Accelerating innovation-based development in emerging economies: Open innovation, capacity building, assessments and informed strategic approaches.

Stanley P. Kowalski. J.D., Ph.D.
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1. **The evolution of innovative economies**
2. **The global innovation market of the 21st century**
3. **Assembling innovation**
4. **Examples**
5. **Rocketing ahead; building capacity**

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Progressive Innovation Trail:

Time honored professorial paradigm for the stages of evolution in intellectual property and innovative economic development.

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Progressive Innovation Trail:

(Painstaking gradual) Stages include:

- ✓ Copying
- ✓ Reverse Engineering
- ✓ Imitation
- ✓ Knock-offs
- ✓ Low level innovation
- ✓ Eventually higher level innovation

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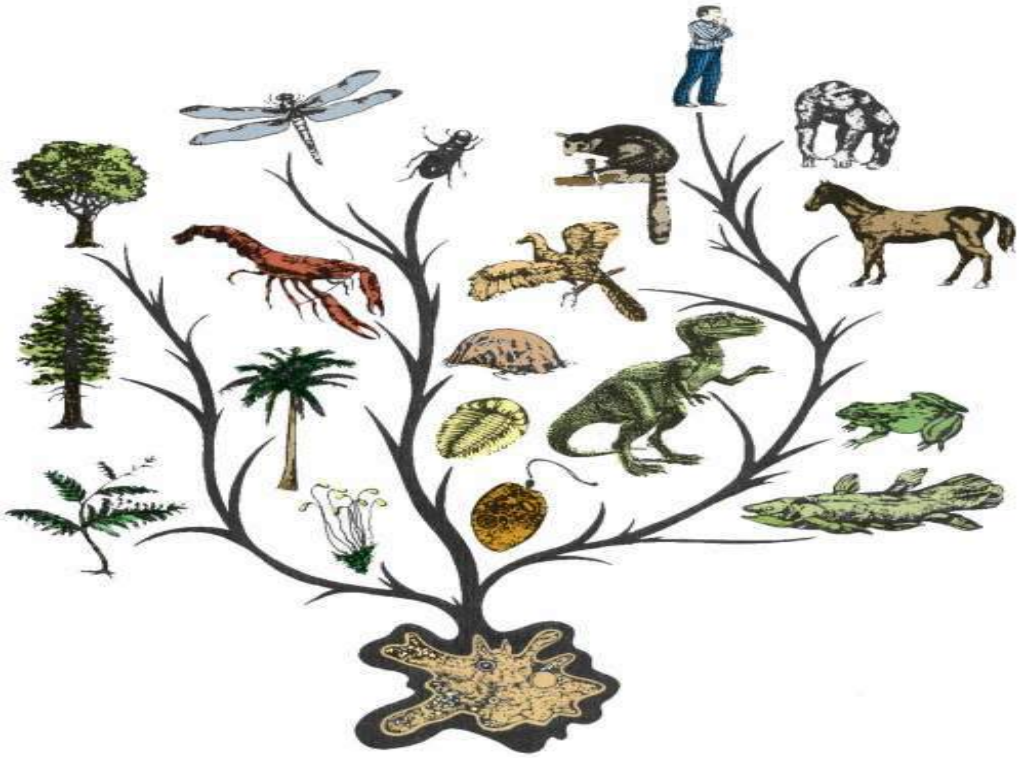
Progressive Innovation Trail: Precedential Models … agonizingly slow evolution … decades and decades and even more decades!



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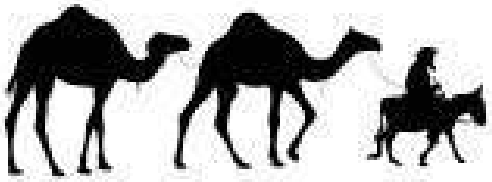

Progressive Innovation Trail:
Plods along, according to a "pre-set agenda", until a country is "ready" for IP and Innovation,

However …

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***P*rogressive**
***I*nnovation**
***T*rail is a ….**

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PIT

A problematic, precedential paradigmatic PIT, increasingly obsolete.

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Now in the 21st Century; accelerated strategic evolution is crucial for the emerging economies, to advance knowledge-based, innovation-driven development.

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Rapidly emerging global innovation marketplace

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TECHNOSPACE: GLOBALIZING TECHNOLOGY TRANSFER:

The term "technospace" is meant to capture the fact that international technology transfer is no longer merely unidirectional or bidirectional, but increasingly omnidirectional and global. Technospace is the planetary locus of economic opportunities for development and application of new technologies. Like cyberspace, market space (or, for that matter, petrospace or outer space), technospace can, and because it can, should be explored, occupied, or even conquered.

Professor William O. Hennessey, Franklin Pierce Ctr. for IP

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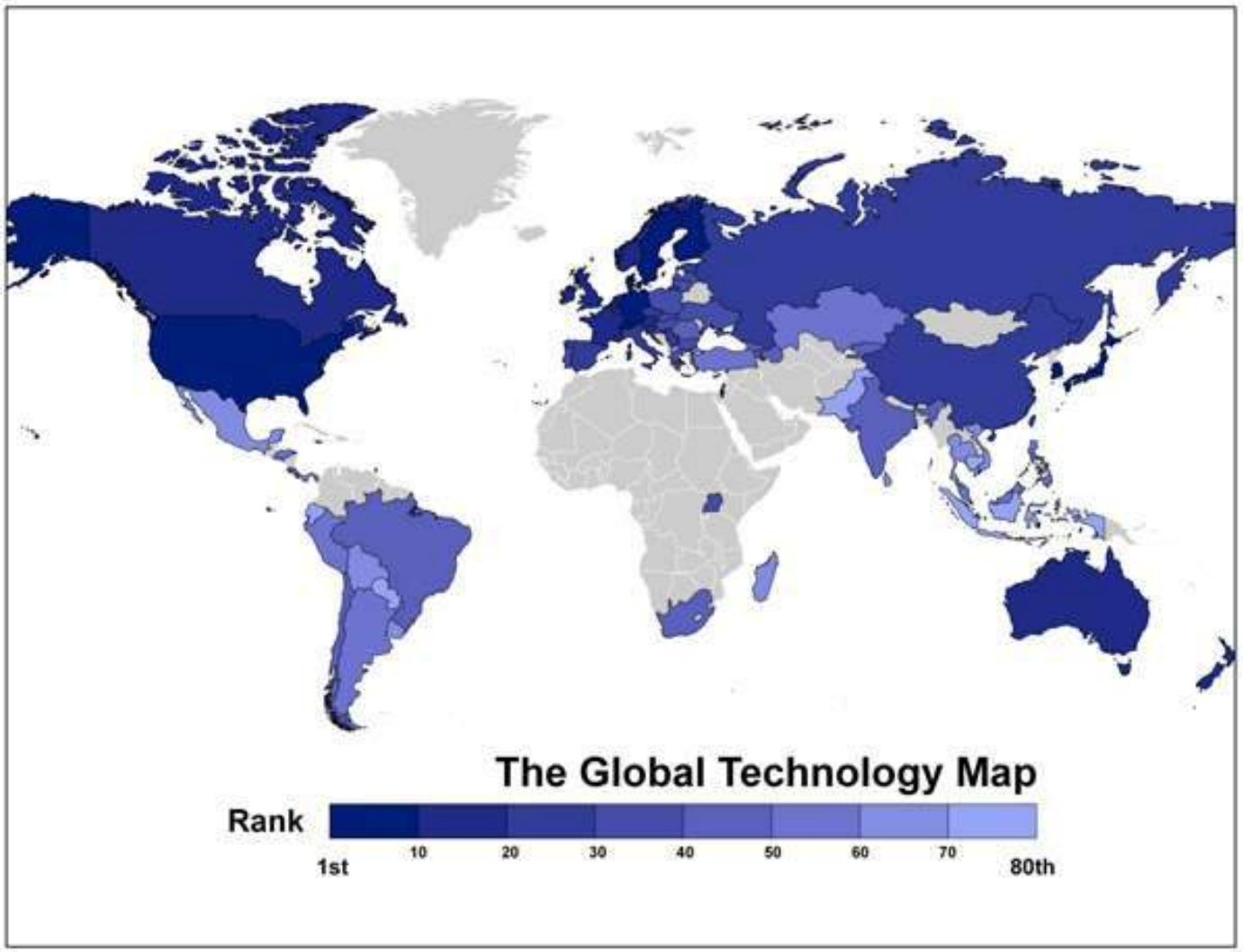

Rapidly emerging global innovation marketplace

Source: http://www.theatlanticcities.com/technology/2011/10/worlds-leading-nations-innovation-and-technology/224/

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Therefore …

Now, instead of PIT-iful slow progress, what we need is …..

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***R**apid **I**nnovation **S**upported **E**ntrepreneurial*

Development = RISE

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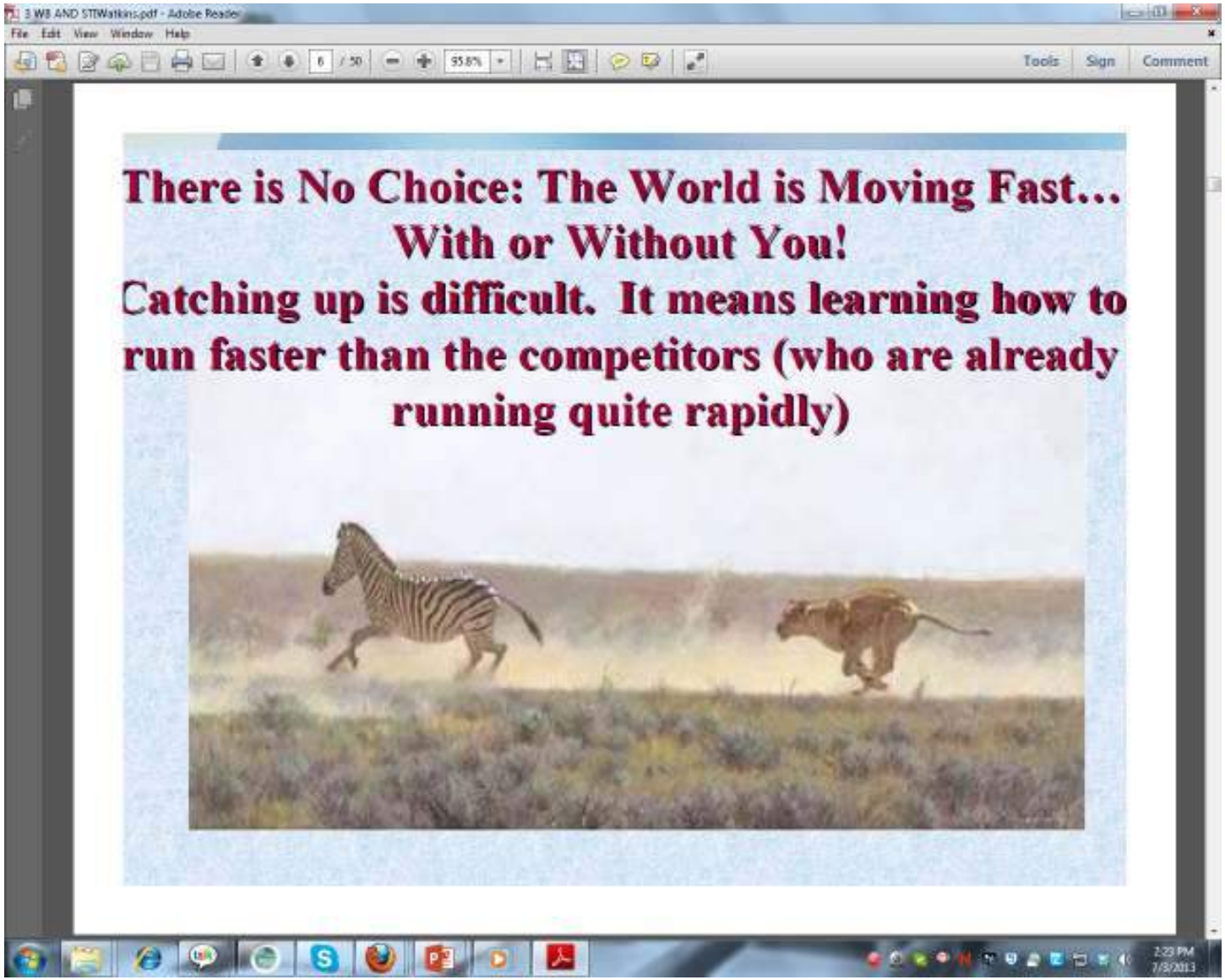
The time for action is now: the world is rapidly changing and catch up is crucial for the world's developing and emerging countries!



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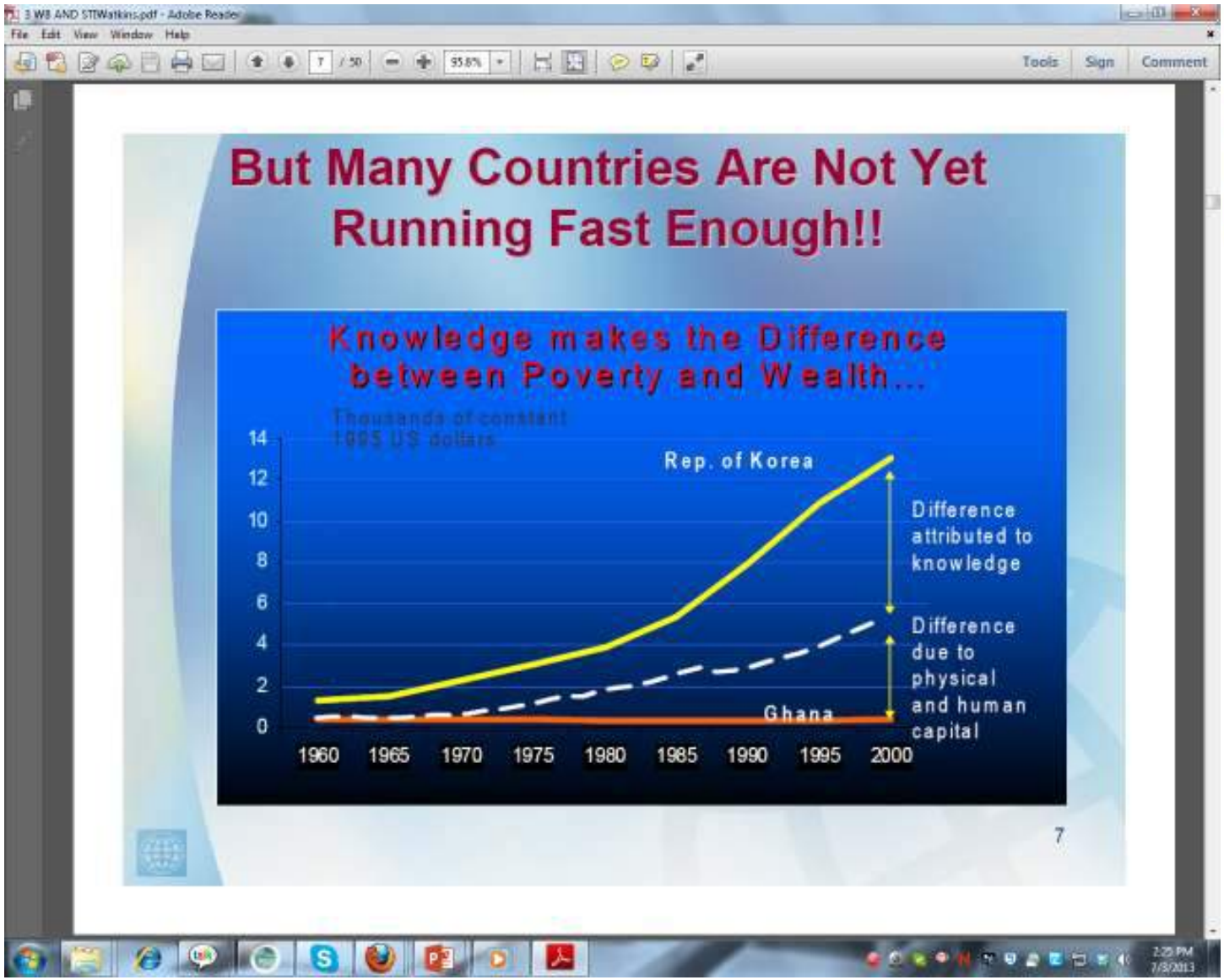
Courtesy Dr. Al Watkins, World Bank



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Courtesy Dr. Al Watkins, World Bank

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In the *<u>global innovation market</u>*, accessing, absorbing, assimilating, assembling and adapting innovation will be either accelerated, or obviated, based on the level of capacity: human capital and institutional infrastructure.

Intellectual Property (IP) Capacity Building: Crucial for Accelerated Development:

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- **Technology transfer**
- **Building partnerships in research and development**
- **Trust, cooperation, collaboration**
- **Capacity in IP is essential**
- **Capacity building is two-way, that is, reciprocal**
- **Not only about "getting" IP**
- **Part of the larger development perspective**

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The time-honored ways (of "capacity building") are no longer adequate:

- Workshops
- Whitepapers
- High-level Symposiums

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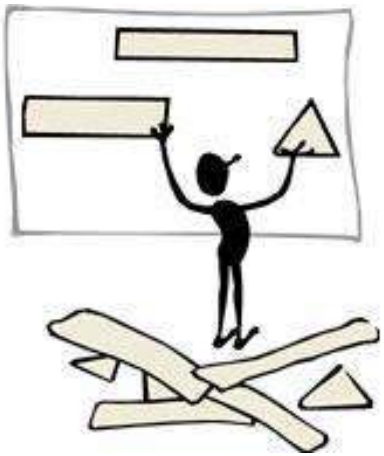
Creative approaches (for "IP management") are not sustainable development strategies:

- **Revisions (re-revisions) of Laws and Treaties (e.g. TRIPS, etc.)**
- **Novel IP Management Tactics (Open-source, IP Pools, Clearing Houses, IP shares markets)**
- **Delayed Compliance with Treaties, IP "Free Zones"**



PATENT FREE ZONE

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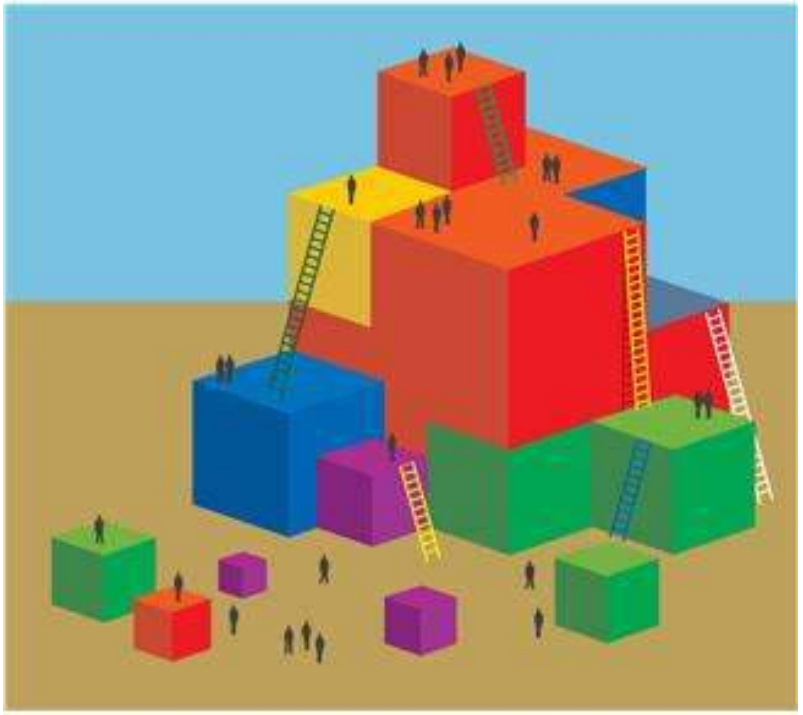
Global Community Development is now needed: International partnerships to advance IP management and tech-transfer capacity, accelerating access to crucial innovations, e.g., in health and agriculture



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***Global innovation market*:**

- **accessing,**
- **absorbing,**
- **assimilating,**
- **assembling and**
- **adapting**

  innovation.

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***Global innovation market*:**

Will be driven by an

Open Innovation System!

Open Innovation, the Basics
Open/Closed Models

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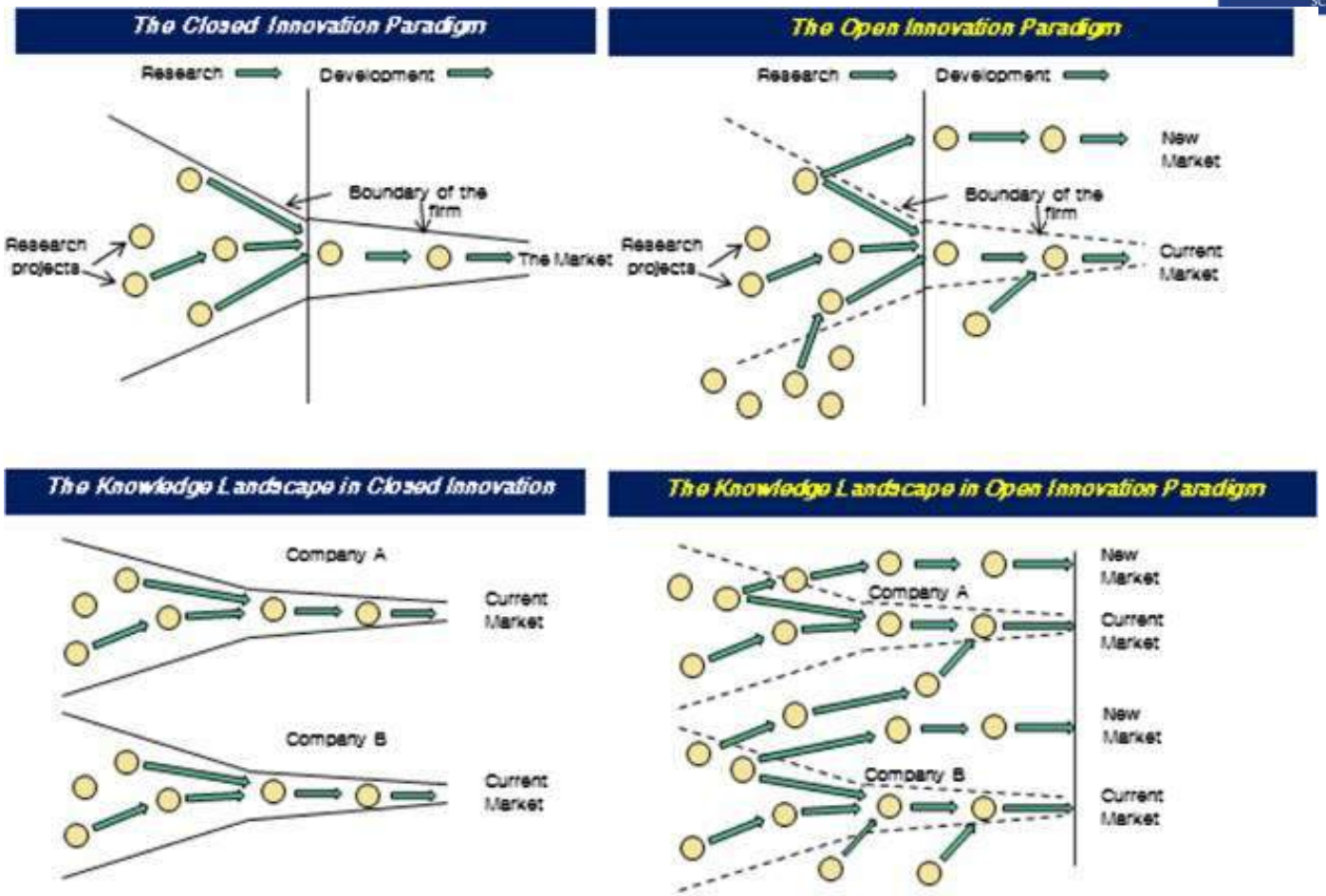

Source: Chesbrough (2006a), p. xxii, xxv, 31, 44.

Open Innovation Basics

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Closed innovation consists of a contained, ***straight and sequential*** line from basic and applied research to product development, manufacturing and sales.

Open innovation consists of ***networking*** with other companies, R&D facilities, ***interacting*** with start-up ventures, public research institutes, universities, external suppliers and ***sharing and accessing*** outside information and technology.

Open Innovation Basics

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Key aspects of Open Innovation:

- Networking
- Collaboration
- Entrepreneurship
- ***IP management***
- Global Vision
- ***Knowledge***
- Access to finance
- ***Access to information***

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Open Innovation Basics

Open innovation does not refer to free knowledge or technology. While "***open source***" refers to royalty-free technologies, ***open innovation*** refers to collaborative networking, and may still involve the (significant) payment of license fees for IP.

Open Innovation Basics

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In the emerging global knowledge economy, ***knowledge itself*** has become the key resource. Open innovation needs to be embedded in an overall business strategy that emphasizes the interchange of ideas, knowledge and technology in value creation.

Open Innovation Basics

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In the 21st Century, TTOs cannot expect to do it alone, as contained units.

They must connect to the global network of information, technology, innovation and product development.

An Integrated Global Innovation Network System

Intellectual Property Management and Open Innovation

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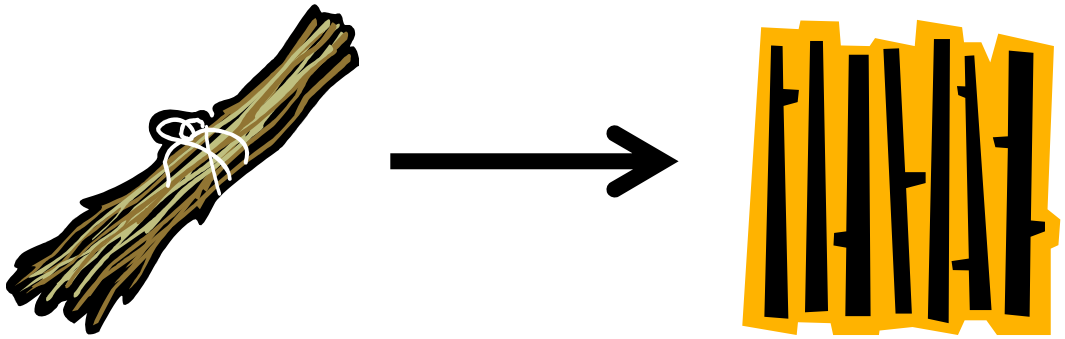
Think of IP in the context of IPR, as ***bundles of rights***: Patent owners can divide their bundle of rights not only into separate exclusive licenses to make, sell, and use the patented item, but also divide each of those into fields of use.



Intellectual Property Management and Open Innovation

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Companies engaged in open innovation organize licensing activities and strategic alliances for a pro-active intellectual property strategy that aims at sharing technologies rather than hoarding IP as a defense mechanism.

Information and Knowledge are Fundamental

The Way Forward
(Strategies, Tactics, Options)

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Example: Combining IPR from more than one organization. Synergy of IPR as both an ***Asset and a Tool*** ….

a **"silver hammer"** that must be combined with other IPR to realize value, via cross-licensing.

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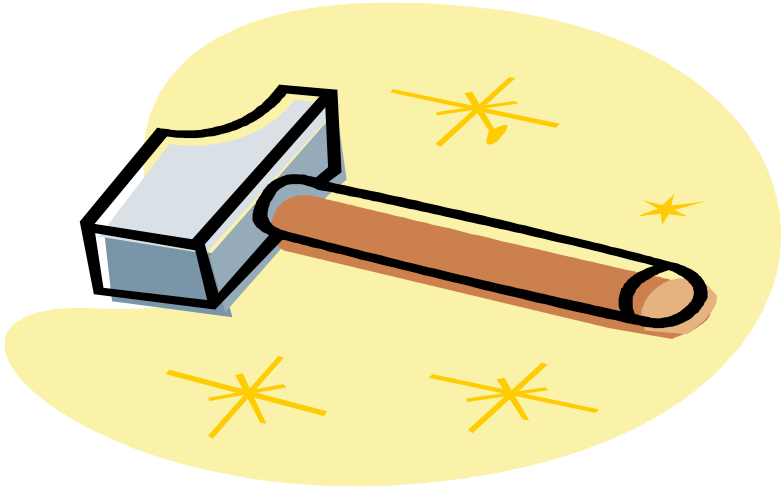
The Way Forward (Strategies, Tactics, Options)

IPR as both an ***Asset and a Tool***, a silver hammer:



The Way Forward
(Strategies, Tactics, Options)

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IPR as both an ***Asset and a Tool***, a silver hammer to combine with other TTOs IPR, a silver chisel:

The Way Forward
(Strategies, Tactics, Options)

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IPR as both an ***Asset and a Tool***, a silver hammer, and chisel, combined to drive innovation

The Way Forward
(Strategies, Tactics, Options)

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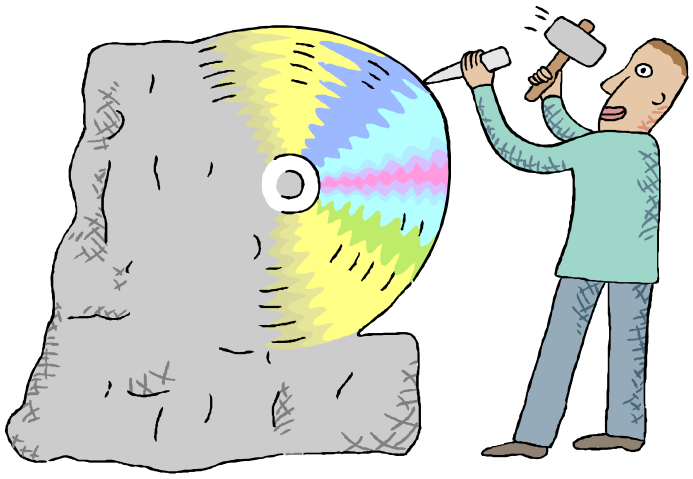
IPR as both an ***Asset and a Tool***, for product development



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The Way Forward (Strategies, Tactics, Options)

IPR as both an ***Asset and a Tool***, to build value

Open Innovation, the Basics
Open: Flow of Innovation

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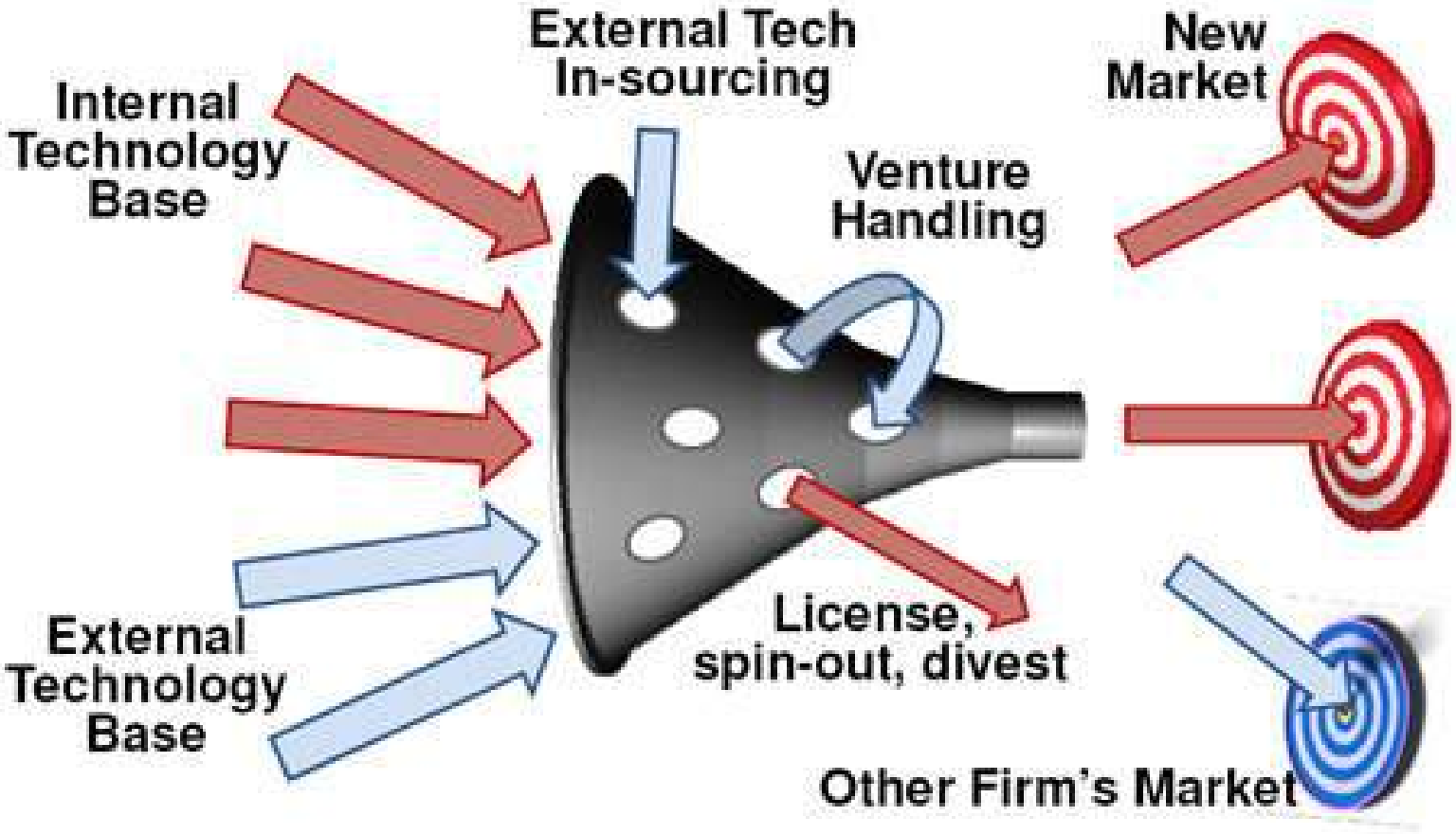

Open Innovation, the Basics
Open: Role of IP Management

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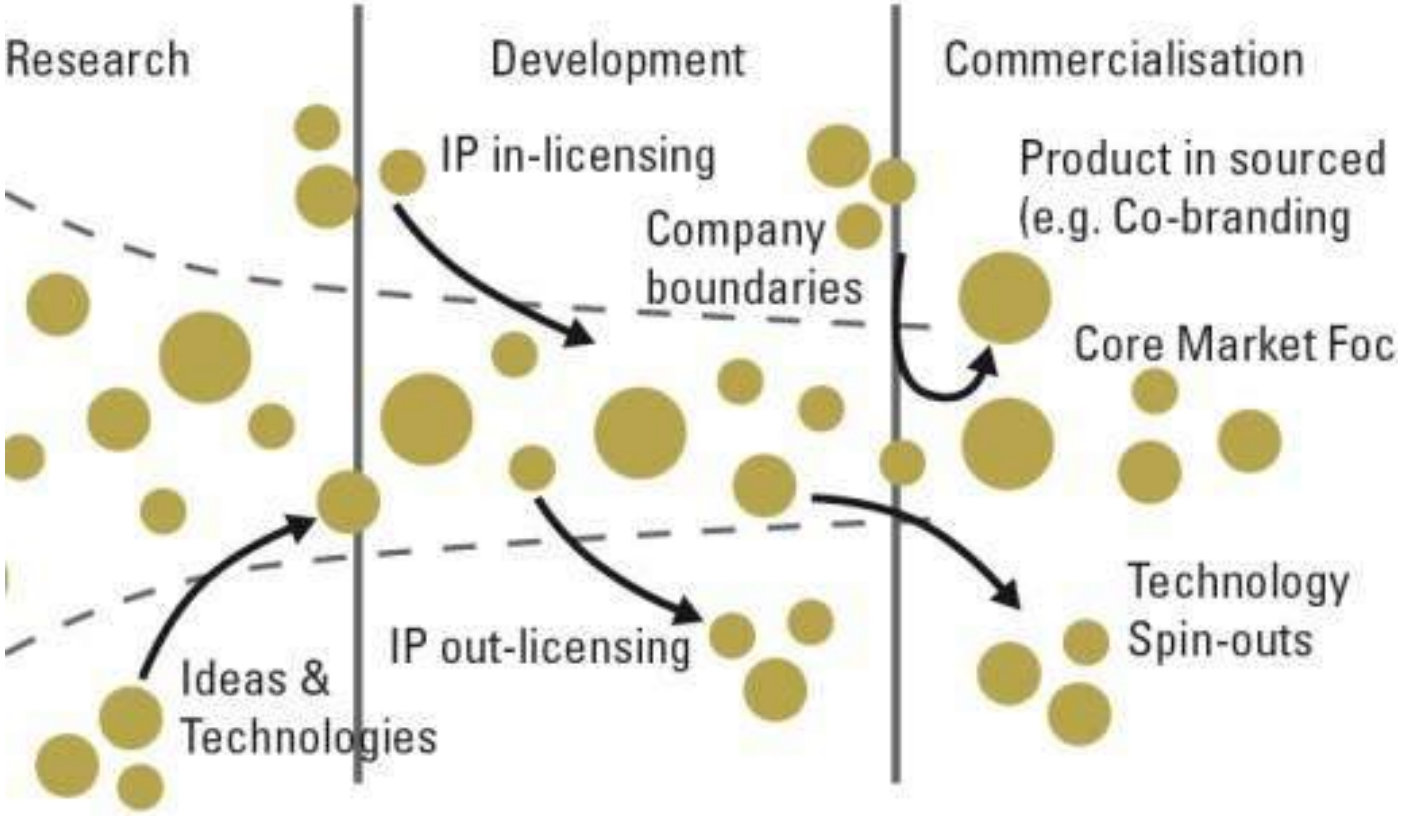

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To connect to the Global Innovation Market, bridges must be built, but first let's discuss …..

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Legos

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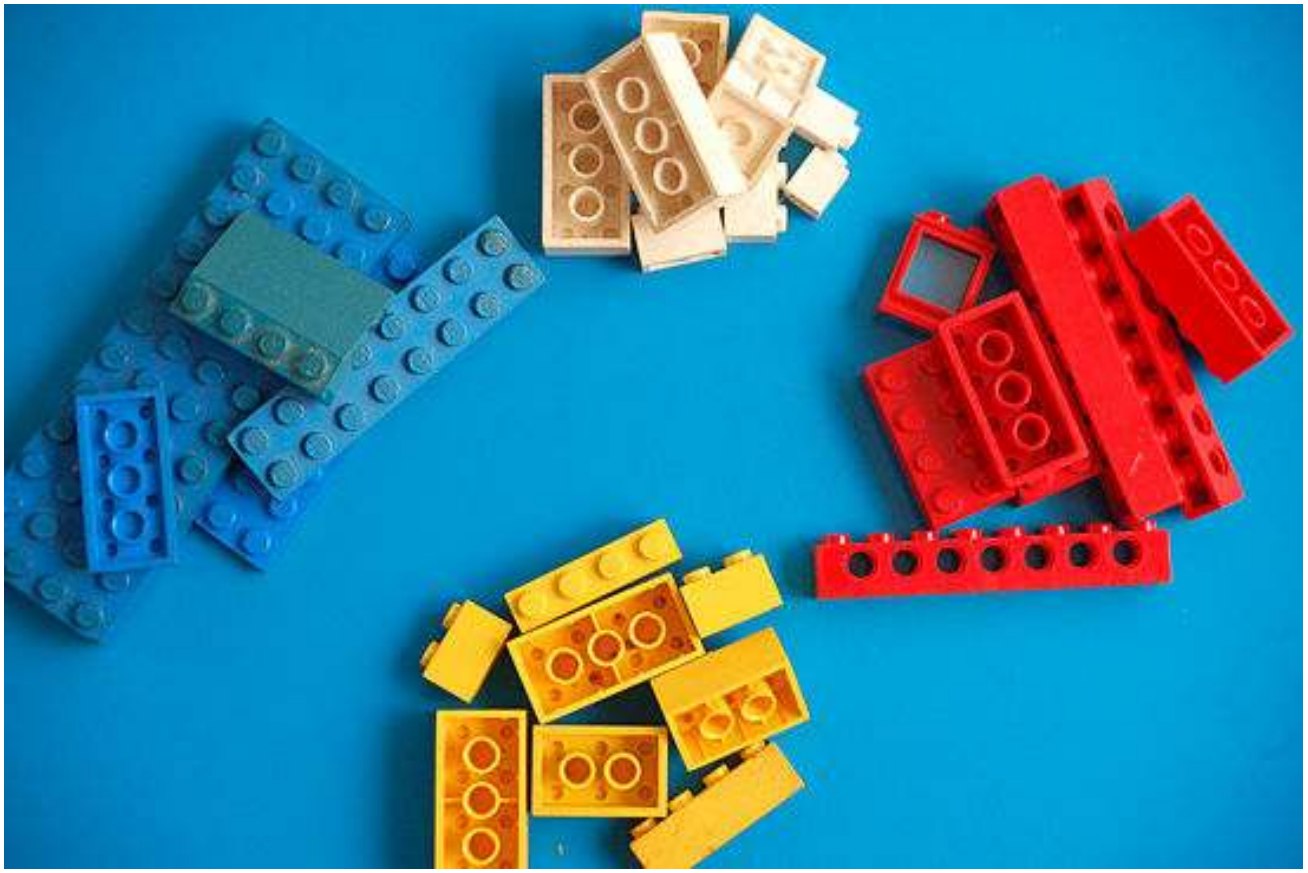
Owned by multiple entities.



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Pieces need to be accessed, adapted and assembled in order to accelerate innovation development.

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Two Real-world Examples of Open-Innovation, applied to advanced innovations in Health and Agriculture:

1) Dengue Fever Diagnostics

2) Golden Rice

Real World Example: Crucial Innovation in Health

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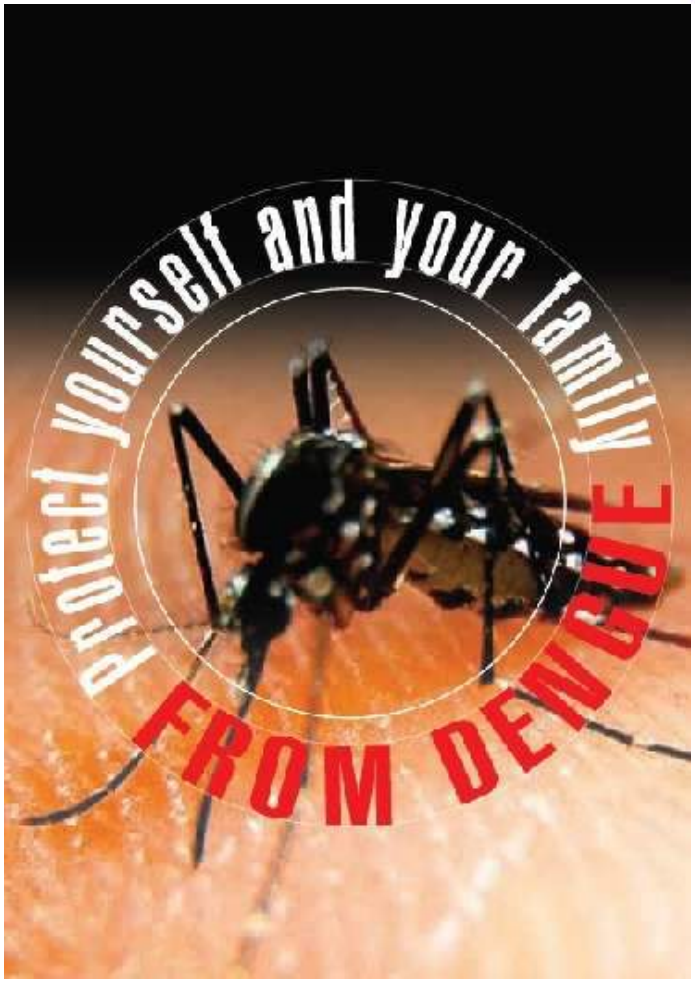
Dengue Fever Diagnostics and the *Global Innovation Market*



Dengue Fever Diagnostics and the *Global Innovation Market*

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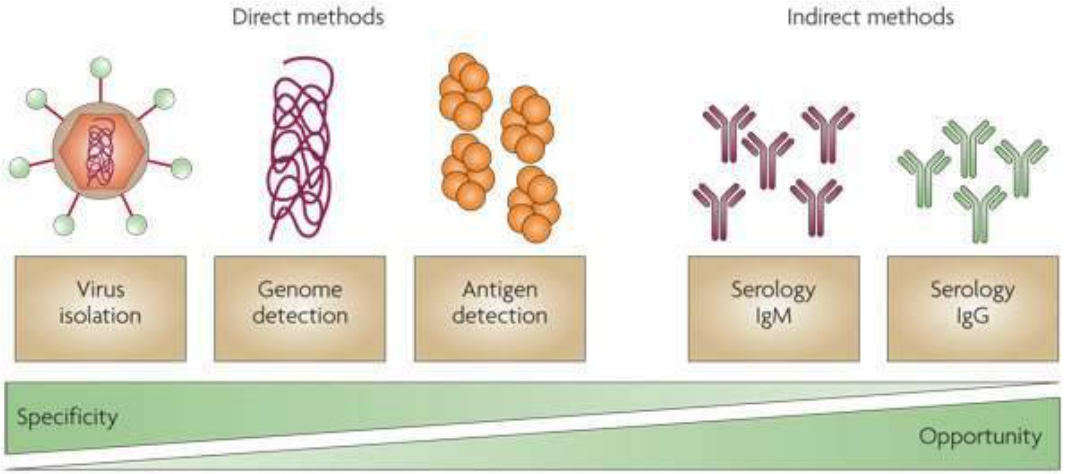
Dengue Fever Diagnostics and the *Global Innovation Market*



Dengue Fever Diagnostics and the *Global Innovation Market: Dengue in the Philippines, over 80,000 cases in 2012*

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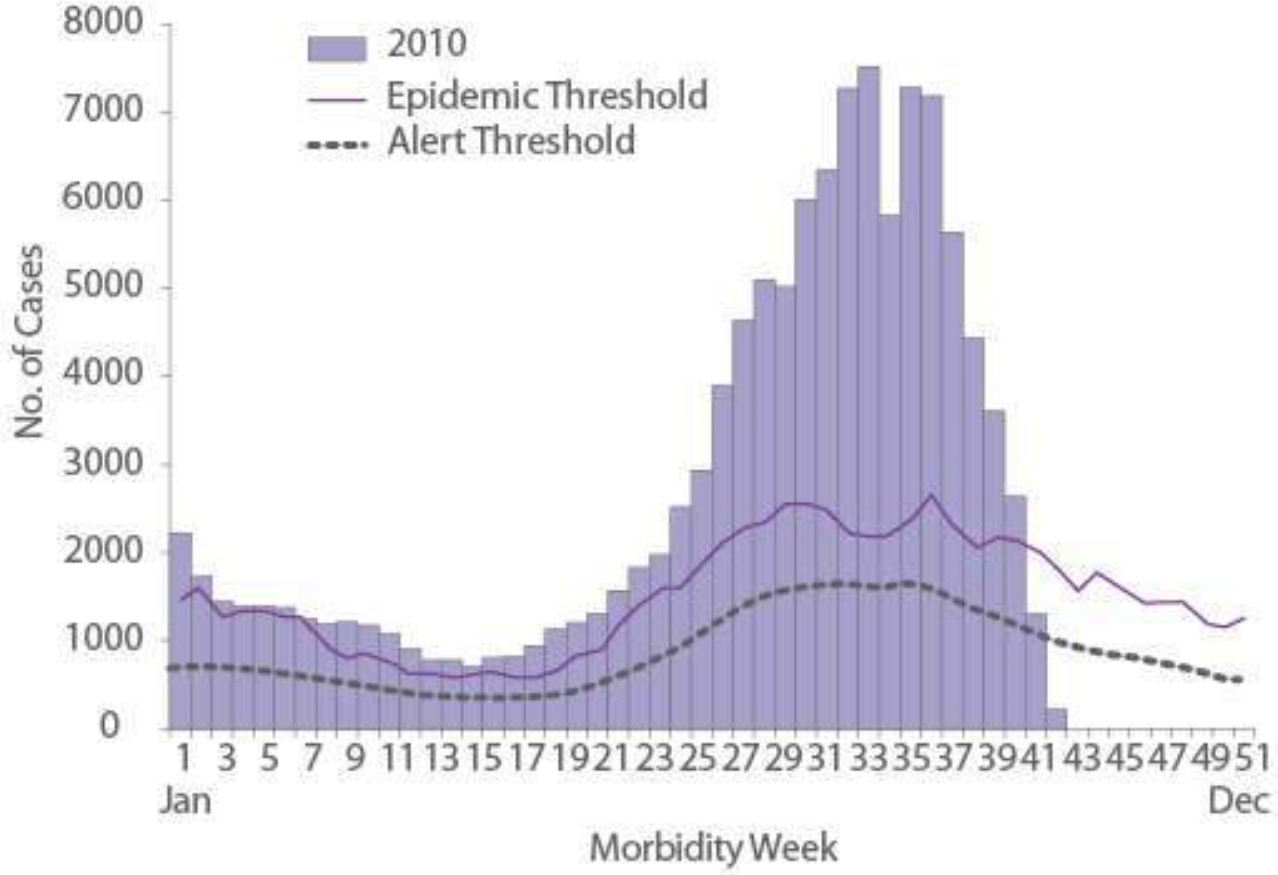

Dengue Fever Diagnostics and the *Global Innovation Market*

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Dengue fever (DF), a rapidly emerging global health threat, is caused by any of four closely related viruses (serotypes): dengue 1-4. Infection with one serotype does not protect against the others; sequential infections put people at greater risk for dengue hemorraghic fever (DHF), dengue shock syndrome (DSS). Dengue is transmitted by mosquitoes.

Dengue Fever Diagnostics and the *Global Innovation Market*

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About 2.5 billion people, or 40% of the world's population, live in areas where there is a risk of dengue transmission. Dengue is endemic in at least 100 countries in Asia, the Pacific, the Americas, Africa, and the Caribbean. The World Health Organization (WHO) estimates 50 to 100 million annual infections, including 500,000 DHF cases and 22,000 deaths, mostly among children (CDC).

Dengue Fever Diagnostics and the *Global Innovation Market*

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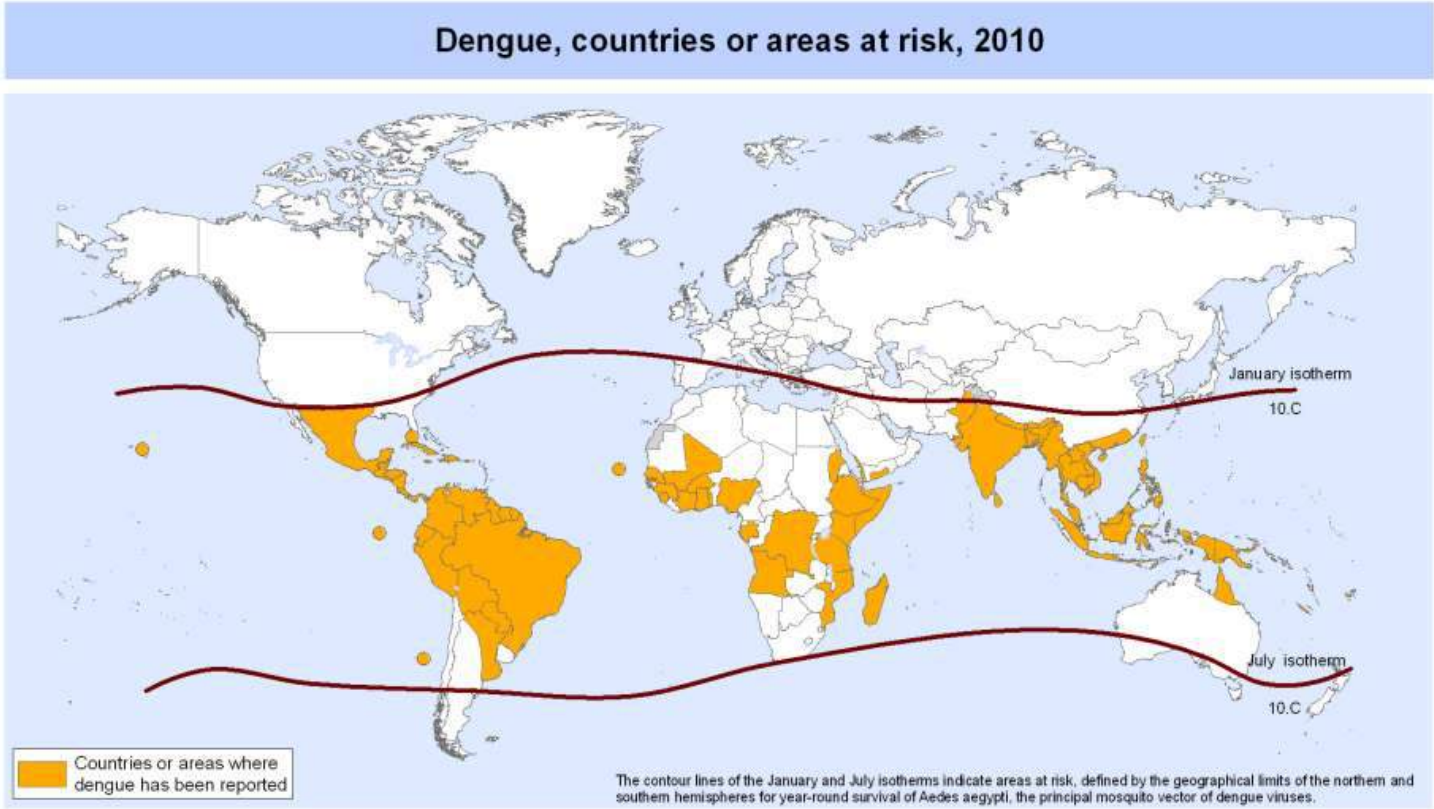

Dengue Fever Diagnostics and the *Global Innovation Market: Assembling the Technology, the Pieces*

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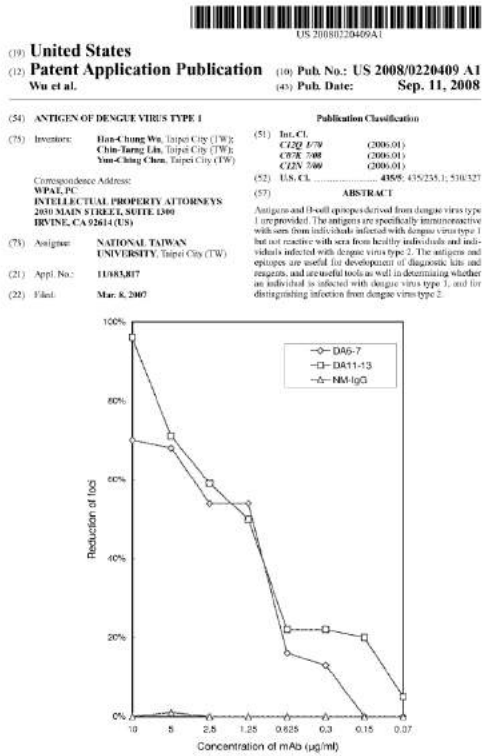
Dengue Diagnostic Patents:

1. Diagnostic Kit
2. Methods of Diagnosis
3. Compositions of Kits
4. ELISA
5. PCR
6. Luminescence Biosensors
7. Spectroscopy
8. Dengue Specific
9. *Flavivirus* Specific



US 20080220409A1

(19) **United States**
(12) **Patent Application Publication**
Wu et al.

(10) **Pub. No.: US 2008/0220409 A1**
(43) **Pub. Date: Sep. 11, 2008**

(54) **ANTIGEN OF DENGUE VIRUS TYPE 1**

(75) Inventors: **Hon-Chung Wu**, Taipei City (TW); **Chin-Tarng Lin**, Taipei City (TW); **Yun-Ching Chen**, Taipei City (TW)

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(73) Assignee: **NATIONAL TAIWAN UNIVERSITY**, Taipei City (TW)

(21) Appl. No.: **11/683,817**

(22) Filed: **Mar. 8, 2007**

Publication Classification

(51) Int. Cl.
C12Q 1/70 (2006.01)
C07K 7/08 (2006.01)
C12N 7/00 (2006.01)

(52) U.S. Cl. **435/5**; 435/235.1; 530/327

(57) **ABSTRACT**

Antigens and B-cell epitopes derived from dengue virus type 1 are provided. The antigens are specifically immunoreactive with sera from individuals infected with dengue virus type 1 but not reactive with sera from healthy individuals and individuals infected with dengue virus type 2. The antigens and epitopes are useful for development of diagnostic kits and reagents, and are useful tools as well in determining whether an individual is infected with dengue virus type 1, and for distinguishing infection from dengue virus type 2.

Dengue Diagnostic Patent Landscape Filing Trend

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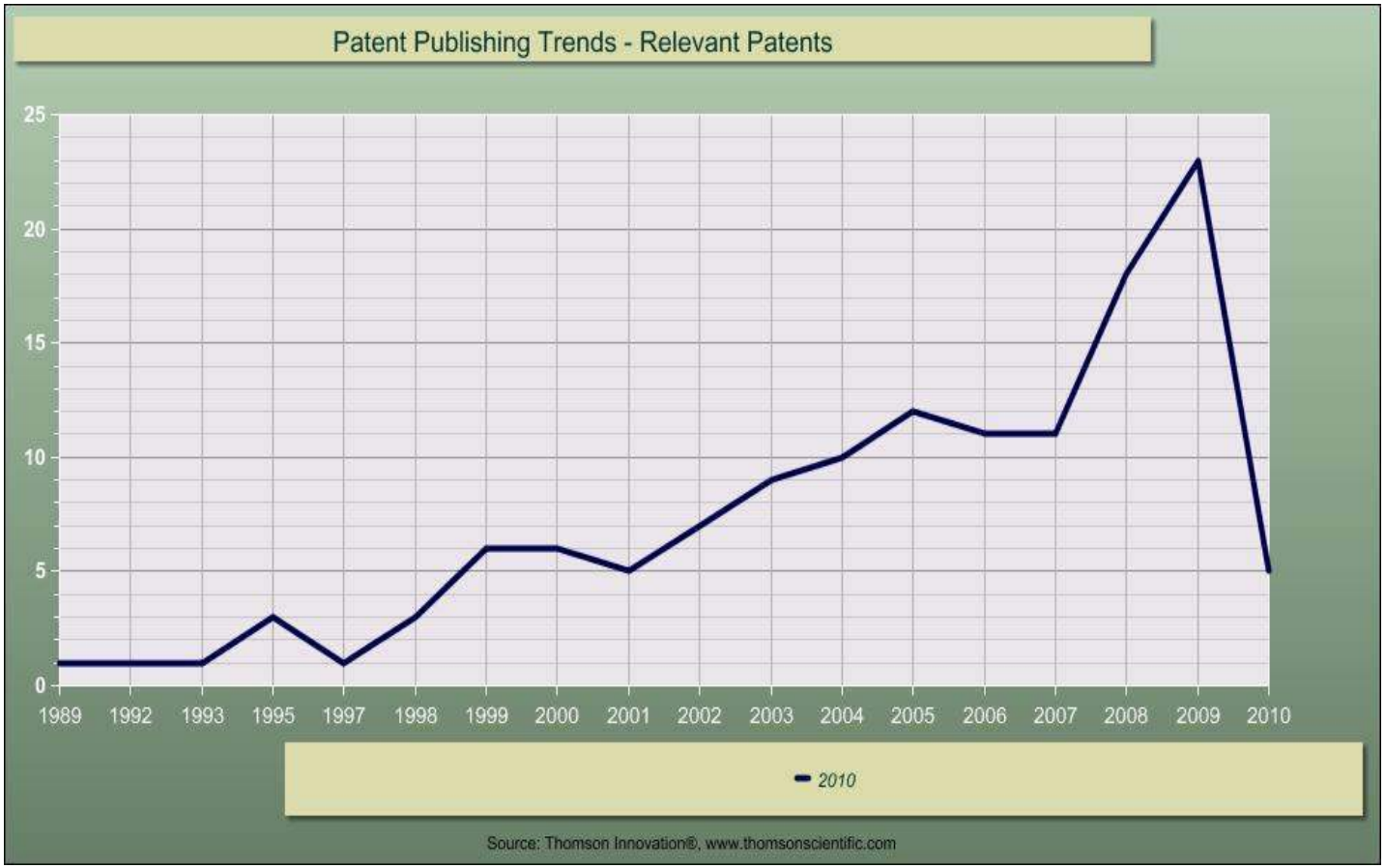

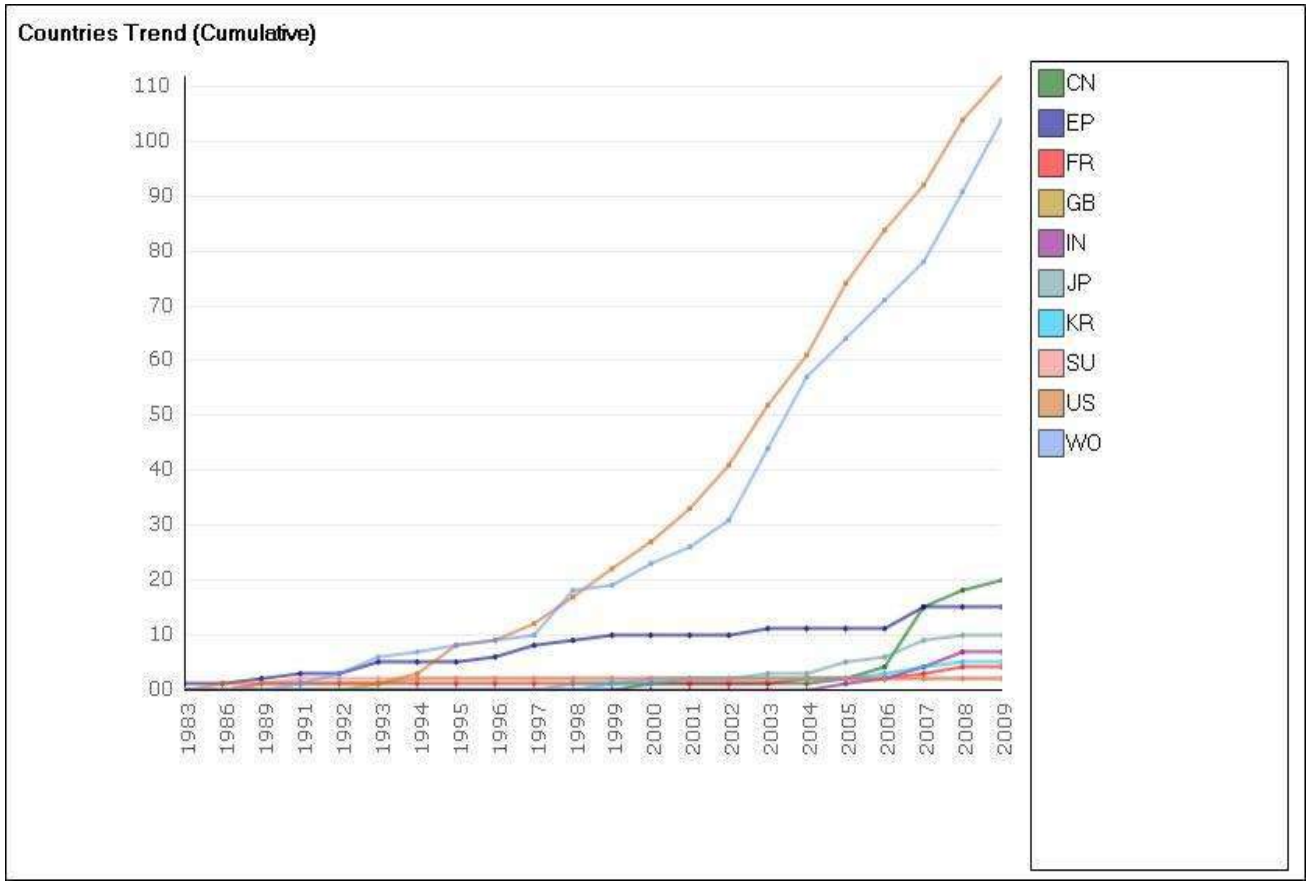

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Filing date of dengue diagnostic patent documents (290 families) in various jurisdictions (including WIPO/PCT and EPO) over 17 years. Patent filing increases in an exponential manner from 1992 in US and WIPO, with a steady increase in all jurisdictions since 2005 (Patent iNSIGHT Pro).

Who Owns Intellectual Property Rights for Dengue Diagnostics Technologies?

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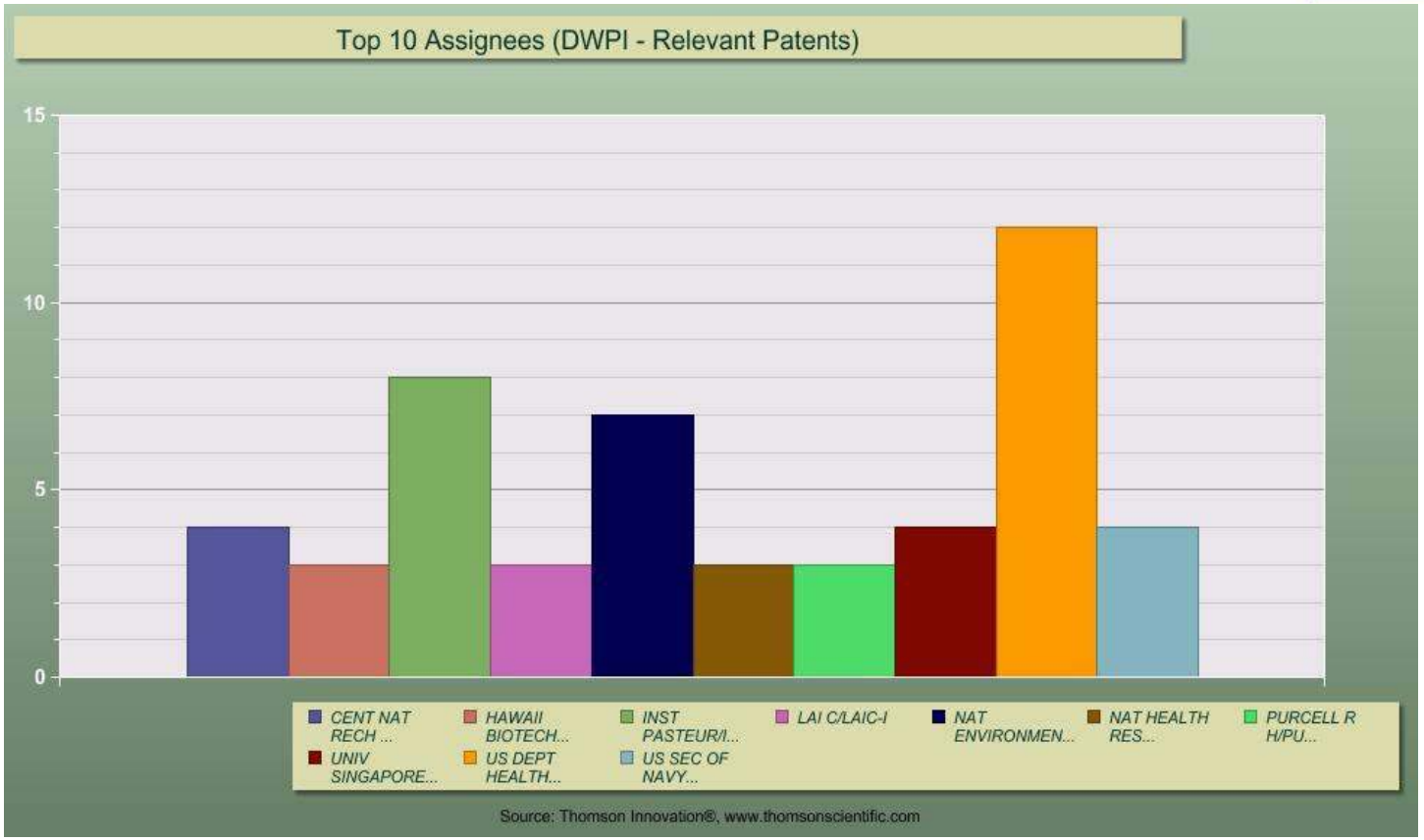

Top Assignees Relevant Dengue Diagnostic Patents

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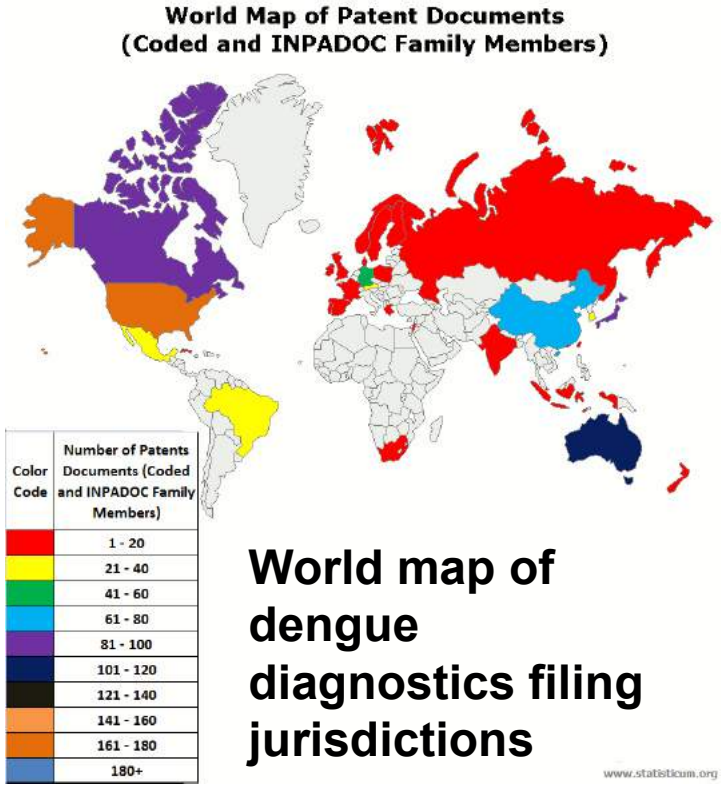
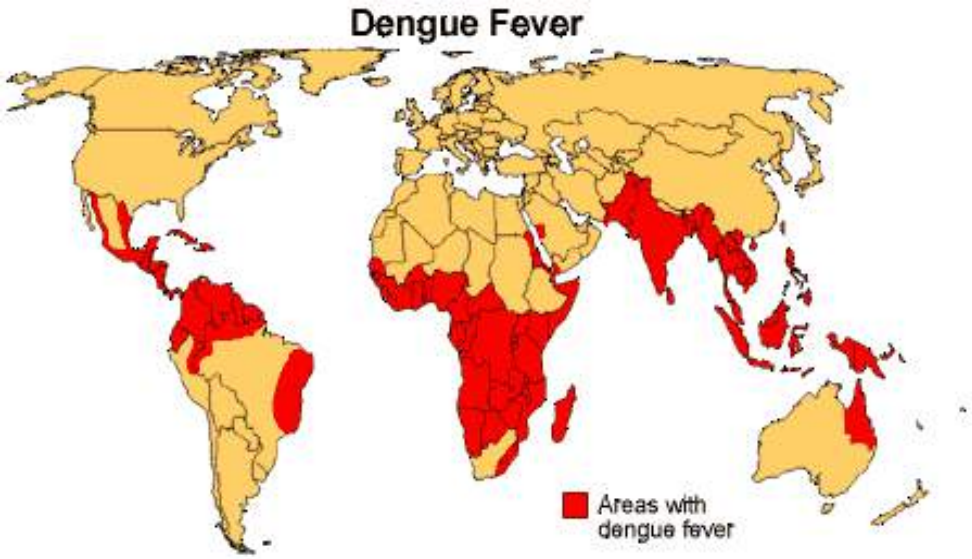


World map of dengue diagnostics filing jurisdictions

290 patent families, global filing trend



Worldwide Occurrence of Dengue
From: http://www.traveldoctor.info/diseases/18.html

Dengue Fever Diagnostics and the *Global Innovation Market:* *Pertinent Example of a patented innovation*

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(12) **United States Patent**
Lai et al.

(10) **Patent No.: US 7,622,113 B2**
(45) **Date of Patent: Nov. 24, 2009**

(54) **MONOCLONAL ANTIBODIES THAT BIND OR NEUTRALIZE DENGUE VIRUS**

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(73) Assignee: **The United States of America as represented by the Department of Health and Human Services**, Washington, DC (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 241 days.

(21) Appl. No.: **10/582,006**

(22) PCT Filed: **Dec. 3, 2004**

(86) PCT No.: **PCT/US2004/040674**

§ 371 (c)(1),
(2), (4) Date: **Jun. 7, 2006**

(87) PCT Pub. No.: **WO2005/056600**

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(57) **ABSTRACT**

The present invention relates to monoclonal antibodies that bind or neutralize dengue type 1, 2, 3, and/or 4 virus. The invention provides such antibodies, fragments of such antibodies retaining dengue virus-binding ability, fully human or humanized antibodies retaining dengue virus-binding ability, and pharmaceutical compositions including such antibodies. The invention further provides for isolated nucleic acids encoding the antibodies of the invention and host cells transformed therewith. Additionally, the invention provides for prophylactic, therapeutic, and diagnostic methods employing the antibodies and nucleic acids of the invention.

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Patent Number US7622113, Antibodies

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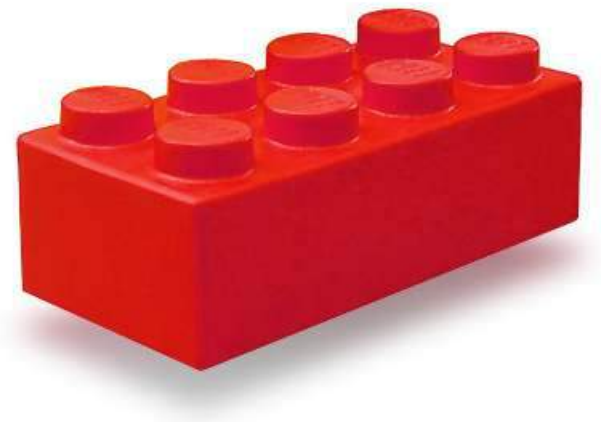

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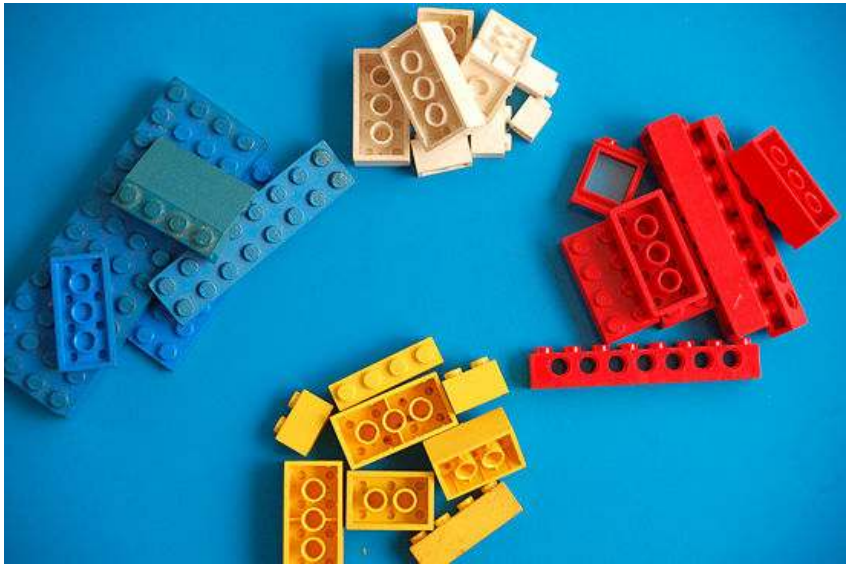

Golden Rice: Where did it all begin?

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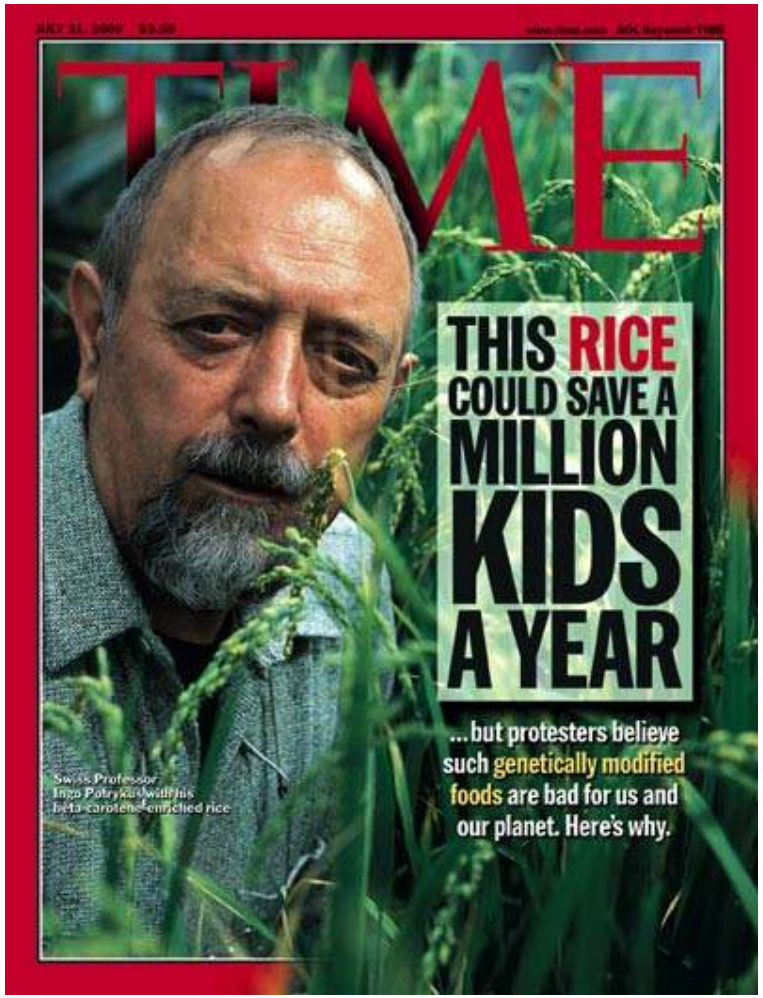

Golden Rice: Genetically Engineered, Nutritionally Enhanced Grain

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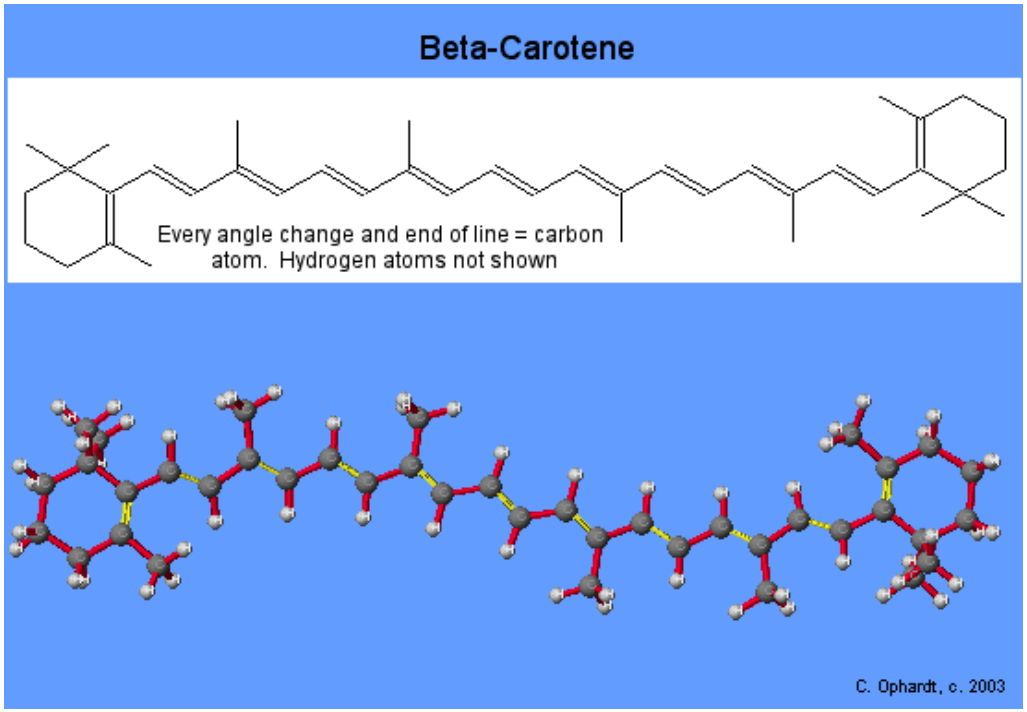
Vitamin A Deficiency (VAD): A Global Health Problem



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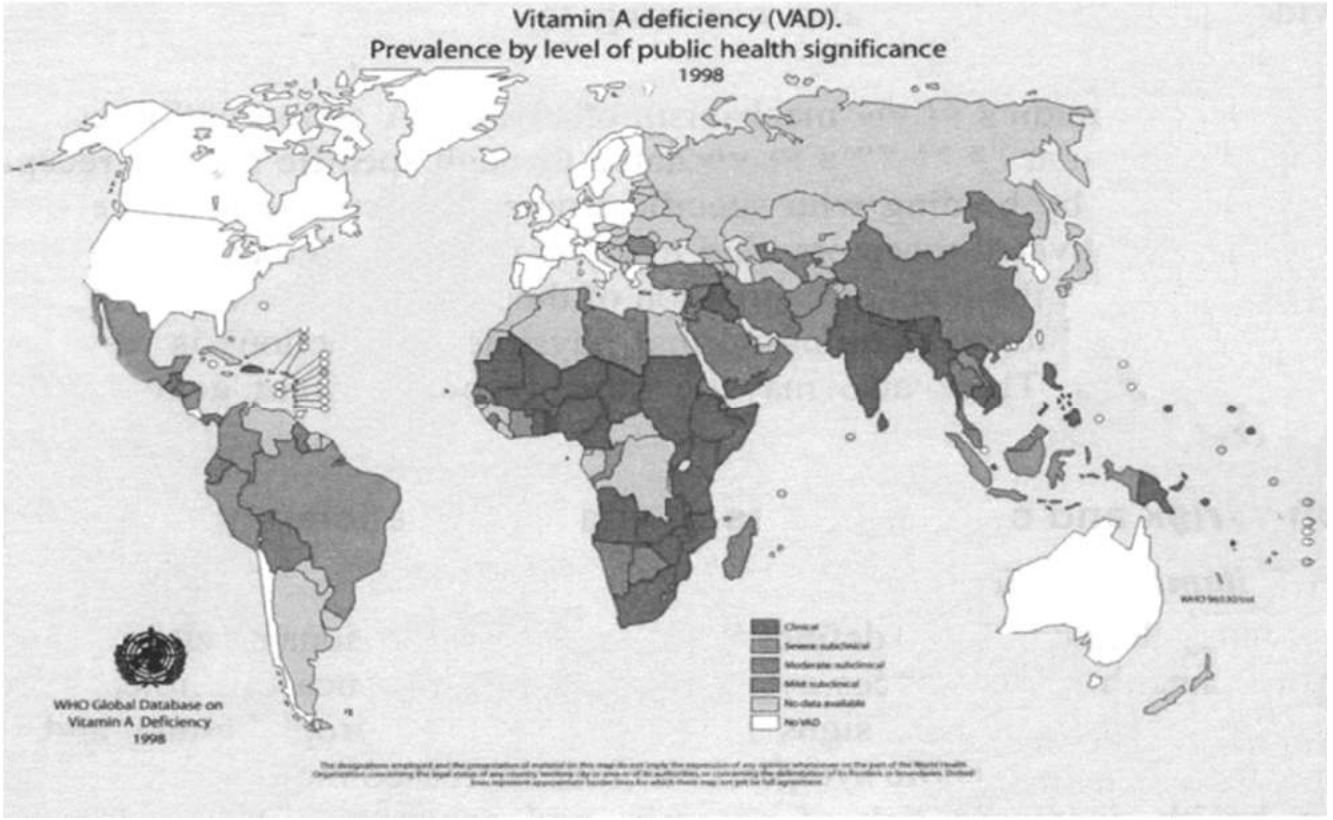
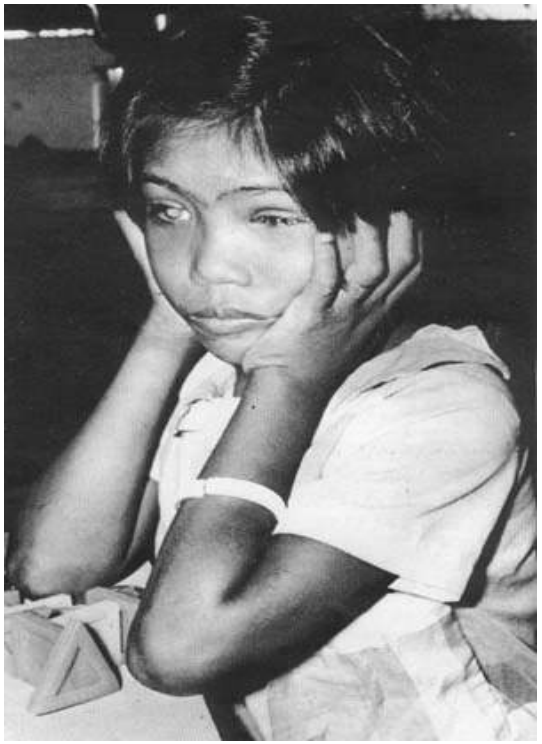
In developing countries, vitamin A deficiency (VAD) is a major problem affecting primarily children under age five and pregnant women.





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Severe VAD leads to:

1. permanent blindness 250,000 children, lose their sight every year due to VAD.
2. a depressed immune system that increases the incidence and severity of infectious diseases and infant mortality rates. VAD afflicted children die at nine times the rate of healthy children, with over one million children dying of infections every year.

To mitigate VAD, engineer (insert) relevant genes into rice, to generate beta-carotene-rich rice, thus enhancing carotene in local rice varieties and, in local diets: "Golden Rice".

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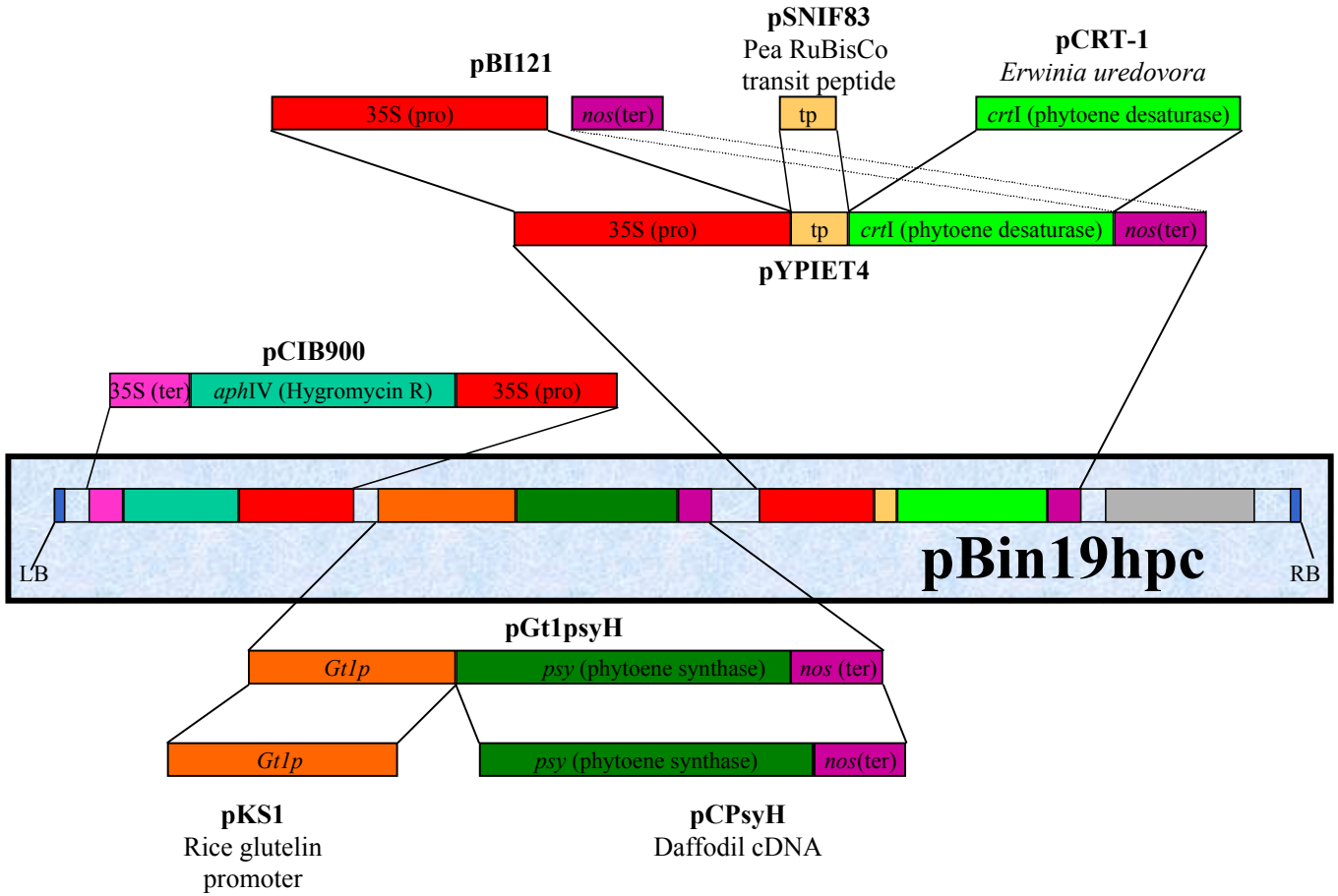
Assembly of Golden Rice, four major components to consider:

1. **Plant/seed source,**
2. **Gene constructs, e.g., cloning vectors.**
3. **Genetic transformation and related technologies, and**
4. **DNA amplification technologies**



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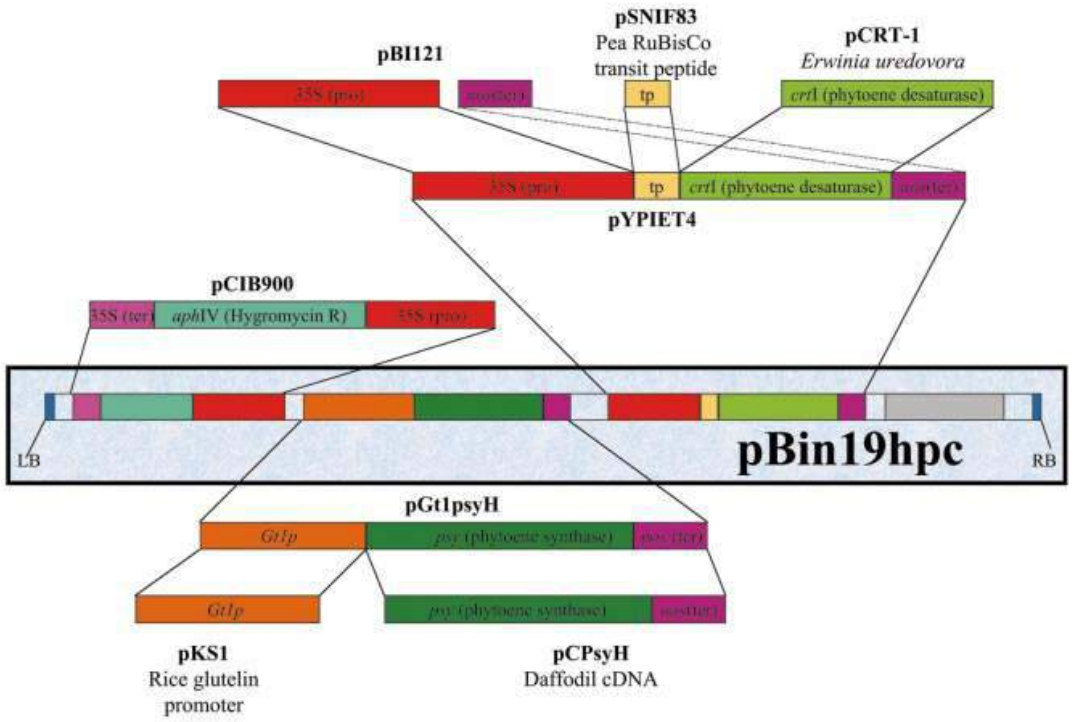
Technical Complexity: one, of three, genetic constructs developed to generate Golden Rice, source: Kowalski SP, Ebora RV, Kryder RD, Potter RH. Transgenic crops, biotechnology and ownership rights: what scientists need to know. 2002 Aug; Plant Journal 31(4):407-21.



Component	Reference	No. of Patents	No. of Assignees
Phytoene desturase - *crtI*	Fraser *et al.*, 1992 Misawa *et al.*, 1993	1 US 2 PCT	2
Phytoene synthase - *Psy*	Schledz *et al.*, 1996 Burkhardt *et al.*, 1997	3 US, 1 EP 1 JP, 3 PCT	6
Hygromycin phosphotransferase - *aphIV*	Waldron *et al.*, 1985 Wünn *et al.*, 1996	1 US	1
CaMV35S Promoter - 35S(pro)		3 US 1 PCT	2
CaMV35S Terminator 35S(ter)		None found	None found
Nopaline synthase terminator - *nos*(ter)		None found	None found
Rice glutelin promoter - *Gt1p*	Okita *et al.*, 1989	1 JP 1 PCT	2
Pea RuBisCo transit peptide - tp	Schreier *et al.*, 1985	3 US	2

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The technical complexity of Golden Rice mirrored by the IP complexity.

Color-coded correlation of genetic construct and corresponding patent documents of possible relevance.

"Pieces" of Golden Rice innovation assembled via creative, dynamic, informed IP management strategy.

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Golden Rice is currently under development, for delivery to VAD afflicted countries:

1. **successful field trials in Louisiana,**
2. **introgression into local rice varietie the Philippines and India,**
3. **bioavailability trials,**
4. **fast adoption rate and successes of transgenic crops in developing countries are creating a fertile ground for upcoming end user activities.**

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Connecting to the Global Innovation Marketplace is Key for Assembling Innovation

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Priming the Innovation Pump to increase the flow of Innovation in the Emerging economies.

Longer term sustainable system development: Intellectual Property capacity building

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Longer term sustainable system development: Intellectual Property capacity building

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Building human capital and institutional capacity for sustainable development of IP management and tech-transfer systems: Accelerate access to and absorption of innovation.

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The Way Forward (Strategies, Tactics, Options)

Ecosystems of innovation link global innovation networks with people, institutions (universities, government agencies, etc.) and other companies in own or different countries to solve problems, source knowledge and generate ideas.

Building the institutions to facilitate this process:

A supportive legal environment is necessary *but not sufficient for* … effective technology transfer … must be supplemented by the establishment of an Innovation and Technology Entrepreneurship Center (ITEC) to handle … spinning-in, adapting for local use, and spinning-out technology. This organization can either be a newly established entity or an existing unit within an established organization (Inclusive Innovation Center or university technology transfer centers), retrofitted to carry out new functions.

Global Forum Action Plan: Science, Technology and Innovation Capacity Building Partnerships for Sustainable Development, September 1, 2010, Compiled by Alfred Watkins and Joshua Mandell (with Alistair Brett)

Longer term sustainable system development: Intellectual Property capacity building

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Strategic initiatives to build institutional IP infrastructure in developing countries:

- **ITECs**
- **TTOs**
- **TISCs**

Longer term sustainable system development: Intellectual Property capacity building ITEC

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A supportive legal environment is necessary but not sufficient for … effective technology transfer … must be supplemented by the establishment of an Innovation and Technology Entrepreneurship Center (ITEC) to handle … spinning-in, adapting for local use, and spinning-out technology. This organization can either be a newly established entity or an existing unit within an established organization (Inclusive Innovation Center or university tech-transfer centers), retrofitted to carry out new functions. (Watkins and Mandell 2010, World Bank)

Longer term sustainable system development: Intellectual Property capacity building TTO

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A framework to allow technology transfer to the public institutes of developing countries must be stimulated and developed. This has been addressed in some countries by the establishment of … [technology-transfer offices] "TTOs". TTOs can play multiple roles in research and development (R&D) institutes, [including] protection of IP … revenues through licensing of IP … education and awareness, networking … creation of new start-up companies … institutional policies related to tech-transfer [and] service to society. (Maredia et al. 2000, MSU and EMBRAPA)

Longer term sustainable system development: Intellectual Property capacity building TISC/ITSO

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Technology Innovation Support Centers (TISCs) act as service-oriented providers to: allow local users to benefit effectively from the increased accessibility of IP information offered by internet searches through direct personal assistance; assist local users in creating, protecting, owning and managing their IPR; strengthen the local technological base by building up or reinforcing local know-how; and to increase tech-transfer. … TISCs act as local drivers of innovation. [T]raining in other areas of IPR … not only continues to develop staff knowledge and their personal development, but also offers a one-stop-shop as regards other elements of IPR and of innovation support. (Takagi and Czajkowski 2012, WIPO)

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Strategically focused capacity building, human capital and institutional infrastructure, to accelerate innovation management and development.

Don't repeat history ….

Make history!

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RISE!

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