بسم الله الرحمن الرحیم

پژوهش علمی- دانشگاهی درعلوم تجربی

عیسی یاوری - دانشگاه تربیت مدرس

پژوهش : از واژه فرانسوی ***Recherche***
به معنای **بررسی ژرف**، تلاش انسان برای
بررسی هوشمندانه پدیده هاست

- هدف از پژوهش:
- کشف، تبیین، و تکوین روش ها برای گسترش دانش بشری در مورد دنیای پیرامون و کیهان
- در پژوهش می توان از **روش علمی** استفاده کرد؛ **اما ضرورتا چنین نیست**

قلمروهای علم

علوم تجربی شامل علوم طبیعی وعلوم اجتماعی
Empirical Sciences

علوم بین رشته ای شامل رشته های مهندسی و علوم پزشکی و پیراپزشکی

Chemistry: A Central Science

Scientific Method روش علمی

فن بررسی پدیده ها، کسب دانش جدید،
یا تصحیح و تکمیل دانش پیشین که
مبتنی است برگردآوری شواهد تجربی
مشاهده پذیر و سنجش پذیر

دانشگاه، هدفی والاتر از پژوهش ندارد

پژوهش یعنی حقیقت پژوهی
حقیقت پژوهی، مقدمه و نیز محصول شناخت است و شناخت، چراغ راه بهبود خواهان.

مردمانی که با حقیقت پژوهی بیگانه باشند، در عرصه نظر به جایی نمی رسند، بلکه در زندگی عملی نیز سقوط می کنند و نادانسته دروغ را به جای راست می پذیرند

انواع پژوهش علمی

پژوهش ابتکاری یا نوجویی:

یافتن یا کشف آنچه بر دیگران مجهول است

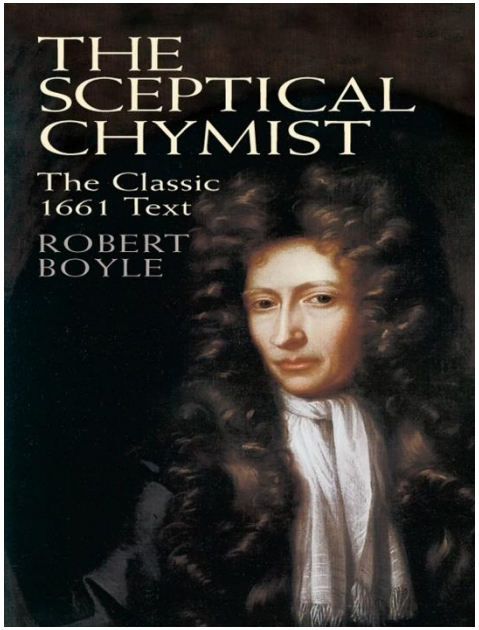
پژوهش تاییدی یا نو گستری:

گستردن یا تفصیل آنچه بر دیگران به اجمال معلوم است

در هر دو مورد، از آنچه دیگران در یافته اند بهره می گیریم تا به آنچه در نیافته اند برسیم.

پژوهش، متضمن نو آوری است و از تکرار و تقلید و کهنه آموزی به دور.

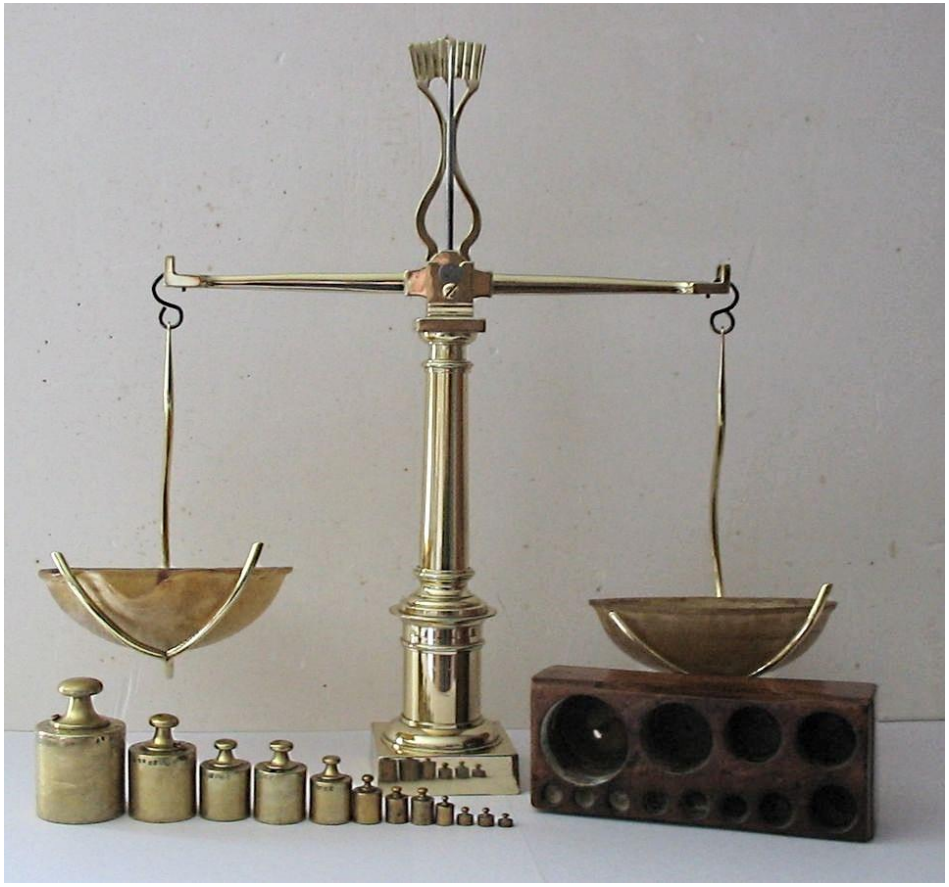
17th and 18th Centuries: Early Chemistry



Robert Boyle

قانون بویل 1662: در یک سیستم بسته، حجم یک گاز در دمای ثابت رابطه معکوس با فشار مطلق دارد

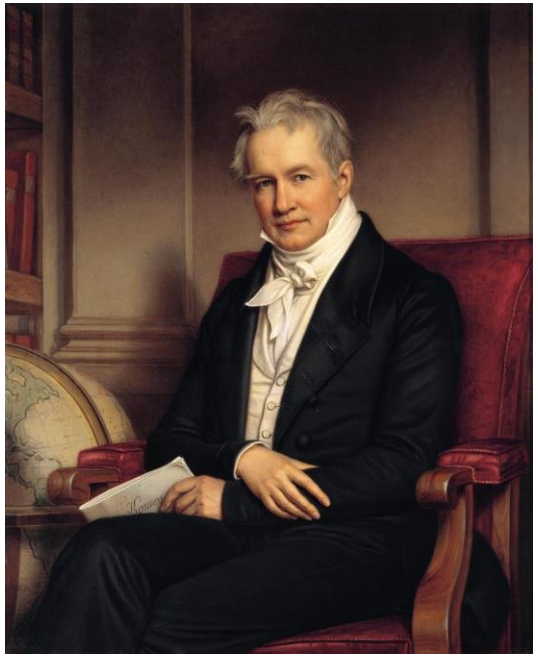
درستی تمام نظریه های علمی باید با آزمایش اثبات شود



Antoine Lavoisier
(1743–1794)
لاوازیه، پدر شیمي مدرن.

دستاوردهای لاوازیه:

قانون بقای جرم، قانون نسبتهای معین، قانون نسبتهای اضعافی، استوکیومتری و رد نظریه فلوژیستون



Wilhelm von Humboldt
1767–1835
Prussian minister, philosopher, linguist

Alexander von Humboldt
1769–1859

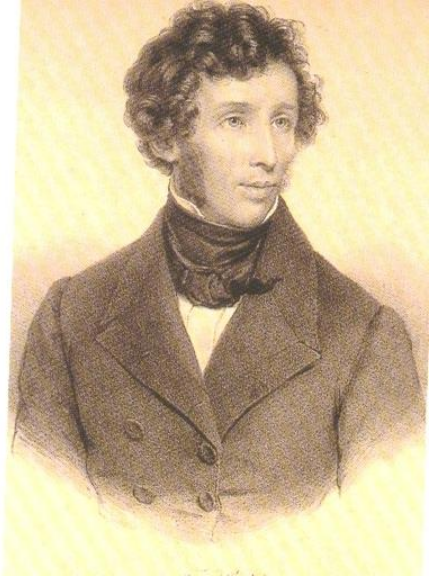
German polymath, geographer, naturalist, explorer, and proponent of science
His quantitative work on botanical geography laid the foundation for biogeography
His systematic geophysical measurement laid the foundation for modern geomagnetic and meteorological monitoring

Latin American expedition 1799-1804

Expedition to Russia in 1829-1830

Friedrich Wöhler (1800-1882)

وهلر را به خاطر سنتز اوره (1828)، پیشگام شیمي آلي مي دانند.



وهلر، در کشف بریلیم و سیلیسیم شرکت داشت. کلسیم کاربید را سنتز کرد. در سال 1834، به اتفاق لیبیگ، بنزآلدهید را از روغن بادام تلخ بدست آورد.



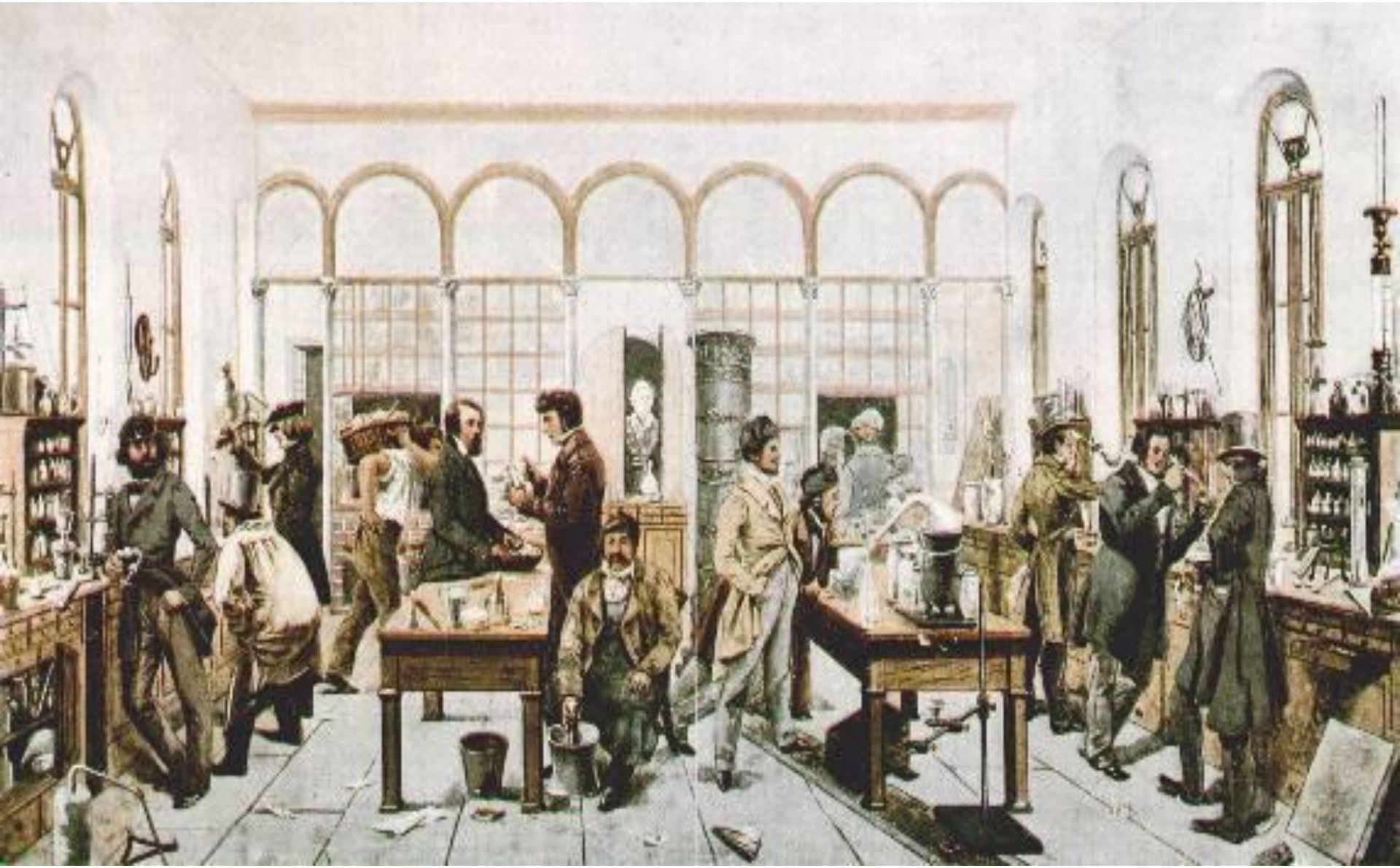
يوستوس فون ليبيگ، (1803-1873) Justus von Liebig

شيميدان برجسته آلماني، شيمي آلي را سازمان داد و كارهاي ارزشمندي در شيمي كشاورزي و بيو شيمي كرد.

روشي جديد براي آناليز عنصري پيدا كرد كه 40 بار سريعتر از روشهاي پيشين بود.

پروفسور تئودور هاوس، رئيس جمهور اسبق آلمان در سال 1953:

هيچكس به اندازه ليبيگ براي اين تعداد از انسانها امكان زندگي فراهم نكرده است.



آزمایشگاه شیمي تجزیه لیبیگ (1840)

قرن بیستم،

با کشف الکترون و پروتون،

پیدایش نظریه کوانتوم و پدیده فتوالکتریک،

تبیین ماهیت پیوند شیمیایی با

نظریه های پیوند ظرفیتی و اوربیتال مولکولی،

نظریه اسید/ باز لوویس، آروماتیسیتی و

اثرهای استریوالکترونی

آغاز شد

Supports fundamental research in the natural, life, and social sciences, the arts and humanities in its 86 Institutes

Max Planck Society for the Advancement of Science	
Predecessor	Kaiser Wilhelm Society
Formation	1911; 112 years ago
Type	Non-profit research organization
Headquarters	Munich, Bavaria, Germany
President	Patrick Cramer
Budget	€1.8 billion (2018)
Staff	23,767 (2018)

Entrance of the administrative headquarters of MPS in Munich

MPS has **17,000** permanent employees, including 5,470 scientists, plus 4,600 non-tenured scientists and guests. As 2018, MPS employed **23,767** staff.

Max Planck Institutes operate independently from the universities, and focus on innovative research that does not fit into the university structure due to its interdisciplinary or transdisciplinary nature or that require resources that cannot be met by the universities.

Max Planck Institutes are organized into research departments headed by directors; comparable to full professor to department head at a university. Other core members include Junior and Senior Research Fellows

24 Nobel Laureates
Max-Planck-Society
(since 1948)

10 Chemistry

7 Medicine

7 Physics

Ferenc Krausz, Nobel Prize, physics, 2023
Svante Pääbo, Nobel Prize, medicine 2022
Benjamin List, Nobel Prize, chemistry 2021
Klaus Hasselmann, Nobel Prize, physics 2021
E. Charpentier, Nobel Prize, chemistry 2020
Reinhard Genzel, Nobel Prize, physics 2020
Stefan W. Hell, Nobel Prize, chemistry 2014
Gerhard Ertl, Nobel Prize, chemistry 2007
Theodor W. Hänsch, Nobel Prize, physics 2005
Christiane Nüsslein-Volhard, Nobel Prize, medicine 1995
Paul Crutzen, Nobel Prize, chemistry 1995
Erwin Neher, Nobel Prize, medicine 1991
Bert Sakmann, Nobel Prize, medicine 1991
Robert Huber, Nobel Prize, chemistry 1988
Hartmut Michel, Nobel Prize, chemistry 1988
Johann Deisenhofer, Nobel Prize, chemistry 1988
Ernst Ruska, Nobel Prize, physics 1986
Klaus von Klitzing, Nobel Prize, physics 1985
Georges Köhler, Nobel Prize, medicine 1984
Konrad Lorenz, Nobel Prize, medicine 1973
Manfred Eigen, Nobel Prize, chemistry 1967
Feodor Lynen, Nobel Prize, medicine 1964
Karl Ziegler, Nobel Prize, chemistry 1963
Walter Bothe, Nobel Prize, physics 1954

A 2015 photo of JPL from above

Jet Propulsion Laboratory (**JPL**) is a **R & D** center in California. Founded in 1936 by Caltech researchers, JPL is now sponsored by **NASA** and managed by **CalTech**

Jet Propulsion Laboratory (JPL)	
Established	October 31, 1936; 87 years ago
Research type	Applied
Staff	>6,000
Operating agency	Managed for NASA by Caltech

In 2022, **JPL** budget was **$2.4 billion**, with the largest share going to Earth Science and Technology development

JPL-developed missiles on display at JPL in 2006

There are **6,000** full-time Caltech employees, and a few thousand contractors working at **JPL**.

NASA has a resident office at the facility staffed by federal managers who oversee JPL's activities and work for NASA.

There are also some Caltech graduate students.

A display at the May 2007 Open House

JPL had an open house once a year on a Saturday and Sunday in May or June, when the public was invited to tour the facilities and see live demo of **JPL** science and technology.

More private tours are also available. Thousands of schoolchildren visit **JPL** every year.

Mars Perseverance rover team in front of JPL's administration building

Weizmann Institute of Science	
Type	Public research
Established	1934
Endowment	$600 million (2019)
Academic staff	952
Administrative staff	400
Students	1,082
Postgraduates	356
Doctoral students	700
Postdoctoral fellows	380

Koffler particle accelerator

Weizmann Institute of Science is a research university in Israel, established in 1934. It differs postgraduate-only degrees in the natural and exact sciences.

Weizmann Institute of Science is a multidisciplinary research center, with around 3,800 scientists, postdoctoral fellows, Ph.D. and M.Sc. students, and scientific, technical, and administrative staff.

As of 2019, six Nobel laureates have been associated with Weizmann Institute.

Weizmann Institute of Science was ranked number 2, globally, for research quality by the Nature Index in 2019, and in the top 25 research institutes/universities in the world in two main categories: Top Cited Publications and Patents Awarded.

The institute was in 7th place in the European Research Council report in 2020 for its high rate of success in obtaining research grants.

In 2018 the institute was ranked 9th, globally, (1st in Israel) by the CWTS Leiden Ranking.

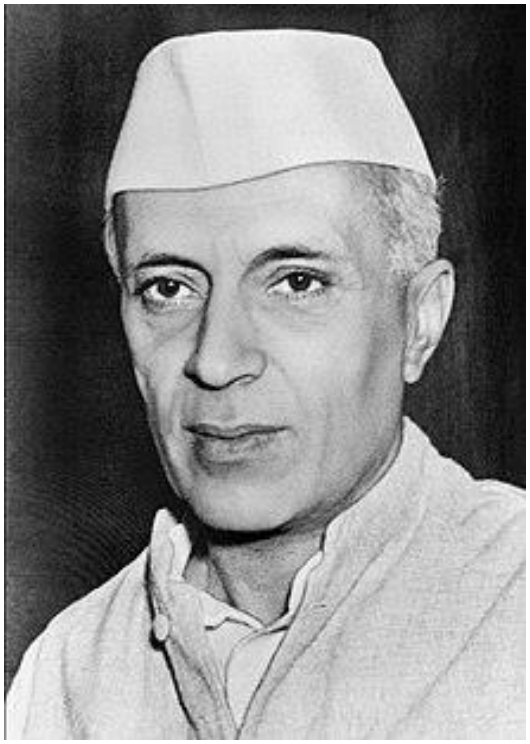
Indian Institutes of Technology	
Type	Public Technical
Established	15 May 1950
Budget	(US$1.2 billion)
Location	23 cities in India

IITs are owned by Ministry of Education of the India and are governed by the Institutes of Technology Act, 1961. The Act declares **IITs** as Institutes of National Importance and lays down their powers, duties as the country's premier institutions in the field of technology.

Each **IIT** has autonomy and is linked to others through the **IIT** Council. The Minister of Education is the chairperson of the **IIT** Council.

The Indian Institute of Technology (IITs) are Centrally Funded Technical Institutes located across India

In 1950, the office of the Hijli Detention Camp served as the first academic building of IIT Kharagpur



Jawaharlal Nehru

A 22-member committee, recommended the establishment of these institutions in various parts of India, along the lines of the Massachusetts Institute of Technology (MIT).

On 15 September 1956, the Parliament of India passed the Indian Institute of Technology (Kharagpur) Act, declaring it as an **Institute of National Importance**.

In 1956, **Jawaharlal Nehru**, first Prime Minister of India, said: Here in the place of that Hijli Detention Camp stands the fine monument of India, representing India's urges, India's future in the making.

The IITs receive comparatively higher grants than other engineering colleges in India: $20–30 million per year for each IIT.

Other sources of funds include student fees, research funding from industry, and contributions from the alumni.

The faculty-to-student ratio in IITs is between 1:6 and 1:8.

Doctoral

The IITs offer the Doctor of Philosophy degree (PhD).

The candidates are given a topic of academic interest by the ins or have to work on a consultancy project given by the industries.

Teaching Assistantships (TA) and Research Assistantships (RA) are often provided.

Brain drain

Among the criticisms of the IIT system is that it encourages **brain drain**. Since 1953, nearly 25000 IIT graduates have settled in the US.

Since the US benefited from subsidized education in IITs at the cost of Indian taxpayers' money, critics say that subsidising education in IITs is useless.

Others argue that the capital sent home by the IIT graduates has been a major source of the expansion of foreign exchange reserves for India.

سعدی:

اي كه دستت مي رسد كاري بكن
پیش از آن کز تو نیاید هیچ کار


با تشکر فراوان