

LIFE SCIENCES RESEARCH IN INDIA: TODAY'S STATUS AND TOMORROW'S PROSPECTS

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TAKE HOME MESSAGE

New developments during the last decade

**Biotech enterprises
End-driven research initiatives
New institutes in biosciences
Clinician- Basic scientist dialog ↑
Higher budget inputs into R & D in biology
Greater international connectivity**



TAKE HOME MESSAGE

India is spending more on biology
Translational medicine has caught on
Areas such as stem cells are encouraged
More international collaborations
Resource complementation exists
Jobs in Industry, academia, Res. Labs. ↑



Rand Corporation ranks India and China
among 24 Scientifically Proficient Countries
The Elephant and the Dragon

Biological research and training has had
a good historical tradition in India,
since the last 50 years-

in 'classical areas' such as botany, zoology,
microbiology, entomology, organic chemistry
and also in genetics, biochemistry,
biophysics, and nutrition.



Landmark discoveries from India during those years:

callus/anther culture,
protoplast fusion,
promiscuous flowering
of trees such as bamboo,
Collagen structure,
Ramachandran diagrams of conformations
of proteins, DNA and polysaccharides,
human molecular genetics,
discovery and description of
vibrio cholerae and its toxin.



Introduction of New Biology-

through Indians coming for doctoral
and postdoctoral programs-
to UK, (Germany, France, Canada)
and US starting from the 1950s,
through Colombo Plan, DAAD,
Humboldt, TCM, Fulbright, Ford
and Rockefeller Foundations.



**Advances in Sci. & Tech. education
through new universities (1960s):**

**JNU, Madurai, MSU Baroda,
AIIMS, JIPMER, PGI, IITs,
Pantnagar, PAU Ludhiana, APAU,
and later Univ. Hyd., SGPGIMS,
Pondicherry....**



**Green Revolution using dwarf,
high- yielding cereal varieties.
White revolution,
making India the world leader
in milk production.
Wiping out of small pox, goitre,
moves to eliminate malaria,
leprosy, polio.**

**Life expectancy jumps from
the 40s to 63 years in one generation!**



Post 1970s- Molecular Biology,
Genetic Engg, Transgenics,
Immunology, Bioinformatics...
enter mainstream Indian biology.

We see the products of this era here in this hall!

This is also the age when
new biological centers were set up-
the IITs of Biology!

CCMB, NII, NCBS, IMTECH,
IICB, UDSC, NCCS, CDFD,
JNCASR, U Pune,



6 DBT biology labs
(NII, CDFD, ILS, NCPGR, IBSD, NBRC)

5 DST labs
(JNCASR, Bose, Chitra, Agharkar, Birbal Sahni)

8 CSIR labs
(CCMB, CDRI, IMTECH, CFTRI,
ITRC, NBRI, IGIB, CIMAP)

4 DAE labs
(TIFR, NCBS, BARC, CRI)

and 21 ICMR labs
(e.g., NIN, IIH, TRC, NIV, NARI, MRC...)



**Research centers of
private foundations,
Pharma and Biotech companies**

**CHG, HERF, MDRF, Manovikas,
Ranbaxy, Reddylabs,
Biocon, Shantha, Bharat Biotech,
Torrent, Panacea, Dabur...).**



Research Productivity

Between 1994 and 2004,
India produced 188,086 papers
(#13 among 146 top performing countries);

These had 595,627 citations
(rank #21 among the 146),
but cites per paper was 3.24 (ranking #117/146).



Grants available from Indian sources:

DBT, DST, CSIR, ICMR, DAE, DRDO
Little or no private funding for R & D

Typical individual researcher grant: 3 years:
Equipment and spares,
Salaries of a PDF, JRF/SRF
Consumable chemicals and plasticware
Some travel (domestic), office expenses,
10-15% admin. overheads

Typical grant: Rs. 2 - 8 million for 3 yrs.



SAMPLING OF INDIA'S R&D SPENDING (2004-05)

AGRICULTURE	\$408 million
ATOMIC ENERGY	\$778 million
INFORMATION TECH.	\$183 million
ENVIRONMENT	\$325 million
HEALTH	\$758 million
OCEAN RESEARCH	\$ 53 million
Dept. SCI. & TECH.	\$300 million
INDUSTRIAL RESEARCH	\$302 million
BIOTECHNOLOGY	\$ 75 million
SPACE	\$635 million
DEFENCE	\$547 million
TOTAL	\$4364 million

Of these, less than 20% is extramural research grants



**During 2003 - 2004 alone,
there were, from India:**

**6 papers in PNAS US,
4-6 papers in Nature journals,
2 in Science, 13 in J. Immunol.,
104 papers in J Biol. Chem.,
9 in J. Bacteriology, 4 in Chem. & Biol.,
1 in Cell (+1 in press),
2 in Genome Research**

We are collecting data on JMB, Biochem., etc



Winning International Grants

Wellcome Trust Grants to
Indian researchers in India,
currently operating:
15 + 3 approved.

NIH based RO-1, RO-3, FIRCA,
NIH Alumni grants: total of 90.

Several Indian scientists have received
Rockefeller Grants to work in rice biology.



International Collaborative agreements

DBT, CSIR, DST, ICMR, Science Academies

with UK, France, Germany, Japan, Korea,
Russia, Israel,
mutually between both government
S & T departments, and science academies

Enable exchange visits, material transfer



1990s: Change of Scene -

Biotech Industry gets strong and indigenous.

Today, > 200 biotech firms across India.

Produce vaccines, antibiotics, drugs (statins...), proteins (insulin, mAbs, G-CSF)

Actively recruit R & D scientists, chemical engineers, MBAs.

Are entering into global partnerships



Birth of Academia- Industry Interaction

Some labs have incubated budding biotech companies, helping them bring out products for manufacture.

The US model!

**CCMB and Shantha,
IISc and Bangalore Genei**



**Besides basic research,
a growing number of academics
are working with these companies
on product development.**

**Examples: Ram Rajasekharan,
PN Rangarajan, Vijay Chaudhary,
Ashok Khar, G Padmanaban,
A Surolia, J Gowrishankar,
PV Subbarao, G. Khatri...**



**Interaction between
basic scientists
and medical institutes
now more vibrant.**

**Examples are:
LVPrasad, MDRF,
CHG, IISc, NBRC.**

**Some basic researchers
have made a career shift!**



Gender situation

No Glass Ceiling in salary, or lab space.
But, sociology does operate.
Hiring couples in the same department?
These issues discussed in the
Science Academies of India and the
Scientific Advisory Committee to the Cabinet:
some special action programs?

Please read Vineeta Bal in
Current Science (2005), 88(6); 872- 878.



Current focus areas in Indian biological research?

Some multi-center cooperative efforts:

Rice genomics,
Tuberculosis,
Structural biology using NMR
and X-ray crystallography,
Natural products as drug candidates,
Genetic ancestry of Indians



CSIR

TKDL (Traditional Knowledge Digital Library)

NMITLI (New Millennium Indian Technology Leadership Initiative) program:
Over 15 programs in biology

Tuberculosis, Natural products,
Bioinformatics software package “Biosuite”,
Eye and Vision,
Genomics and proteomics of cancers in India,

Tripartite: Academia, R & D labs, Industry
Deliverables: Products and Licensable patents



Some projects involving Industry,
supported by other agencies:

Vaccinology

(JEV, Rotavirus, HIV, DNA vaccines).

Stem cell biology-

involving city clusters

(academia, research labs,
medicos, industry)-

in ophthalmology, cardiology, diabetes...



**During the year 2006,
National Science &
Engineering Foundation
created,
as also two new
institutes of science
(at Pune and Kolkata)
a la IISc/IIT.**



**Where are the jobs for the
returning Indian biologist?**

**The usual choice of universities and
national labs is expanded.**

**Industry is hiring vigorously-
Ranbaxy, DRL, Shantha,
Biocon, Bharat Biotech,
Panacea, Torrent,
Reliance Life Sciences, Cadila..**



New Institutes:
IISERs, ILS at Hyderabad,
ILS at Bhubaneswar

Medical Foundations
HERF, Aravind, MDRF...

Medical Institutions
NIMS, SVIMS...;

Universities



US-India Collaboration in Biosciences

Excellent resource complementation!

Already existing avenues:
Vaccine Action Program (DBT),
Mother and Child Health (ICMR),
Environ. and Occupational Health (ICMR),
Contraception & Reproductive Health (DBT)

USEFI, NSF...
and the new NEI initiative on
eye research collaboration



NIH as a special partner:

over 100 Indian visitors
(PDF, VF, VA, VS and guests) right now

Those who want to get back to India
have new opportunities of
funding for research.

RO-1, RO-3, FIRCA,
NIH Alumni grants.



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Thank you!

