ucts and services required by the information economy.

We therefore commit the organizations of the United Nations system to assist developing countries in redressing the present alarming trends.'

While communication revolution is perceived as a liberating influence, what is most likely to happen is that in many developing countries (including India, I am afraid) scientists and scholars will be among the last to be reached by the revolution. Therefore, the relative disadvantage they suffer (in the matter of access to information and knowledge) will only increase. The number of institutions and individual scholars having access to E-mail and Internet in developing countries and the rate at which this access has grown over time will support this contention. The speedy transition to electronic publishing will make it much easier for scientists and scholars in the developed countries to interact with colleagues and members of their invisible colleges. My major worry is that the low level of information and communication technologies in the developing countries would lead to the progressive exclusion of a majority of scientists and scholars in these countries from the collective international discourse that is essential for making progress in new knowledge production. Even now, when much publishing takes place in print, participation by India and other developing countries in high impact journals (such as *Science, Cell, Journal of the American Chemical Society*) is very low. The already existing gulf in the levels of science and technology performed in the developed and the poorer countries will be widened further, and that could lead to increased levels of brain drain and dependence on foreign aid of a different kind (knowledge imperialism).

In an earlier era, the brilliant Indian mathematician, Srinivasa Ramanujan, who was a genius but who had not gone through a conventional training programme, was nurtured in the intellectually stimulating ambience of Cambridge University, thanks to the vision of G. H. Hardy. While such individual initiatives may still be welcome to overcome real and apparent handicaps, what we need to overcome the current crisis is a far more organized and systematic programme of action. Early introduction of satellite-based high bandwidth Internet access to tertiary educational institutions and research laboratories at low cost and differential pricing for information (journal subscriptions and access to databases) to developing countries are high on my agenda. On both fronts, I am not happy with what is happening. For example, India can easily afford to invest in Internet provision to the 100 or so cities and towns where most of the nation's research laboratories and universities are located. But this has not happened, although we go through the motions and give the impression of being serious. Within the last one year, there have been at least three initiatives. V. S. Arunachalam of Carnegie-Mellon University spent a few weeks in India, discussing with important people (such as the then Finance Minister Chidambaram, and the technology-savvy Chief Minister of Andhra Pradesh Chandrababu Naidu) a proposal for networking academic and research cities of India at a cost of a few tens of millions of dollars. He was even toying with the idea of getting the funds either as aid or as a soft loan from some international agency. The Scientific Advisory Committee to the Cabinet appointed a subcommittee under the chairmanship of Roddam Narasimha to prepare a report on the subject and the report was submitted to the then Prime Minister I. K. Gujral. Now, the Vajpayee government has appointed a committee under the chairmanship of Jaswant Singh, and the first draft of the committee's report is ready. Let us hope the nation is lucky this time round. But what is actually happening is disheartening. Different agencies in the telecom sector who have to implement and deliver ultimately are quarrelling with one another. Indeed, this is characteristic of the Third World: it often takes far too much time for things to happen or to translate something from the realm of the possible to reality. As for differential pricing, both publishers of primary journal and database producers are reluctant. In one rare exception, the Institute for Scientific Information, Philadelphia, offers its *Science Citation Index* at 50% discount to most developing country subscribers. Even then it is perceived as too costly!

I would not be surprised if very soon the gulf between the scientifically advanced nations and the others widens even further, leading to further reducing the role of the developing countries in the enterprise of knowledge production, dissemination and utilization. Do I sound pessimistic? So did Toni Morrison.

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COMMENTARY

Health care and medical research in India—A thumb nail sketch in *The Lancet*

T. Jacob John

Robin Fox, formerly editor of *The Lancet*, has helped the high profile medical journal put together a profile of India, in its 25 April issue[1]. During the Narasimha Rao–Manmohan Singh quinquennium, India had 'ended its long love affair with Soviet-style planning and embraced the free market'[1]. Fox, a veteran India visitor, returned to expose to the world what had been happening to health care and medical research through the thoughts and words of a well chosen panel of experts, several

of them delightfully Fellows of the Academy. One could not miss two news pieces on India in the same issue, adding contours to the profile[2,3].

It is not possible to paint everything in a profile sketch of our vast country. Patchy as it is, it does however provide a broad brush picture of the nature of our problems and the seeds of ideas for their cure. May those with eyes see; those with ears hear. Indira Nath makes it clear that our health care needs, medical research and medical education have not guided, supported or met the needs of each other. The occasional spectacular successes such as the Chitra valve and the taming of hepatitis E virus are more due to the grit and determination of individuals (I call it the *P. T. Usha phenomenon*) than to organized infrastructure. Kerala reached zero population growth over a decade ago, but had to search for the road map. 'Researchers have now agreed that the main agent of change in Kerala health indicators is the education of girls' as succinctly stated by K. R. Thankappan. The mix of monarchy, missionaries and Marxism is nonreplicable, but the quintessential quality which allowed girls to live (Kerala is the only State without 'missing girls') and be literate can be transplanted anywhere else if politicians have the vision and will. The great second model is Tamil Nadu which also has recently achieved zero population growth through organized planning and efforts not related to high female literacy. If you have access to *Lancet*, please examine K. Srinivasan's graph on demography. If Bihar, Madhya Pradesh, Rajasthan and Uttar Pradesh (*BiMaRU* States) can adopt the Tamil Nadu model, the predicted year of achievement of total fertility rate of 2.1 as 2040 to 2110 (note the error here, not 2010) can be revised and advanced. Indeed a bit of both Kerala and Tamil Nadu factors will work wonders there. The Malthusian thesis of disease bringing down population is no longer tenable; no, not even AIDS will do it, but it is good health that will have to lead to fertility control. The 'economic importance of good health' is that it both contributes to development and results from development, in one happy upward spiral. Health is also a means to, not only a measure of economic development.

On the matter of AIDS, Valiathan was perhaps caught unprepared; probably there are cumulatively already some 10 million persons with HIV infection in India and one million (that is 10% of all infected) with clinical AIDS. The epidemic will now grow in its natural course and reach a peak of some 20 million some time in the next century and there is no evidence that interventions have made much of an impact on the force of transmission. But the point is, why do we need figures, unless we had agreed on some particular course of action based on figures. Is there a threshold figure that will galvanize a definitive plan of action? If not, it is not worth playing into the hands of those who play the numbers game. A policy of not testing for HIV infection in the clinical setting was forced on us. Testing was supposed to be only for 'surveillance', so we were taught by experts who did not even know the meaning of the word surveillance. Small sample surveys do not constitute surveillance. Valiathan is quite correct when he points out the virtual uselessness of data from a few sentinel laboratories. Once again, India discarded indigenous scientific advice and went for foreign expertise and funds with unseen strings. History has repeated, for Indira Nath does point out how we failed to use science to solve the problem of poliomyelitis. Outside advice takes precedence over science in India: 'the discoveries of scientists do not affect mainstream health care' or 'do not translate into policy'. AIDS exaggerates infectious diseases that we are already used to; we are also used to death of those who should have lived much longer. In this context, if HIV infection is not specifically tested for, there will be no AIDS, only a lot of death due to underdiagnosed infectious diseases. If they are not counted and tallied, we will not know the trend or magnitude. If AIDS in all its gory pathos and pathology is not recognized locally, no one will be worried about the statistics on HIV infection in blood donors and antenatal women, for is it not merely a laboratory test result on healthy people? 'Epidemiology is very weak in our country, and I would like to see it taken up as a priority', so says Valiathan, and I cannot agree more. Epidemiology is the foundation science of public health. No epidemiology, no public health. Look at India.

Srinath Reddy draws attention to the demographic and epidemiologic transitions of modern India. Read on and you will find *transition* is not the right word, perhaps *overlap* is. We have all the problems of lack of hygiene or public health. Diarrhoeal diseases of every cause under the sun have, as shown by M. K. Bhan, more solutions in addition to those improved ones for oral rehydration. All hepatitis viruses flourish, no matter how they spread, by sex or dirty water or illicit injections or faeco-orally if that is possible. If it is true it must be possible; otherwise known as coprophagia. S. K. Panda and Shahid Jameel are world leaders of hepatovirology, but we also hold the records for epidemics of HEV and for the largest number of HBV carriers in the world. We cannot afford not to immunize our children against HBV, and they say we cannot afford to immunize them either. One of the 'many contradictions bringing both hope and a measure of despair'. Thank God (or lucky stars for those who swear by astrology) the new Director General of ICMR, N. K. Ganguly does bring hope, for he is at once at ease with medical research and education and now speaks the language of epidemiology too (of rheumatic fever and rheumatic heart diseases). A population with the annual incidence of RF/RHD of 54 per 100,000 children deserves better diagnostic skills including laboratory support at the primary health care levels everywhere. We also have our (un)fair share of cancers as sketched by K. A. Dinshaw and A. N. Bhisey. One's (tobacco) wealth is another's (cancer) death. Unless tobacco cultivation is replaced by other feasible and lucrative crops, crocodile tears are all we can cry. No more famines, at least the macros, as the country produced 191 million tons of food grains in 1994–95, spread equitably 500 g per person per day. Inequity does lead to micro famines, in families and communities. Impressive reductions (not elimination) in kwashiorkor, marasmus and blinding vitamin A deficiency, according to Kamala Krishnaswami. And the progressive increase in cardiovascular admissions over the past 30 years in the Christian Medical College Hospital in Vellore, all showing the kaleidoscopic overlapping of all diseases of the early, middle and late periods of the 20th century, coexisting like in a museum. K. S. Reddy warns that 'the experience of migrant (to more affluent countries) Indians provides a vision that awaits Indians at home'. Everybody, take

note; your health and that of your children is in your hands.

People's Health in People's Hands is a book by N. H. Anita, which had already been read by Robin Fox and Valiathan. It outlines the philosophy of Panchayati Raj. The MS Swaminathan Committee recommends the new principle of 'local planning, central funding'. A welcome shift from the old model of central plans and target-oriented, rigged-figure-ridden, vertical, hierarchical, top down, inefficient, undersupervised, unweildy, inadequately funded health care system in which no one is accountable and everyone grazes the scapegoat.

Post script. Be on the look out for a forthcoming paper in *The Lancet* on A District Level Disease Surveillance System. A Model for Developing Countries.

1. Nath, I., Reddy, K. S., Dinshaw, K. A., Bhisey, A. N. *et al.*, *Lancet*, 1998, **351**, 1265–1275.
2. Kumar, S., *Lancet*, 1998, **351**, 1261.
3. Kumar, S., *Lancet*, 1998, **351**, 1262.

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SCIENTIFIC CORRESPONDENCE

Flavour of fundamental particles and prime numbers

Earlier Ramanna and Sharma[1] had shown that prime numbers play an important role in the systematics of fundamental particles, and many aspects of unstable nuclear phenomena can be understood through the simple equation:

$$\hbar/MT = n/2^n \qquad (1)$$
$$= \tau/T,$$

where $\hbar$ is Planck's constant, M the mass of the fundamental particle in energy units, T the half-life of the particle in s, τ is the half width, and n a parameter.

Writing $-p = \log_{10} n/2^n$, we have when $n = 6\ 10\ 14\ 21\ 28\ \ldots\ 42\ 49\ \ldots$

$$p = 1\ 2\ 3\ 5\ 7\ \ldots$$

to within a few per cent of the values of the primes.

Denoting all the values of n derived for particles from experiment as n_{exp}, we arrange them in the order of increasing values of n_{exp}. We note, as pointed out earlier[1], that in the region between $n = 22$ and $n = 44$ there is only one particle, i.e. π^0. Using the maximum and minimum values of n_{exp}, we arrange a set of equally spaced numbers but in decreasing order and denote them by n_{int}. Further, we define a function R and its derivative Q w.r.t. n,

where $R = (n - n_0)/(p - p_0)$ and

$$Q = [\{p^*\log 2 - \log n + 1 - (p/n)\}/$$
$$\{n^*\log 2 - \log n - p_0\}^2]$$

n is either n_{exp} or n_{int} respectively, n_0 is the nearest integer to n, p corresponds to p_{exp} or p_{int} respectively and p_0 is nearest prime to p.

In Figure 1, Q_{int} is plotted against n_{int} and it is seen that it has maxima at $n_{int} = 6$, 10, 14, 21 and multiples of 7. Figure 2 gives the same plot for Q_{exp} and n_{exp}. It is remarkable that it also

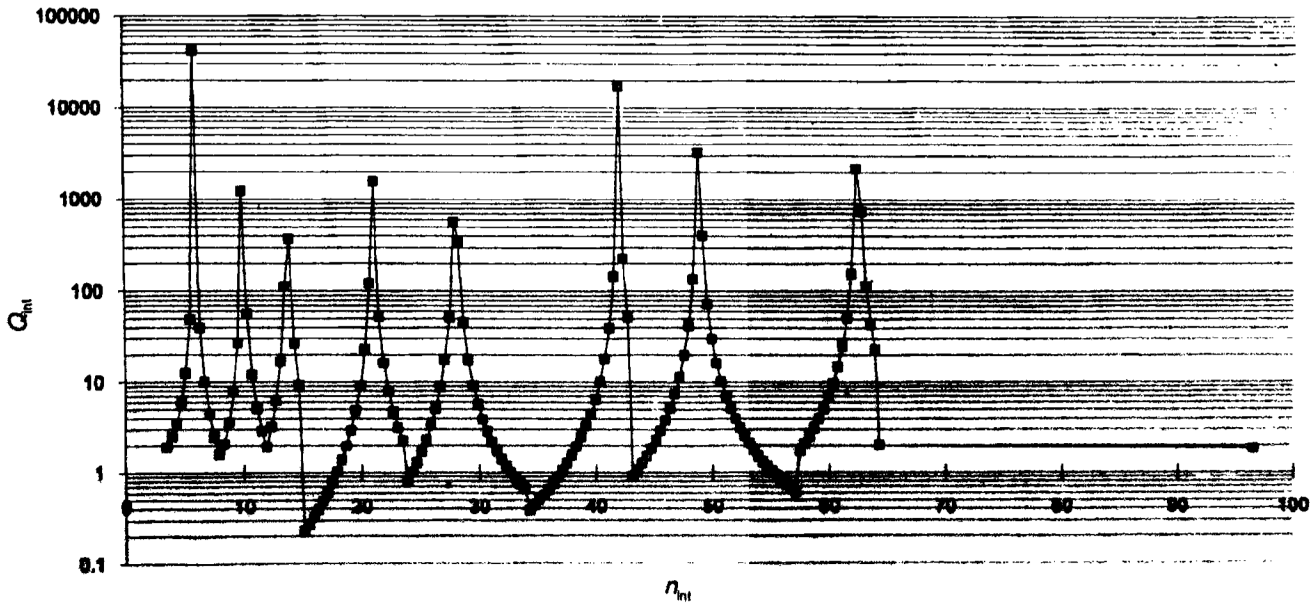

Figure 1. Plot of Q_{int} vs n_{int} showing peak at values of n corresponding to prime nos 1, 2, 3, 5, 7, 11, 13, 17 (derived purely from numbers).