Drivers of Change

Biotechnology and Health Security

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Your Majesty, your Royal Highnesses, your excellencies, ladies and gentlemen, I must begin by saying that I am honoured and privileged by the invitation to participate in this important gathering on Science and Technology: Drivers of Change. It gives me particular pleasure to be, once again, in the company of their Royal Highnesses Prince Hassan and Princess Sumaya bint El Hassan who have been so active in the area of efforts to reap the benefits of scientific and technological advances in the interest of human security in Jordan and beyond.

In these brief remarks I would like to focus on scientific and technological advances in relation to infectious and other diseases. I do this for two reasons. First, this subject has been at the very heart of the discussions over the past three days – in particular water, climate change, poverty, urbanisation and demographic change. Second, the amazing scientific and technological changes in the life sciences are bringing about revolutionary advances in the medical, veterinary and agricultural sectors, which as they become available, will empower communities to exert more control over their own lives along with – very unusual these days – reducing costs. Potentially, particularly for developing countries, there a rich harvest to be gathered if this development it is fully recognised and specific steps are taken to engage all sectors in what has to be a multi-disciplinary scientific and technological endeavour. However, these benefits can be gained only if societies themselves in Jordan and elsewhere help create the right conditions to reap the rewards. These conditions include improving the climate for international collaboration and encouraging public and private sector cooperation – that is between government, academia and private industry.

The challenge as I see it is two-fold:

- It is estimated by the World Health Organisation that almost 14 million people die every year from some form of infectious disease. Most of them in developing countries, and most from diseases that are treatable by today's medical technology. This is bad enough, but chronic diseases such as diabetes, cancer, cardiac illnesses and the like, often thought of as diseases of the developed world, are increasing exponentially in developing countries;
- Second, while advances in biotechnology offer huge promise in medicine, nutrition and industry, they can also be misused, or negligently applied, resulting in harm to humanity and the environment. The challenge is how to safeguard and promote advances in biotechnology while addressing these risks.

It is helpful to look at the biological risks we all face as a spectrum ranging from naturally occurring disease outbreaks – epidemics and pandemics – through laboratory accidents as a result of negligence or lack of awareness, to the deliberate misuse of biotechnology and pathogens to cause harm to people, animals or plants.

In the first decade of the 21st century the pace of advances has been truly astonishing. However, the world at large has yet to enjoy the benefits. Genomic sequencing is one area that illustrates very starkly the pace of change. In the field of information technology most of you I am sure are familiar with Moore's Law. This "law" predicts that the amount of information that can be stored in a given area on a microchip doubles every 18 months. This has proved to be largely true. In the field of genomic sequencing Professor Robert Carlson (University of Washington, USA) has attempted a similar predictive "law". Carlson's "Law" predicts an even faster rate based on the number of base pairs sequenced or synthesised per person per day (Figure 1). This can be illustrated by the following examples:

- Starting in 2002 it took two years for a team to synthesise the polio virus;
- In 2005 it took two weeks for a team of the same size to synthesise a virus of comparable length;
- In addition to the scientific and technical benefits arising from this capability the costs reducing rapidly (Figure 2).

With regard to cost let me give an example from genomic sequencing as follows:

- The first human genome sequencing effort cost US$3 billion over thirteen years;
- Current cost circa $5,000 per human genome;
- Accepted breakthrough level $1,000 per human genome that may be possible in perhaps five years.

While sequencing complete human genomes has hit the headlines less than twelve complete human genomes have been sequenced up to 31 March 2010. This is not where everyday lives are being affected. However, the rapidly growing use and commercialisation of strings of DNA for a wide range of purposes is already becoming widespread -- the costs involved here are rapidly dropping. This coupled with the rapid advances in bioinformatics and nanotechnology is a true driver of change.

These examples are from just one, but important driver of the advances in the life sciences affecting all areas including the medical, agricultural and materials sciences and technologies. As in the case of the acceleration in the advance and rapid dissemination in information and communications technologies it will bring about what may be described as a "democratisation" of the power to bring about change – in the case of the life sciences in health security for people, animals, plants and the environment in general.

The harnessing of the advances in the life sciences can only be realised if the human capacity is educated and trained to seize and apply the amazing advances to their priority challenges. This requirement is not just related to biology but a truly multi-disciplinary

approach is needed embracing biology, chemistry, physics, nanotechnology, materials, information technology – I could go on. It is all about people and knowledge. In effect I am referring to the kind of multi-disciplinary environment being nurtured here at the Royal Scientific Society and envisaged for El Hassan Science City.

An important element in gaining the full benefits of the new technologies is the exploitation of international networks of people in the academic, private and governmental sectors. An example of this is the Biosafety and Biosecurity International Conference (BBIC) process that is connecting scientists and policy makers from across the Middle East and North Africa region. This network engages in common cause to enhance, safely and securely, human and laboratory capacities in order to apply the advances in the life sciences appropriate for the regional and national needs. The benefits will be enjoyed only if individual scientists fully appreciate the importance of the responsible conduct of this area of science so that it is not misused or irresponsibly pursued. The BBIC international collaborative effort relies on the commitment and leadership of individuals from the countries of the region. In this context I am pleased to say that HRH Princess Sumaya has been one of the leaders in getting this process underway and maintaining its momentum. This month Jordan takes over the presidency of the process.

It is clear that El Hassan Science City has the potential to play a leading role in the Middle East in exploiting and applying the advances I have been describing through multi-disciplinary and cross-sector (public-private partnership) activities. From what I have seen the fruitful exploitation of the drivers of change in Jordan is in good hands and is well on the way to dealing with the challenges arising from water scarcity, urbanisation, climate change, energy, waste treatment and poverty. A key issue in my view is the dealing with infectious and chronic diseases arising from these challenges. The science and technology is now becoming available and affordable to help face the human and economic cost of infectious and chronic diseases. As the Prime Minister stated in his address two days ago a key factor in realising success lies in education to assure the availability of the necessary human capacity to apply the revolutionary advances in the life sciences. It is all about people and knowledge.

Figure 1.

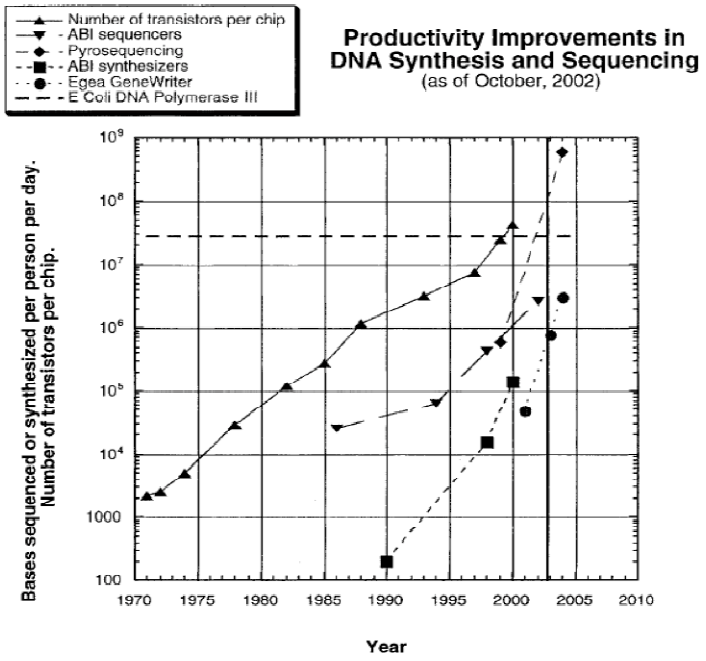

Figure 2.