innovation in national technology development.

> “Invention is the first occurrence of an idea for a new product or process, while innovation is the first attempt to carry it out into practice. . . . While inventions may be carried out anywhere, for example in universities, innovations occur mostly in firms, though they may also occur in other types of organizations, such as public hospitals. To be able to turn an invention into an innovation, a firm normally needs to combine several different types of knowledge, capabilities, skills, and resources” (Fagerberg, 2005, p. 4).

Post-patent law reform bio-medical technology invention and innovation in Brazil is studied here. Brazil has a long-established pharmaceutical industry, but Brazilian bio-medical R&D traditionally meant that their public and private drug-makers reverse-engineered international pharmaceuticals so that they could manufacture and market medicines and vaccines innovated in the North to the Brazilian marketplace. Brazilian pharmaceutical makers were at liberty to reverse-engineer, manufacture, and market products under patent in the United States and Europe because pharmaceutical compositions were not patentable subject matter in Brazil. But, in 1996 the Cardoso administration led the Brazilian congress to amend the patent laws with Law No. 9,279 to allow for the patentability of pharmaceutical product patents so that, subject to procedural processes and some restrictions, only patent-holders or their licensees would be permitted to market under-patent medicines.

Bio-medical technology invention and innovation in the state of Sao Paulo is the focus of study. The state of Sao Paulo is the wealthiest state of Brazil, representing some 40% of the gross domestic product of the country, and is the main scientific and business center of the country. Federal research support and “the strong support by the state government makes the state

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IPRs Are Vital to Innovation, As They:

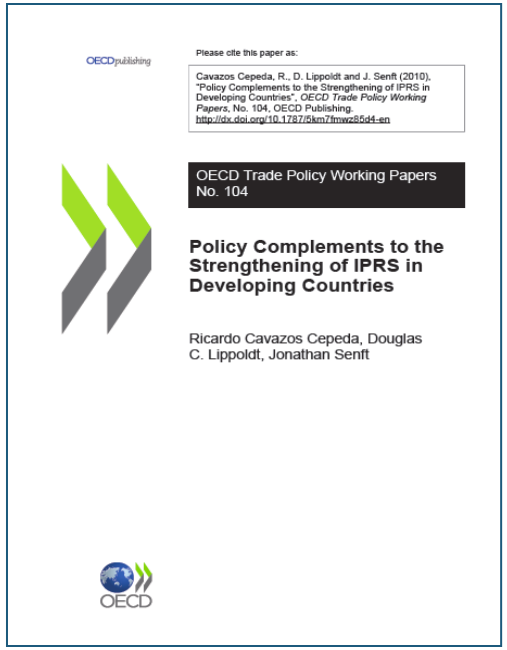
1. Create incentives for domestic innovation.
2. Enable a virtuous cycle of innovation.
3. Induce knowledge spillovers that help others to innovate.
4. Boost domestic levels of exports, R&D, and FDI.
5. Promote the international diffusion of technology, innovations, and knowhow.

Stronger IPRs Lead to Increased R&D, FDI, and Exports

- Strengthened patent, trademark, and copyright protections have a "statistically significant" association in relation to domestic R&D, inbound FDI, and exports.

- A 1% ↑ in: copyright protection = 3.3% ↑ in domestic R&D
  trademark protection = 1.4 % ↑ in domestic R&D
  patent protection = 0.7 % ↑ in domestic R&D

- A 1% ↑ in: copyright protection = 6.8% ↑ in FDI
  trademark protection = 3.8 % ↑ in FDI
  patent protection = 2.8 % ↑ in FDI



Source: OECD, "Policy Complements to the Strengthening of IPRs in Developing Countries"

Stronger IPRs Lead to Increased Technology-Intensive Imports

- Stronger patent rights associated with increased import of patent-intensive goods.

  (Foreign sources of technology account for over 90 percent of productivity growth in most countries.)

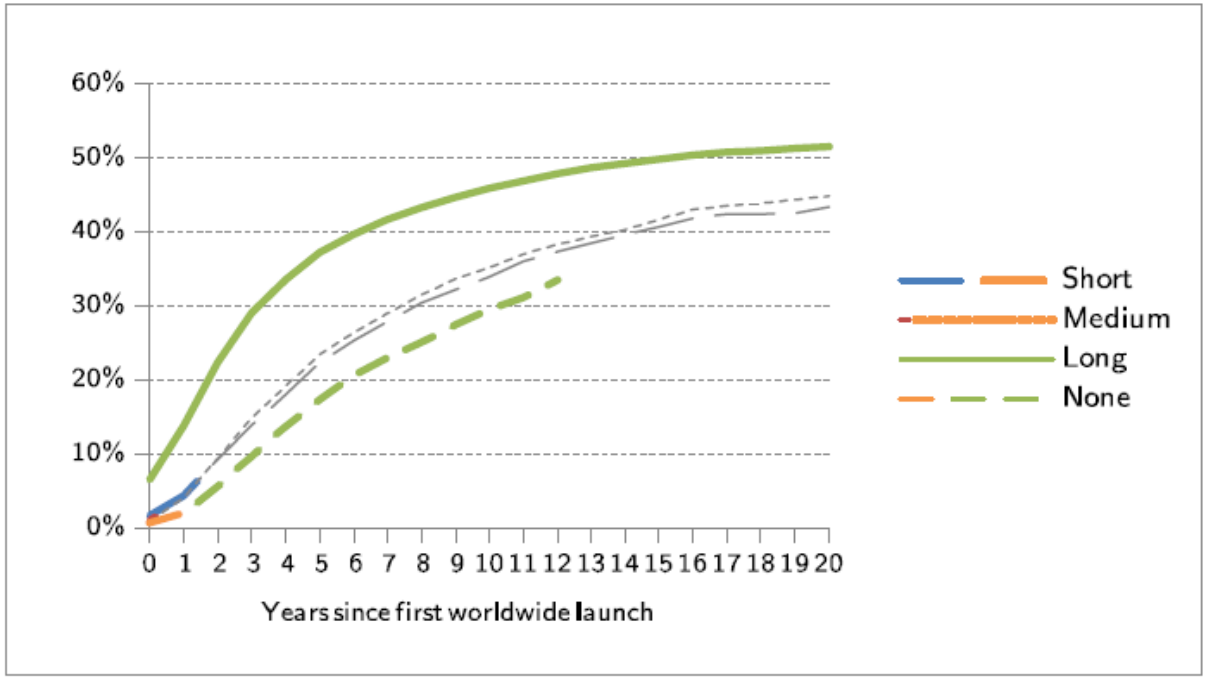
- Strengthening of patent rights strongly positively associated with increased pharmaceutical imports to developing countries.

- Probability of drug being commercially available lowest in countries with weak patent protection and weak/no market exclusivity.

Stronger Patent Rights Encourage Drug Launches

- Study of 642 new drug launches in 76 countries from 1983 to 2002.
- Finds speed/extent of diffusion strongly associated with countries' patent and price regulation schemes.
- Moving from a regime of no product patents to long product-patent terms reduces drug launch lags by 55%.

Fraction of Drugs Launched by Patent Regime



Source: Cockburn, Lanjouw, and Schankerman, *Patents and The Global Diffusion of New Drugs, 2016*

Innovation Policy Recommendations for Colombia

- ✓ Develop a national innovation and productivity strategy.
- ✓ Turn Colombia's universities into engines of innovation.
- ✓ Give universities rights to IP stemming from publicly funded R&D.
- ✓ Offer entrepreneurial leave programs for students and faculty.
- ✓ Introduce industry-university collaborative R&D tax credits.
- ✓ Create a "knowledge tax credit" that incents companies' investments in R&D, workforce training, and advanced plant and equipment.

Keys to Developing-Country Life-Sciences Innovation Leadership

1. Leverage country's unique strengths for biomedical innovation.
2. Recognize there are many opportunities to make value-added contributions throughout the drug development process (e.g., clinical trials).
3. Invest in and incentivize biomedical research.
4. Implment an efficient regulatory drug approval process.
5. Set a goal of being a "G20" life-sciences innovator.

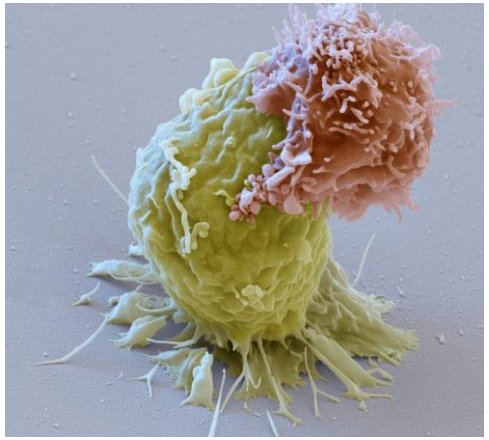


Image of a CAR-T cell (reddish) attacking a leukemia cell (green).

Muchas Gracias!

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