

# Trends in Basic Sciences in Iran:

The Growth and Cognitive Structure  
of

Mainstream Basic Sciences in Iran

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**Abstract.** We attempt to chart out the scientific performance of Iran in the mainstream research in the world. In the light of our data, we also aim to bring Iran's position in the region into the focus by comparing her performance with that of some neighboring countries in the region, so that her competitive position in the Middle East becomes crystal clear. Comparison with South Korea is presented in the context of studying scientific performance of newly industrializing countries in the third world.

## Introduction.

Iran's scientific production faced a crisis about a quarter of century ago, at the time of revolution in 1979. The eight year Iran-Iraq war aggravated the situation. As a result, the country experienced a grave brain drain for almost a decade. However, in recent years Iran's scientific production has been gaining momentum. We will try to describe the dynamics and the cognitive structure of this recent growth in Iran's scientific production.

## Methodology and Data:

We choose the international ISI data-base for the bibliometric information of scientific papers from all over the world. The journal set of this data-base has been expanding over the years – from 2000 in 1970s to 3000 in 1980s and to about 5500 in the last decade of the millennium. The use of this data-base for studying the third world science has been subject to criticisms. For our purposes, however, it is accurate enough and serves well to make comparative studies. In particular, the ISI data has provided us with sensible and sensitive information to assess the sever migration of the scientists from Iran after the revolution and during the Iran-Iraq war. The scientific production of Iran has now increased almost 50 folds compared with the worst year of that time, namely 1985 and we, therefore, feel confident enough to resort to this data-base for our studies. The procedure has been as follows:

For the period 1980-2005, the data pertaining to Iran were downloaded. Research articles, review articles, letters, and notes are, by the consensus of experts, the four indices of scientific achievements. These items were retrieved from the downloaded data and analyzed. To obtain the cognitive structure of the scientific performance of the country, we have adopted different classification system of sciences for various resolution powers. For overall cognitive structure ,

we have used Popesceau's classification. For discussing Iran's basic sciences, however, we have adopted the Kirchof-Piaget system. This system was initially developed CHI- Research for a contract with NSF in US. In spite its comprehensive nature, however, has minimal resolution with the following fields: mathematics, Physics, chemistry, biology, earth and atmospheric sciences, engineering, biomedicine, clinical medicine. In what follows we have limited our discussion of basic sciences in Iran to the years 2001 to 2005.

## Results I:

Scientific activity of Iran has been subject to drastic changes during the past four decades. If we take the year 1970 as our point of departure, we observe that in the light of 1973 crisis and noticeable increase in the country's income as a result of increase in oil price, Iran's performance reaches a peak at the time of the revolution, 1979. Then as a consequence of Iran-Iraq war and revolution, the country experiences a collapse in scientific production. The performance in 1985 reduces to almost a fourth of the peak year. However, when one looks at its cognitive structure (data not presented here) one fortunately observes that the brain drain was confined to fields of clinical medicine (the migration of specialists was mainly to North America). Therefore, when in 1988 a Graduate Study Bill (GSB) was passed by the authorities to internalize and expand the education at graduate levels, the decision was timely. From Fig.1 we see that this decision bore fruit almost immediately. The scientific production of the country begun to rise after a decade of decline and stagnation. The growth was 6 folds one decade after the GSB and forty folds by 2005. The dynamism is, somewhat, staggering. But we should also note its shortcomings:

The cognitive structure of Iran's science, like that of the rest of the world, was initially dominated by medicine. This pattern has now changed. Presently, the chemistry dominates the scene but without any substantial connection to the

industry (e.g., the oil industry, the major source of income of the country). Life sciences have enjoyed considerable support by the policy makers. But it is only in the year 2005 that one observes a detectable growth in them, especially the clinical medicine. This is a welcome news, however, chemistry's position still requires much policy orientation. (See Fig.2)

Before proceeding to the analysis and discussion of basic sciences in Iran, we would just like to draw attention to the overall cognitive structure of science in the country. Fig.3 presents this structure in terms of Popescaus' classification system of sciences. As noted above, we can see that medicine for the first time since GSB was introduced enjoys the top position, and chemistry after enjoying the first rank for almost two decades is now in second rank – a position which, taking into account world average- must be further checked.

## Results II:

We now focus our attention to Iran's basic sciences in the light of Piaget classification system of sciences (though modifying it, by adding earth and atmospheric sciences to physics).

Fig.4 gives Iran's performance, in basic sciences over a period of five years – from 2001 to 2005. As can be observed the doubling time in some cases is even shorter than the five year period.

## Concluding remarks

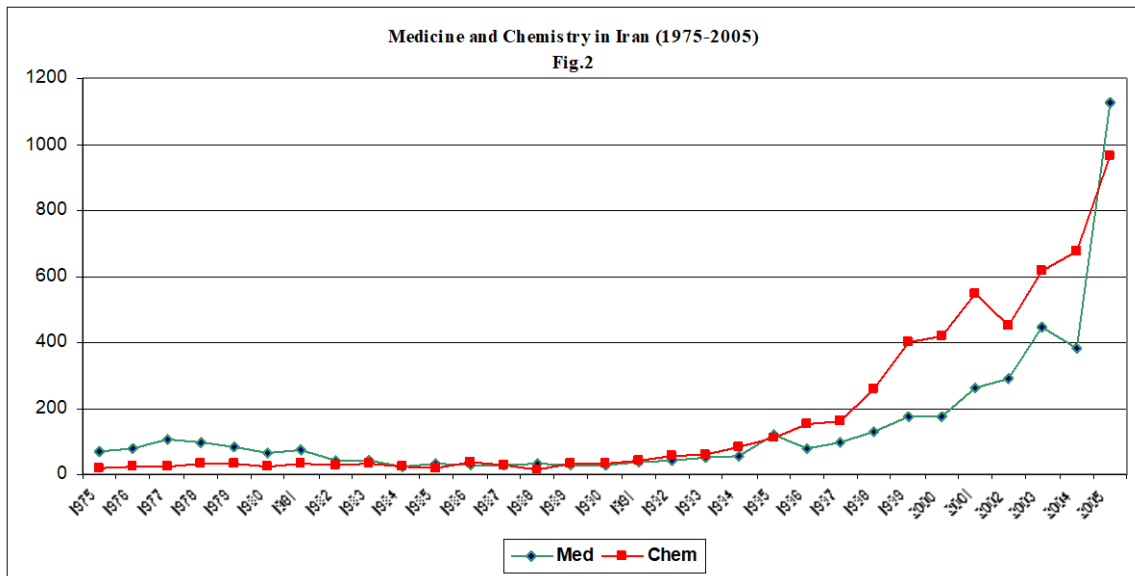
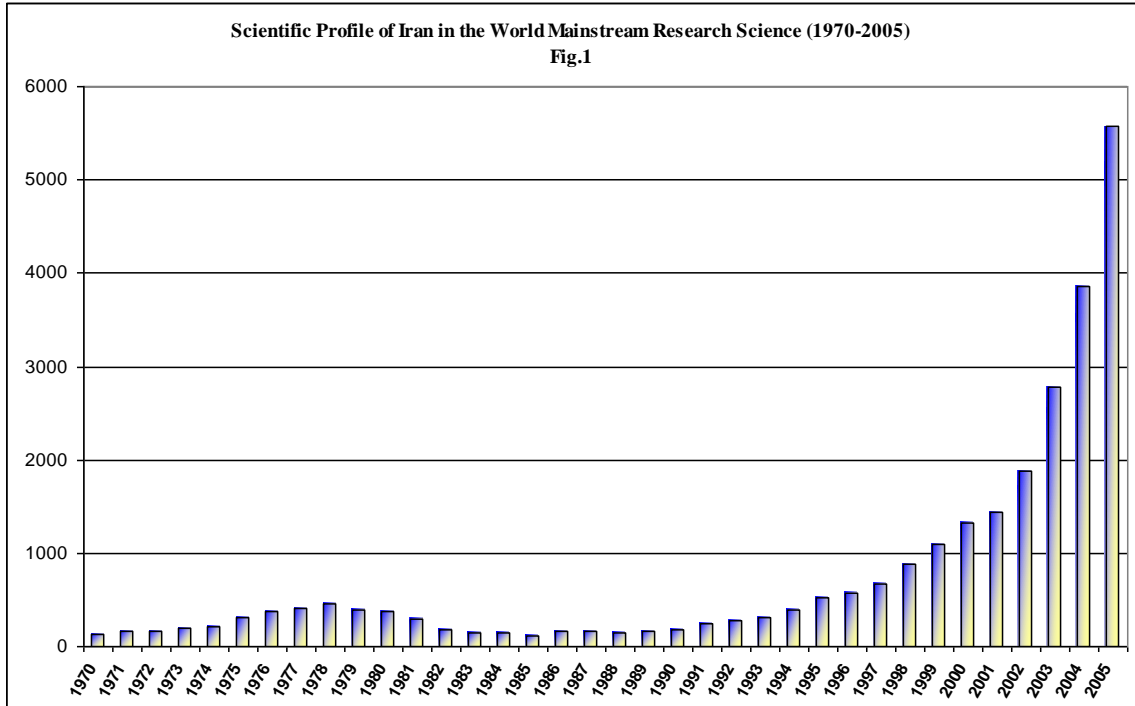
We noted in the above a sudden and unexpected jump in the field of clinical medicine. Since the cognitive structure of Iran's profile has been dominated, contrary to the world average, by Chemistry, in Fig.5 we have re-presented and compared the performance of Chemistry with that of Clinical Medicine. As can be seen the rise in the performance of Clinical Medicine is very sharp. Since this

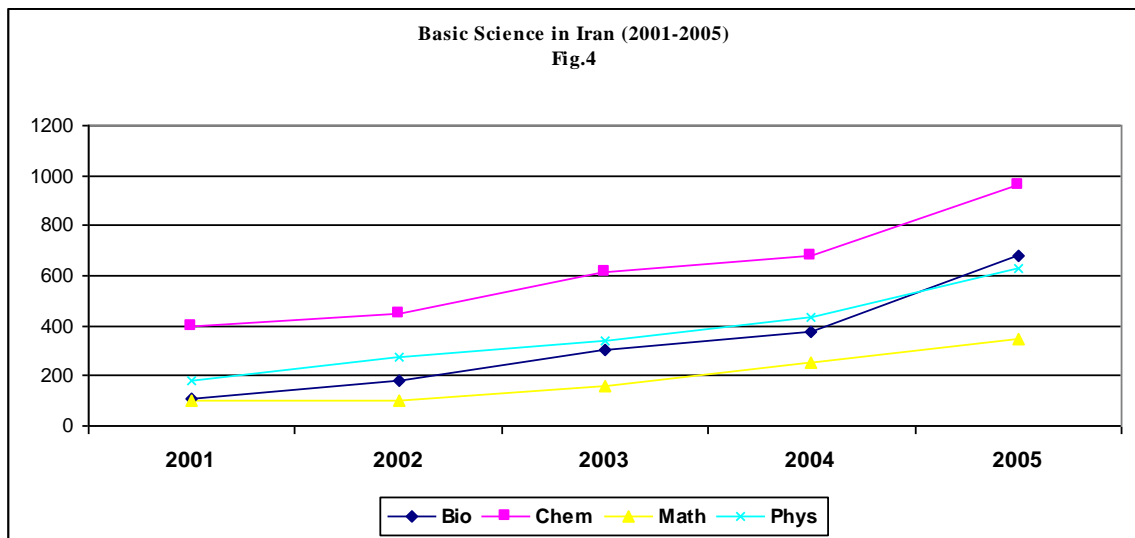
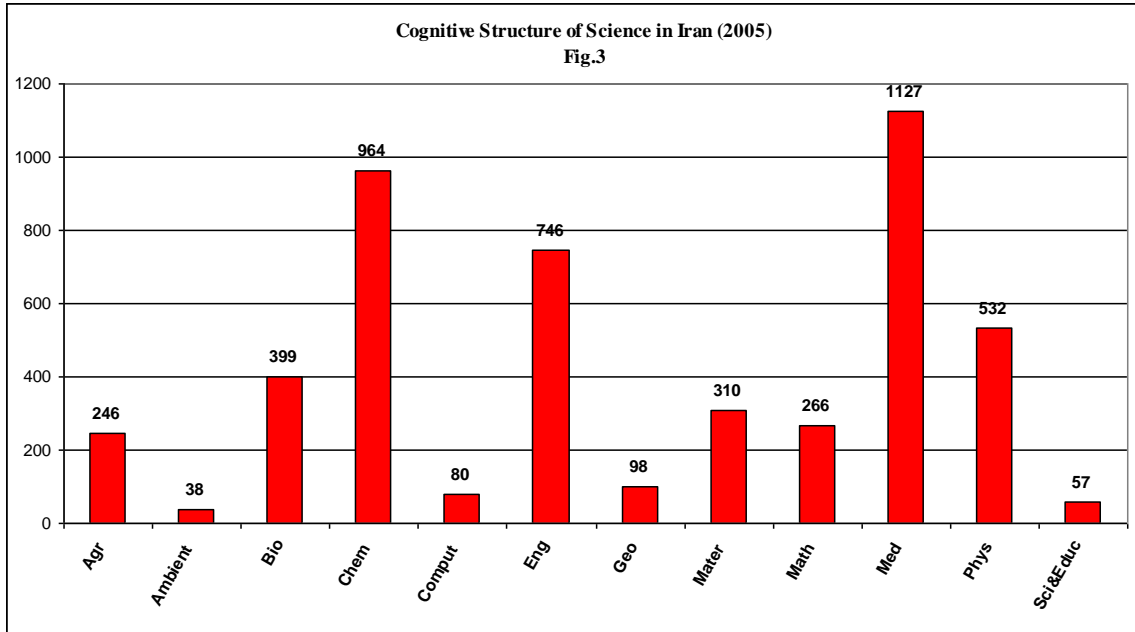
change may contribute to a major shift in Iran's profile in such a way that the distribution of physical sciences and life sciences in her performance become more balanced and nearer to that of world average, we were curious to find out whether this rise may be sustained. We therefore looked at 26 subfields of clinical medicine to see whether the rise is concentrated in some particular field. To our surprise, we discovered that almost all subfields have registered a distinctive rise- (especially and significantly in dermatology, endocrinology, gastrology, obstetrics, oncology, ophthalmology and orthoptics, pediatrics)- but some heading towards a disciplinary matrix (like cardiology, neurology, psychology all reaching three digits becoming comparable to the well-established pharmacology.) (Fig.6)

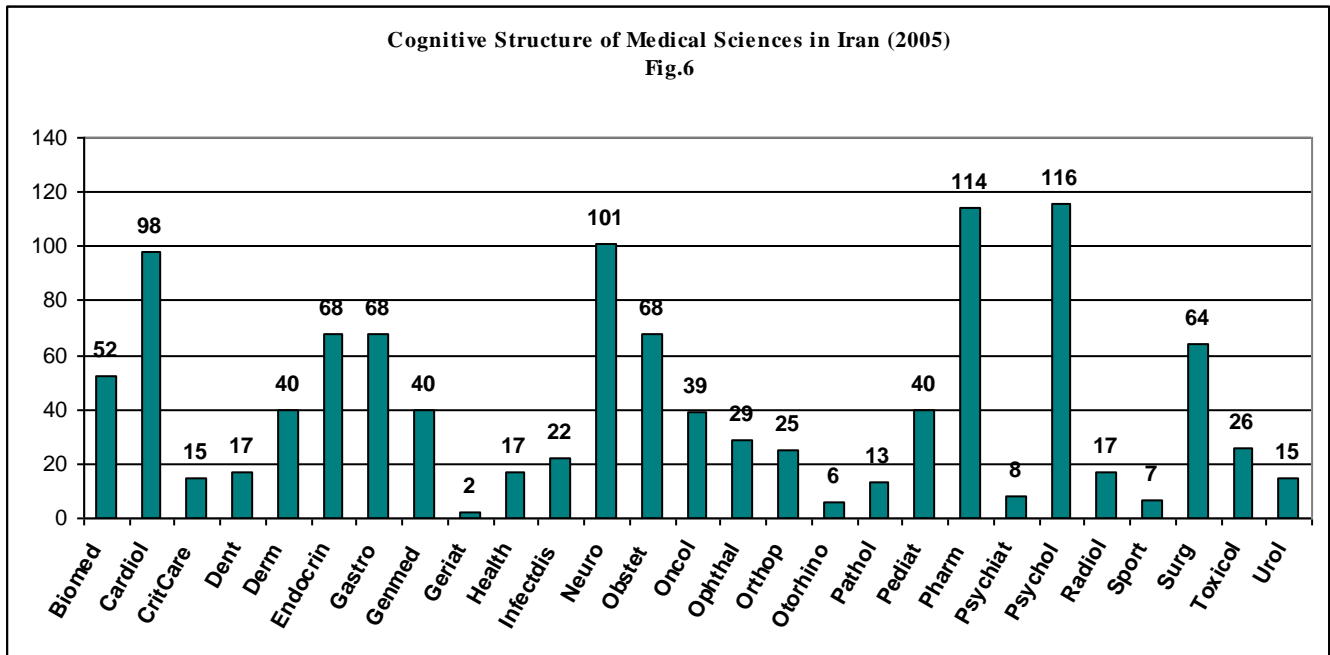
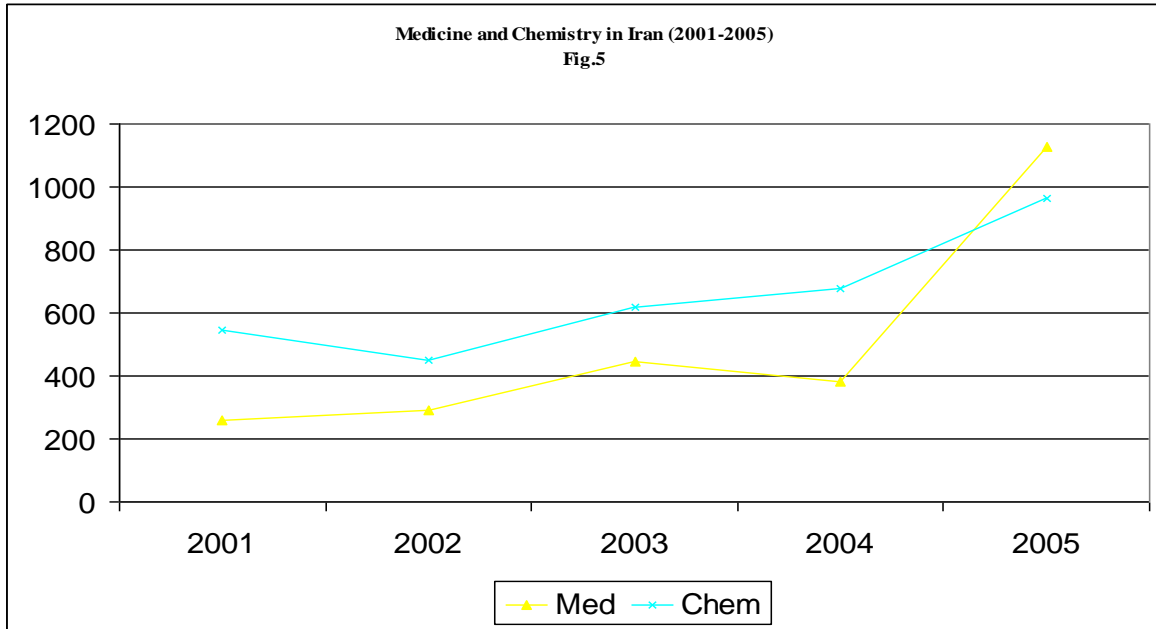
Moreover, we studied the population of medical scientists of 2003 and 2004 in order to compare them with that of 2005. We observed that in 2005 the field's population increases about four fold. However, one should study to what extent this latent population of medical scientists has been responsible for the field's under publication for earlier years and to what extent it is comprised of newcomers to the field.

If medical sciences could sustain their production in coming years, it seems that Iran's profile of scientific production will for the first time since war and revolution regain a balance (of fields) similar to that of world average. Moreover, because the doubling time of her scientific production has shortened significantly, she is in a position to move in the footsteps of newly industrializing countries who have managed to proceed towards proper scientific development. In Fig.7 Iran's position relative to that of South Korea and Turkey is presented in order to see how Iran's position has reached a turning point. To go beyond this point much investment is needed. But at the same time it all depends how the current political

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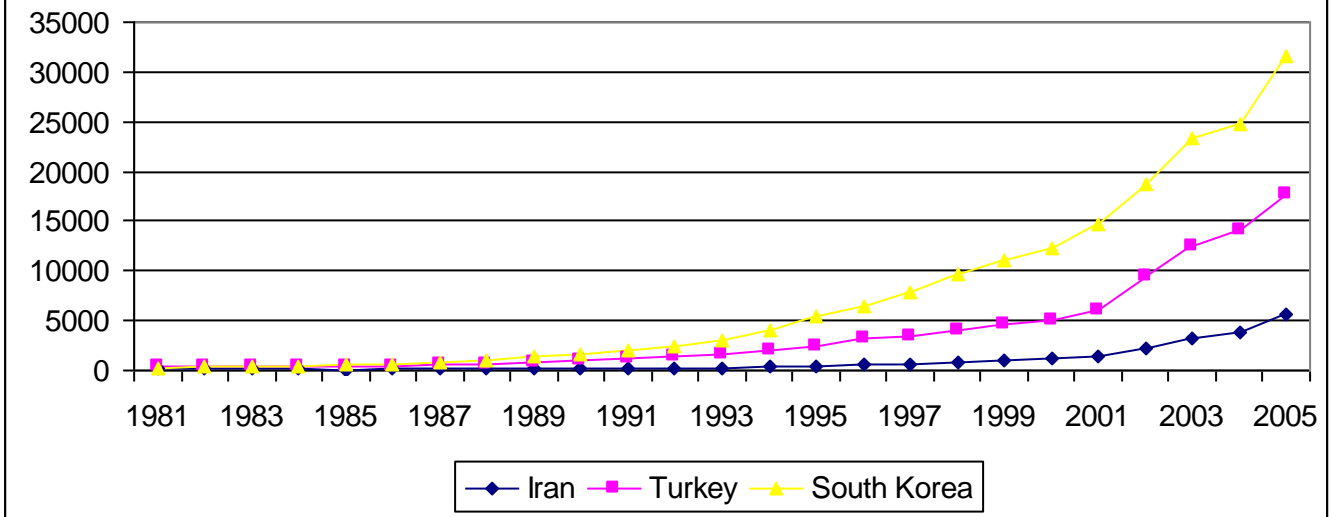








Comparison of Scientific Productions of Iran, South Korea and Turkey  
Fig.7



References: