Global Biosafety and Biosecurity:
Taking Action

February 15-17, 2011

Bangkok, Thailand

"An armchair tour of the world of biosecurity"

It is wonderful to be with you to night – speaking with you is certainly speaking to the converted – you, better than anyone else, understand the bio-safety risks associated with laboratories, and the ways in which they must be managed.

I am pleased to have been invited, and am happy that I was able to stop by on my way back to London from Melbourne, where I participated in a one health conference that was part of the growing movement of collaboration between those working in human and animal health, and all others who are concerned with the issues that underlie infectious diseases at the animal/human interface. Certainly working in this area is one that will demand great attention to bio-security issues and I know that you will be fully involved.

As I thought about what to say to you this evening, it occurred to me that I could tell you nothing that you don't already know. In fact I had a note from Nicoletta when I arrived who said that this meeting was moving in directions that none had done before, and would certainly result in greater attention to biosecurity worldwide.

So instead of trying to tell you anything new, I decided instead that it might be interesting to take you on an armchair tour of the world of bio-safety – from Europe to Africa, to Asia, to the Middle East and to the future.

Our tour begins in Geneva in 1967 – at the Executive Board room of the World Health Organization. Many of you have been there – for those who have not, it is a rather dingy place, with no windows to the exterior, but it is a place where profound decisions are made, and where ministers of health hold themselves accountable to those decisions. And the decision to eradicate smallpox was one of those decisions.

In 1967 smallpox was still occurring in just over 30 countries, and there were an estimated 2.7 million deaths from smallpox in that year alone. Most countries had, however, eliminated smallpox through routine vaccination activities, and a decision was made to eliminate smallpox from those countries still endemic through a global partnership in smallpox eradication.

It was considered feasible to eradicate smallpox because there was no reservoir of the smallpox virus in nature, because there was an effective and thermostable vaccine that had already been successfully used to eliminate smallpox in most of the countries of the world, and because every infection was clinically expressed in the same manner making it easy to diagnose and easy to track where the virus was circulating.

The smallpox eradication programme was successful – through a strategy of surveillance and containment transmission was interrupted in the remaining endemic countries. The surveillance strategy was active – searches from house to house, market to market, and at religious and other festivals wherever they occurred. Search was done with photograph cards of a child or adult with smallpox – and reports were taken as to where there were persons who had illness similar to what was on the photo. These persons were then traced and isolated.

Containment was the same strategy that has recently been recommended should smallpox be used deliberately to cause harm – ring vaccination around active cases of smallpox, and tracing of all contacts to vaccinate them – in fact vaccine could be effectively used up to four days after infection and still be effective in attenuating disease and decreasing transmission.

Smallpox transmission was gradually eliminated – and by 1977 it was limited to the Horn of Africa where the last case occurred in Sudan. Once transmission in Sudan had been interrupted, a process of certification began and smallpox eradication was finally certified in 1980 – just over thirty years ago.

But as history would have it, the last case of smallpox did not occur in Sudan as celebrated in 1977 – it occurred in Birmingham in the United Kingdom, an accident caused by a laboratory with insufficient bios-safety procedures in place. As most of you know, somehow a medical photographer working in the same building as the smallpox laboratory became infected with the smallpox virus and died. The official investigation concluded that the virus had travelled in air currents up a service duct from the laboratory below, to a room which was used for telephone calls where the medical photographer – the last person to die with smallpox - had spent much more time in the room than usual ordering photographic materials because the financial year was about to end.

No matter how the medical photographer was infected, the lesson from this tragic event is that biosafety is not only important for the safety of those who work in the laboratory, but for others as well.

For the next stop on our tour I would like to take you back to 1995 – to the tropical rainforest of the Congo Basin near Kikwit in the Democratic Republic of the Congo, at the time called Zaire. Kikwit is the administrative centre of a large district that is made up of small villages in clearings in the forest. The forest provides a livelihood for many of the inhabitants, and one such inhabitant made charcoal for a living. He regularly cut trees in the forest and charred them in a kiln in a small forest clearing. Somehow he became infected with the Ebola virus – no doubt from a bat reservoir living in the forest, either directly from contact with bat excreta, or indirectly by some other means, possibly hunting, killing and butchering an infected primate.

But no matter how he was infected, the charcoal worker became ill with a high fever and severe muscle pains, and then began to hemorrhage and died. Those who were taking care of him – family members and neighbors - also became infected, and in turn died or survived. But they continued a chain of transmission of the Ebola virus in the same village for the following two months. After two months, one of the newly infected persons was transported to one of the two hospitals in Kikwit – a journey that took almost an entire day – and when he arrived at the hospital with a high fever and

generalized myalgia, the laboratory technician was asked to do a thick smear for malaria and some other basic laboratory analyses. Four days later the laboratory technician was also sick with fever and began to bleed from his intestinal tract. The diagnosis was a paralytic ileus, possibly due to typhoid, and he was transferred from the hospital where he worked to the larger district hospital, where he had immediate emergency surgery. Infection control conditions in the operating room were not respected by nurses assisting with the surgery, nor by the surgeon, nor those who cleaned up the operating room after the surgery. The laboratory technician died during the operation – two of his family members later became ill and one died, and several of the nurses, the surgeon and some of those who cleaned up the operating room likewise became ill. The diagnosis of Ebola was made only after a major outbreak occurred at the Kikwit District Hospital, where one third of the cases were health workers and the rest were either their family members or patients whom they had infected in the hospital.

Lesson number 2 is therefore that laboratory workers, and other health workers in general, are at great risk from emerging infectious diseases that are not recognized on admission, and require many diagnostic tests and interventions.

The third stop on our biosafety tour of the world leads us back to 2003, to the Guangdong Province in China where an undiagnosed atypical pneumonia had begun to occur in late 2002, but had not come to attention until health workers began to get sick in early 2003 and inadvertently began to amplify its transmission in several of the hospitals in the Province. One of those health workers - a medical doctor – left the Guangdong Province in February for Hong Kong where he planned to attend a wedding. He arrived in Hong Kong with a high fever and spent the night in a major hotel. Somehow that night he infected tourists and businessmen staying in the same hotel who then carried the infection to Viet Nam, Singapore, Canada, Ireland, the United States, and to several of the hospitals in Hong Kong.

This of course was the outbreak of Severe Acute Respiratory Syndrome, or SARS, and during the following months – through basic infection control measures – the outbreak was stopped and SARS was put back in the box. Measures taken are familiar to all of you – patient isolation, heightened hospital and laboratory infection control, quarantine of contacts, and international travel advisories. The etiology of the infection – a coronavirus – was identified by a group of virologists and laboratory technologists working together virtually, sharing information and thus helping to focus on identification procedures by understanding what had been tried in other laboratories. In July of that year it was clear that transmission of this newly emerged disease had been interrupted – and the world gradually moved back to normal.

But within 6 months the SARS coronoavirus reappeared - in Singapore, in Taipei, and in Beijing where there was a large cluster of cases. It was soon clear in each of these instances that the infection had been caused by a laboratory accident. The infections in Singapore and Taipei, and the index case in Beijing were all in laboratory workers or students working in the laboratories where the SARS coronavirus had been stored, and though not reported, it was thought that there were at least three additional laboratory infections in China.

Lesson 3: All laboratories are at risk of breeches in bio-safety procedures – whether they are advanced technology laboratories in industrialized countries, or basic laboratories in rural developing country settings.

But there is one final lesson that I would like to share with you as well – and that is the importance of laboratories and public health specialists to work together – to create well functioning partnerships. The three diseases included in this evening's armchair tour of the world – smallpox, Ebola hemorrhagic fever, and SARS – are all understood because of this partnership. Without laboratories, public health workers and epidemiologists cannot perform to their maximum. And there is also a reverse paradigm as well – laboratory workers cannot work in safety and ensure biosecurity without the understanding provided by the public health workers and epidemiologists. And this is a wonderful partnership which we all have experienced over an over.

For example, it is through the systematic work of laboratories that we have understood the complexity of the hepatic viruses and their epidemiology and transmission patterns – laboratories providing information from blood banked serum, and testing specimens obtained in serosurveys and other epidemiological investigations. It is in fact from such partnership that we have understood the epidemiology and transmission patterns of hepatitis C.

Therefore it was quite a surprise in the late 1990s when Saudi Arabia publicly banned all Egyptian guest workers because they posed a public health threat from hepatitis C, an infection we knew from out epidemiology/laboratory partnership that occurs only from infected blood, usually by transmission, or from a mother to her child before or during birth. Newspapers throughout the Middle East carried the story, and WHO was called to meet with Saudi Arabian and Egyptian ministries of health to try to resolve the issue. It soon became clear that it was not a public health issue in any sense of the word – in fact it was an issue of economics that had its historical beginnings with the Aswan Dam construction in the mid-20th century.

Egyptians working in the standing water that was created during the construction of the dam became infection with schistosomiasis – and were treated with an antimony compound that could only be given by injection. It is postulated that it was these injections – from improperly sterilized needles and syringes – that resulted in a prevalence of over 40% hepatits C in some parts of Egypt, and this high rate was reflected in the guest workers to Saudi Arabia. Egyptians working in Egypt became ill with hepatitis C periodically, and sought treatment from the Saudi Health system. They soon were considered an economic burden, and took up hospital beds intended for Saudi Arabian citizens. Discussions were then raised to the level of international relations, an agreement was reached that guest workers who became ill with hepatitis C would be repatriated to Egypt, and the situation was resolved.

Resolved because of an understanding of hepatitis C that came from a partnership between laboratories, public health workers and epidemiologists.

We have another opportunity for partnership today – this time between laboratories from industrialized and developing countries – to strengthen capacities including biosecurity. I am sure that Nicoletta has spoken with you about this opportunity, and would imagine that Terry Taylor and others have done the same.

This opportunity lies within the International Health Regulations and the core capacity strengthening capacity required of every country during the coming five years. What better way for you and your national associations to show solidarity. By partnering

between industrialized and developing laboratories, together you can strengthen biosecurity throughout the world, and ensure the laboratory capacity that will permit all countries to detect, diagnose and contain infectious diseases threats where and when they occur – be they naturally occurring – or deliberately caused.