#### **RIETI Policy Symposium**

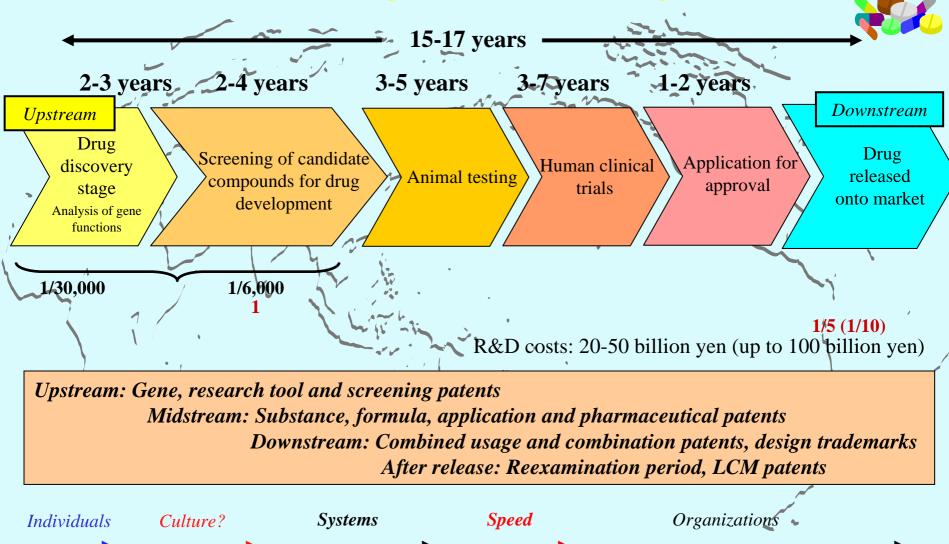


## **The Future of Research and Development** [Focus on the life science industry]

January 11, 2008 Otemachi Sankei Plaza Hiroshi Akimoto, Managing Director Takeda Pharmaceutical Co. Ltd.

Jan. 11, 2008

### **R&D, intellectual property and human resources** in the life science industry



10⇒100

100⇒1000 -

Human

resources?

1⇒10

0⇒1

#### Top 20 Global R&D Spenders, 2006

RANK 2006 2005		COMPANY	R 2006, IN MILLIONS	&D SPENDIN CHANGE FROM 2005	NG ASA% OFSALES	HEADQUARTERS LOCATION	INDUSTRY
1	3	Toyota	\$7,691	9.6%	3.7%	Japan	Auto
2	2	Pfizer	\$7,599	<b>4.7</b> %	15.7%	North America	Health Care
3	1	Ford	\$7,200	-10.0%	4.5%	North America	Auto
4	7	Johnson & Johnson	\$7,125	10.3%	13.4%	North America	Health Care
5	4	DaimlerChrysler	\$6,678	-5.6%	3.5%	Europe	Auto
6	5	General Motors	\$6,600	-1.5%	3.2%	North America	Auto
7	8	Microsoft	\$6,584	<b>6.</b> 5%	1 <b>4.9</b> %	North America	Software and Internet
8	10	GlaxoSmithKline	\$6,351	10.2%	1 <b>4.9</b> %	Europe	Health Care
9	6	Siemens	\$6,294	-2.5%	5.8%	Europe	Industrials
10	9	IBM	\$6,107	4.5%	<b>6.7</b> %	North America	Computing and Electronics
11	11	Samsung	\$5,924	2.8%	<b>6.7</b> %	Rest of World	Computing and Electronics
12	12	Intel	\$5,873	14.1%	16.6%	North America	Computing and Electronics
13	14	Sanofi-Aventis	\$5,571	<b>9.</b> 5%	15.6%	Europe	Health Care
14	16	Novartis	\$5,349	<b>10.9%</b>	14.8%	Europe	Health Care
15	13	Volkswagen	\$5,312	4.0%	4.0%	Europe	Auto
16	19	Roche Holding	\$5,262	16.2%	15.7%	Europe	Health Care
17	15	Matsushita	\$4,992	2.4%	6.3%	Japan	Computing and Electronics
18	17	Nokia	\$4,892	1 <b>.9</b> %	<b>9.5</b> %	Europe	<b>Computing and Electronics</b>
19	22	Merck	\$4,783	24.3%*	21.1%	North America	Health Care
20	20	Honda	\$4,765	8.1%	5.0%	Japan	Auto
			\$120,950 TOTAL**	5.0% AVG.	6.9% AVG.		

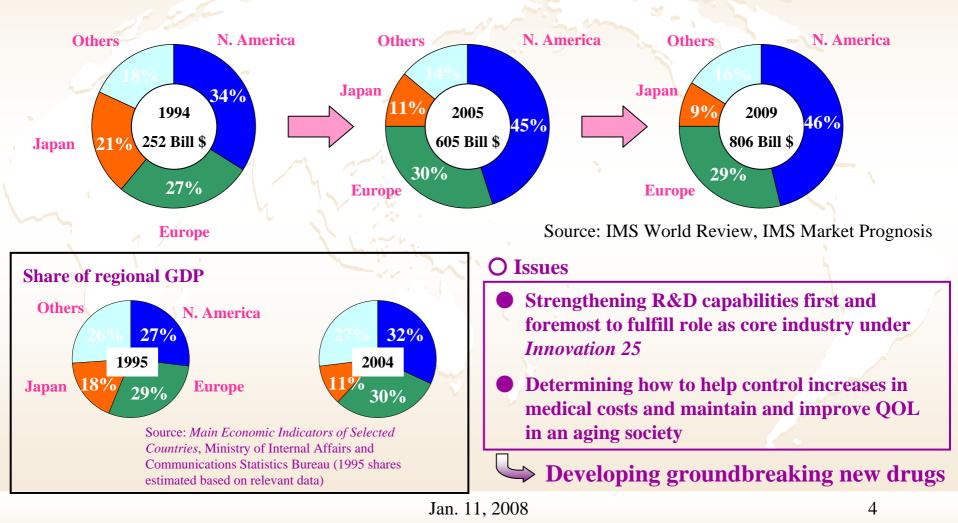
Source: Booz Allen Hamilton

\* Includes substantial acquired research.

\*\* Sums do not add up to total due to rounding.

# The global pharmaceutical market – now and in the future

Japan's share of the global market is on the decline and is set to dip below 10%.

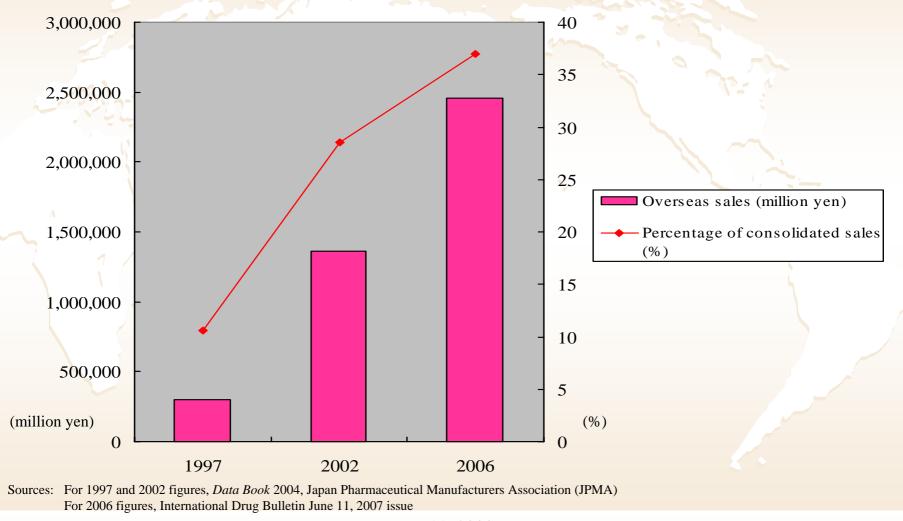


## **Presence of pharmaceutical industry in overseas markets**

Fiscal year	Overseas sales (million yen)	Percentage of consolidated sales (%)
1997	297,249 13 companies	10.6
2002	1,360,367 30 companies	28.5
2006	2,454,792 Top 19 companies	37

Sources: For 1997 and 2002 figures, *Data Book* 2004, Japan Pharmaceutical Manufacturers Association (JPMA) For 2006 figures, International Drug Bulletin June 11, 2007 issue

## **Presence of pharmaceutical industry in overseas markets**



Jan. 11, 2008

## Worldwide ranking of drugs originating from Japan

Position	Brand	Manufacturer	Worldwide sales (million \$)
13	Takepron (ulcers)	Takeda	4,170
19	Actos (diabetes)	Takeda	3,275
- 26	Blopress (antihypertensive)	Takeda	2,842
29	Cravit (antibiotic)	Daiichi/Sankyo	2,740
31	Pariet (ulcers)	Eisai	2,703
34	Aricept (Alzheimer's)	Eisai	~~2,483
40	Harnal (prostatic hyperplasia)	Astellas	2,284
42	Crestor (hyperlipidemia)	Shionogi	2,212
49	Mevalotin (hyperlipidemia)	Daiichi/Sankyo	1,983
50	Leuplin (prostate cancer)	Takeda	1,981
51	Abilify (schizophrenia)	Otsuka	1,972
58	Epogin (renal anemia)	Chugai	1,827
71	Prograf (immunosuppresant)	Astellas	1,474
78	Olmetec (antihypertensive)	Daiichi/Sankyo	1,392
	Items originating from Japan	(14 items)	33,338
	Items with sales of 1,300 million dollars or more	(85 items)	230,781
	Japan's share	(16.5 %)	14.4 %

Jan. 11, 2008

7

Source: Pharma Future, July 2007

\* Worldwide sales include sales on overseas export markets

#### Attitudes towards inventions at drug-discovery pharmaceutical companies (JPMA 2007 survey findings)

#### - Attitudes and underlying feelings amongst life science researchers

[Attitude] Want to invent groundbreaking drugs and make a contribution to the company and society as a whole [Underlying feelings] Want to see more credit given to inventors for their achievements (contributions)

## - Attitudes, underlying feelings and preferences within the life science (pharmaceutical) industry

[Attitudes towards inventors]

- Want inventors to play a prominent role and develop as many hit products as possible in the interests of corporate development
- Companies also want to back up such activities

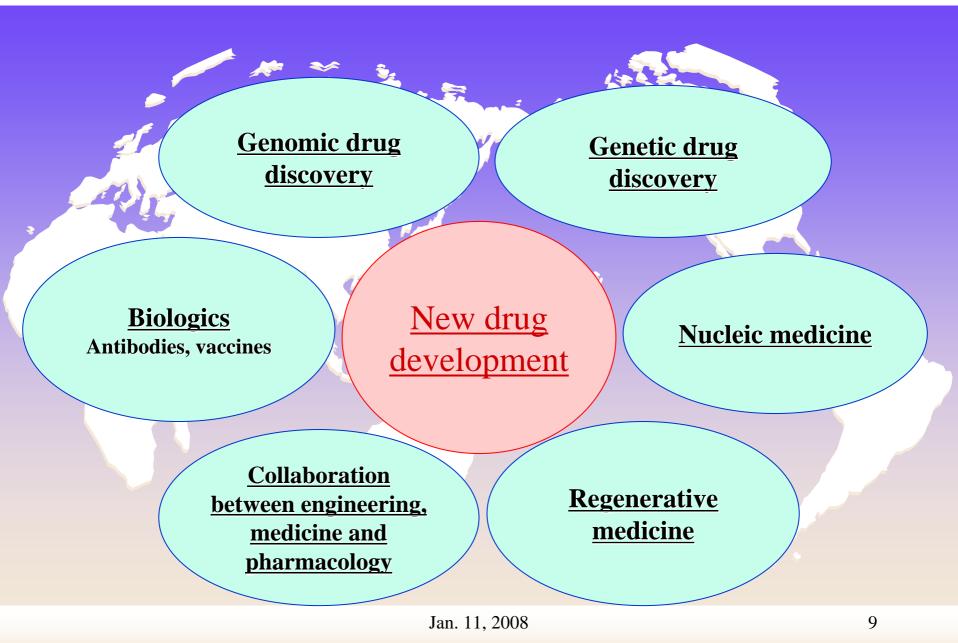
[Underlying feelings within industry]

- With such intense global competition just to stay afloat, companies can't afford to fight it out over lawsuits involving employee inventions

- Inventors and companies should work together to survive within a difficult R&D environment [Preferences regarding jurisdiction over final decisions on the value of inventions]

- Want recognition of the fact that companies face different risks to other industries in view of the rapidly growing array of obstacles making it difficult for drug-discovery pharmaceutical companies to sustain their business models (development periods, development costs, probability of success, etc.)
- Want balance between inventor rewards and the company's contribution in bringing the product to market to be taken into account
- Want values to be calculated appropriately, taking into account the new Article 35 of the Patent Act when applying the former Article 35

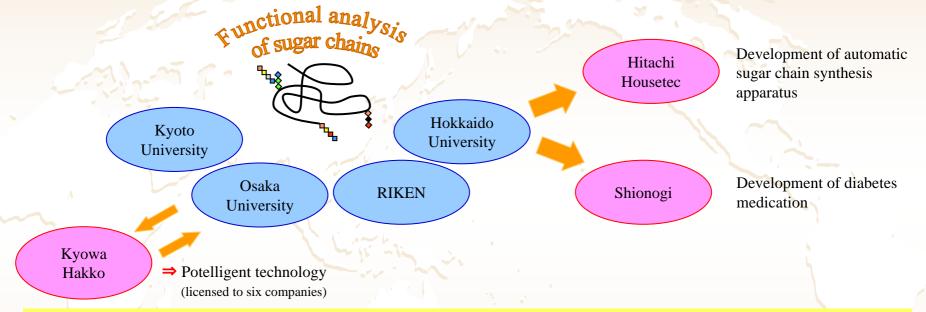
## What next !? Emerging technologies ??



The secret to collaboration between industry, academia and government based on successful examples ~ Academic-led collaboration ~

Progress is being made with collaboration spearheaded by universities and research institutes in the Japan-dominated field of sugar chain research.

Plan to support development of new industries harnessing the functions of sugar chains (2002-)



Osaka University-Kyowa Hakko: Development of next-generation antibody drugs through sugar chain regulation Integration and development of Osaka University's sugar chain modification technology and Kyowa Hakko's increased antibody activity technology proposed by Osaka University

Hokkaido University-Hitachi Housetec-Shionogi: Establishment of a center for future drug discovery and medical innovation

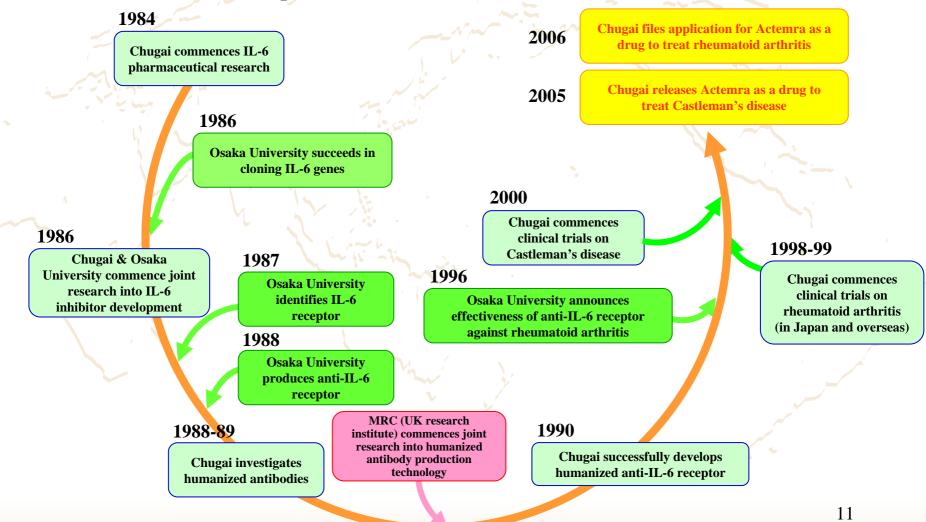
Application of Hokkaido University's automatic sugar chain synthesis technology for the purpose of drug discovery and subsequent commercialization proposed to partner companies

Need to actively disseminate information to link "seeds" and "needs"

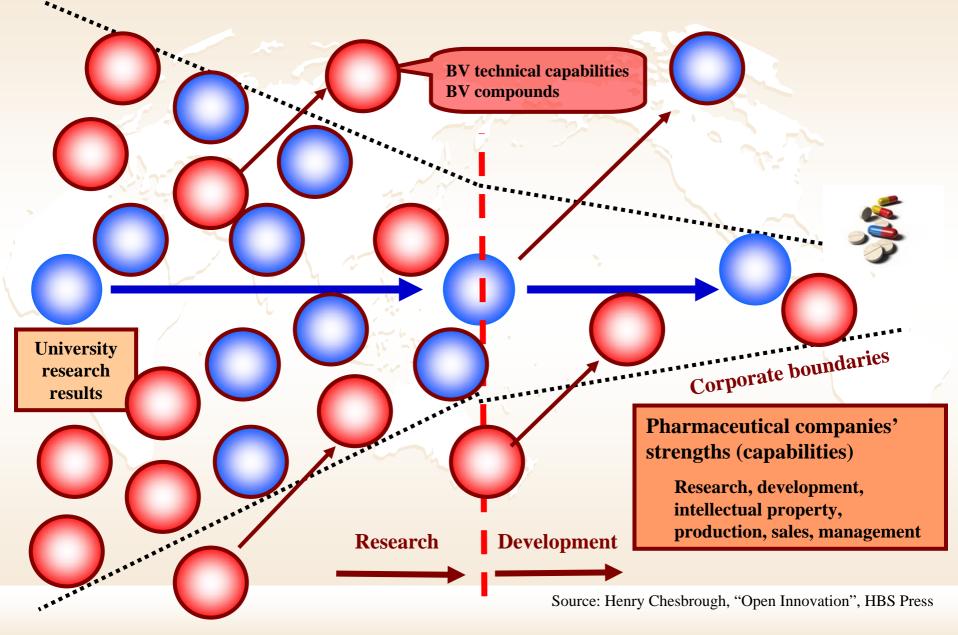
Jan. 11, 2008

The secret to collaboration between industry, academia and government based on successful examples ~ Industry-led collaboration ~

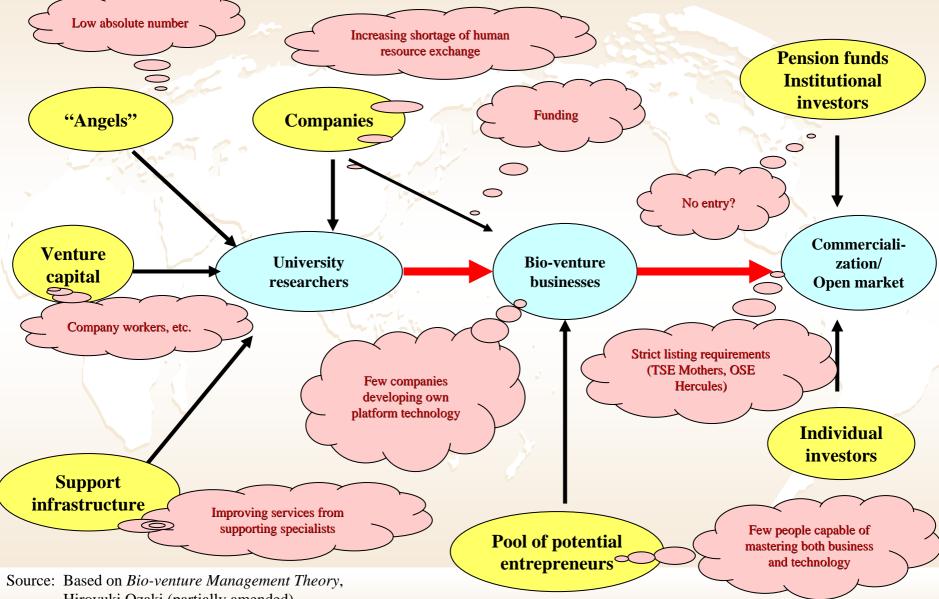
Actemra, Japan's first IL-6 inhibiting antibody drug, was developed over the course of two decades based on an effective combination of Osaka University's research results and Chugai Pharmaceutical's technical capabilities.



Collaboration between industry, academia and government in the field of life sciences and its significance



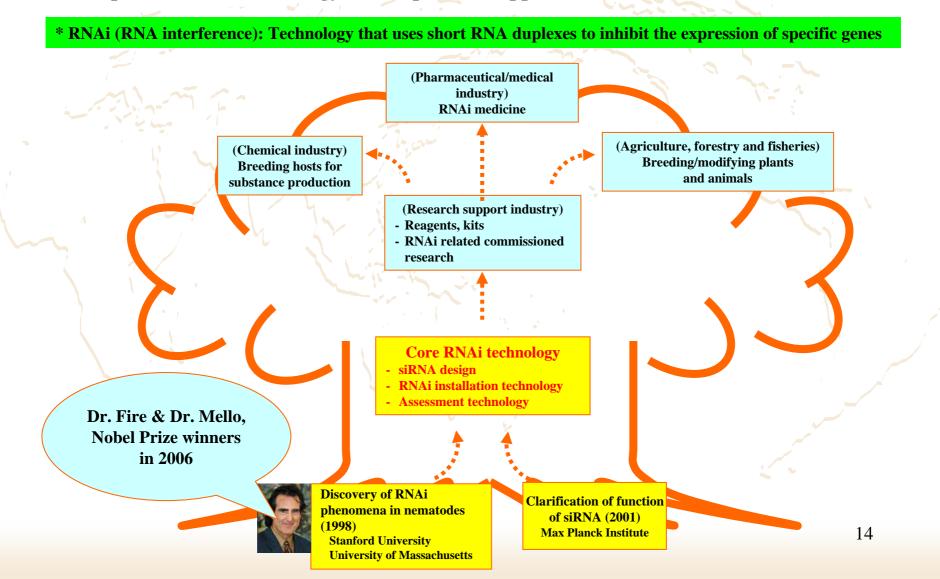
#### The collaborative relationship between industry, academia and government in the field of life sciences



Hiroyuki Ozaki (partially amended)

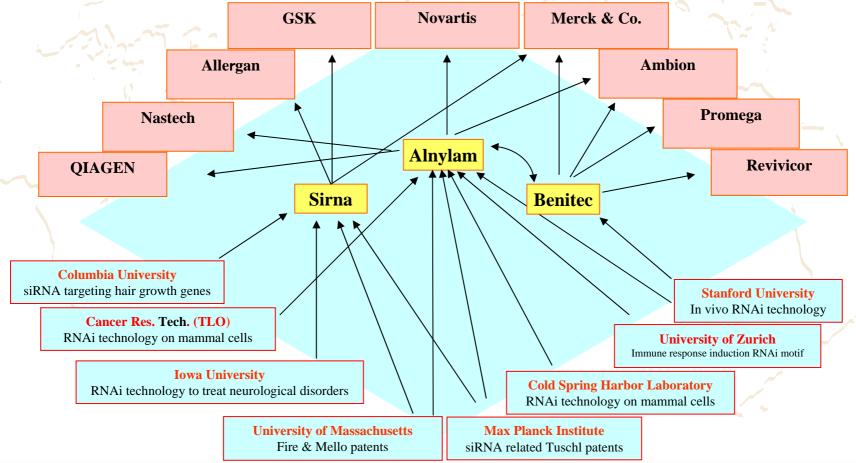
## E.g. Core RNAi\* technology and its scope of application

There are high hopes for the application of RNAi technology in the medical, chemical, agricultural, forestry and fisheries industries and other bio industries. Extensive work is currently underway on the development of core technology for the practical application of RNAi.



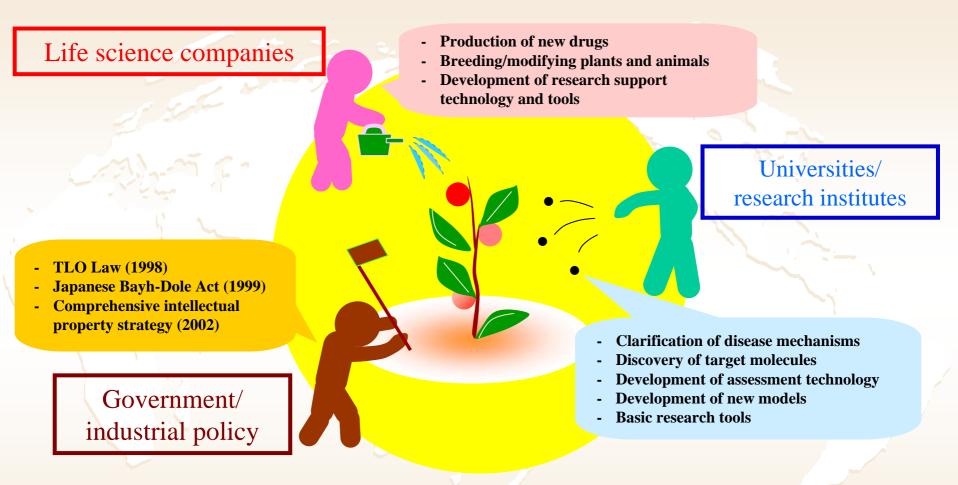
#### <u>Collaboration on core RNAi technology between industry</u> and academia (and government)

Originating from a number of pioneering US universities, including the University of Massachusetts, the Max Planck Institute and Stanford University, a robust framework of professional innovation has been built up through venture businesses into several mega pharmaceutical companies, as outlets for industrialization.



Reference: FY2005 survey report on trends in technology subject to patent applications (Patent Office)

What does collaboration between industry, academia and government in the field of life sciences entail?



Basic research that is beyond the capabilities of companies is handled by universities and research institutes based on a range of policies (soil) aimed at promoting collaboration between industry and academia. Research results (seeds) are then nurtured by companies in order to produce drugs and other products (fruit).