



Nanomedicine and infectious diseases

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First International Conference on Infectious Diseases and Nanomedicine – 2012

Kathmandu, Nepal, 15–18 December 2012.

The First International Conference on Infectious Diseases and Nanomedicine congress facilitated the mixing of researchers in various fields of nanomedicine and infectious diseases, bringing together researchers from the fields of physics and chemistry, on the production of nanoparticles and researchers from various fields of microbiology where these nanoparticles have practical applications. The manufacture and applications of nanoparticles was one of the main themes of the congress, with much emphasis on the use of nanoparticles for the treatment of cancer. The ever increasing problems and concerns around antibiotic resistance also featured prominently in the congress. Various interesting presentations on human viruses were also presented during this congress.

The First International Conference on Infectious Diseases and Nanomedicine conference, which was arranged in Kathmandu, Nepal, was attended by delegates from 21 countries. The importance of this conference for the developing medical and microbial research communities in Nepal was highlighted by the fact the President of Nepal, Ram Baran Yadav, opened the conference. One of the main objectives of this congress was to get world leaders in the fields of nanomedicine and infectious diseases to attend and address this congress. This then gave numerous postgraduate students in Nepal the opportunity to gain valuable experience and first hand information from these international delegates.

The International Union of Microbiological Societies (IUMS) was very well represented at this congress, with five of the IUMS council members attending this congress. These were Geoffrey L Smith (President), Yuan Kun Lee (President elect), Stephen A Lerner (Vice President), Pierre Talbot (Vice President and President of the IUMS 2014 Congress in Montreal, Canada) and Fusao Tomita (IUMS Ambassador to Asia). Researchers from various countries including Australia, Bangladesh, Canada, China, Georgia, Germany, India, Iran, Italy, Japan, Korea, Nepal, Pakistan, Poland, Russia, Singapore, South Africa, Thailand,

United Arab Emirates, the UK and USA also attended the congress.

The First International Conference on Infectious Diseases and Nanomedicine – 2012 was also addressed by the opening Video Lecture on *Helicobacter pylori* by Nobel Laureate Barry J Marshall from The University of Western Australia (WA, Australia).

One of the aims of this congress was to get researchers from the fields of nanomedicine (including physics and chemistry) and various fields of infectious diseases (including pathology, microbiology and clinical sciences) together at the same congress to explore common ground.

The conference could be seen to consist of three main unofficial themes. The first of these was various aspects of nanomedicine, which was mainly focused on anticancer therapy. Another underlining theme of the congress was the ever increasing problems of antibiotic resistance. The third underlying theme was virology.

Nanomedicine

One of the keynote presentations at the congress was presented by Jamboor K Vishwanatha (University of North Texas Health Science Center, TX, USA) who presented a review of the use of nanomedicine in cancer treatment. This presentation was focused on the targeting of nanoparticles to cancer cells [1,2]. He

presented work on the use of a novel noncovalent insertion of a spacer for the delivery of curcumin, a potential anticancer agent, to cancer cells. Various other presentations at the congress covered various techniques which are currently being employed to produce nanoparticles, including silver nanoparticles and zinc oxide nanoparticles.

The interesting question of drug delivery systems was also raised in a presentation by Suresh Neethirajan (School of Engineering of the University of Guelph, ON Canada), who did a presentation on nanobiorobots [101].

Lodewyk Kock (University of the Free State, South Africa) presented an opening talk on the use of Nano Scanning Auger Microscope (NanoSAM) technology for the study of the ultra structure of biological material [3,4]. This was the first time that this technology has been used on biological material and opens up a novel field of study in nanomedicine. Here, Auger atom electron physics coupled to Argon etching and scanning electron microscopy are utilized to visualize the 3D architecture in ultrastructural and element composition modes of the whole cell. This finds particular application in studying the fate of drugs and gold nanoparticles during cell treatment. With this new field of Auger-architectomics, the 'lungs' of cells have been exposed.

Antibiotic resistance

Many of the talks presented at this congress were related to the ever increasing problems of antibiotic resistance and methods to overcome the resistance problems. Stephen Lerner (Wayne State University, MI, USA) presented a special symposium on the ever increasing problems of antibiotic resistance. During this presentation, he reviewed various aspects related to emergence, selection and spread of resistance in relation to the evolution of the bacterial species. Lerner also discussed various options related to strategies to cope with increasing antibiotic resistance. Various other presentations at the congress also addressed strategies, which have been put in place or need to be put into place to ensure good stewardship of the antibiotics that mankind has at their disposal.

Robert Bragg (University of the Free State) presented research work from the Veterinary Biotechnology Research group in which the pros and cons of the potential use of bacteriophages as potential treatment options in a postantibiotic era were discussed [5]. One of the main advantages of bacteriophages is that they are extremely host specific and phage therapy can be targeted to specific bacterial pathogens and not cause any damage to the normal microbiota. Yuan Kan Lee (National University of Singapore) presented a talk on the importance of the normal microbiota and the role that they play in protection of the host against invading pathogens. Thus, any antibacterial treatment that does not damage the normal microbiota could be of tremendous benefit. The very high host specificity of bacteriophages is one of their main advantages but is also one of their main disadvantages. The use of bacteriophages for the treatment of bacterial diseases will require very accurate identification of the bacteria pathogen involved. There are no 'broad spectrum' bacteriophages, although the possible expression of bacteriophage enzymes involved in the release of the bacteriophage from the infected host bacterium, could result in

treatment options with a broader host range. Examples of the specificity of bacteriophages for various avian pathogenic *Escherichia coli* strains were presented by Bragg. He also demonstrated the use of the NanoSAM technology, which was discussed earlier during the congress by Kock, for the study of bacteriophages.

In a second presentation by the same research team, the development of resistance to disinfectants, and particularly quaternary ammonium compound products was discussed. Bragg raised the point that disinfection is the most poorly studied field of disease control in human medicine. He raised the question of how many hospitals actually take the trouble to monitor the efficacy of their disinfection programmes, while nosocomial infections remain a major problem in hospitals around the world, particularly in an era of increasing antibiotic resistance. The use of the NanoSAM technology to study the mode of action of quaternary ammonium compound based products on bacteria was also discussed [6].

Fusao Tomita (Hokkaido University, Japan) presented a talk on the current state of infectious diseases in Japan where he also highlighted the increasing problems of antibiotic resistance. He also highlighted the importance of an effective monitoring system [7].

Virology

The first presentation by Geoffrey Smith (University of Cambridge, UK) was a very interesting historical review of the eradication of smallpox. In his second presentation, he discussed the recent work from his research group on vaccinia virus, the virus that was responsible for the irradiation of smallpox, on how the virus spreads from cell to cell and how the virus can overcome the host defence mechanisms. Their work has demonstrated that the virus spreads approximately four times faster than predicted by the replication kinetics of the virus [8]. He also presented work on how vaccine virus suppresses the innate immune response by the production of intracellular proteins that shut down the signalling pathways [9]. They identified a *DNA-dependent protein kinase* (DNA-PK) and they have demonstrated novel antimicrobial activities of this DNA-PK that play a role in host defence against virus infection.

Pierre Talbot (INRS, Université D'avant-garde, QC, Canada) presented work on emerging coronaviruses [10]. The SARS pandemic of 2002–2003 pushed coronaviruses into the forefront of important viral disease of humans. In 2012, another SARS-like disease was reported from the Arabian Peninsula. It has been found that some strains of mouse coronaviruses cause multiple sclerosis-like neurological diseases in mice. This has led to the investigation of a possible role of coronaviruses in diseases with unknown etiology such as multiple sclerosis and Alzheimers disease in humans [11].

Student posters

The hosting of such a conference, with the number of international presenters, presented the postgraduate students in Nepal and ideal opportunity to gain valuable information from these international guests. This congress also had a poster presentation, with most of the posters being presented by students from Nepal. A total of 44 posters were presented. Pramila Adhikari

(Department of Microbiology, Kantipur College of Medical Sciences, Kathmandu, Nepal), who presented a poster entitled 'Intestinal parasitic diarrhea among children of Nepal', received recognition as one of the three best posters at the conference. Manisha Pradhan (Department of Microbiology, St. Xavier College, Kathmandu, Nepal), with a poster entitled 'Possible pathogens isolated from catheters used in ICU and different wards and their antibiotic susceptibility pattern', was another of the students who received recognition for her poster at the congress. Finally, Eak Dev Khanal (Central Department of Microbiology, Tribhuvan University, Kathmandu, Nepal), with a poster entitled 'Increasing level of drug resistance in *Vibrio cholera* in Nepal' was the final student with a winning poster.

Conclusion

This congress succeeded in bringing researchers from diverse fields of nanomedicine and various aspects of infectious diseases

together where meaningful discussions could be held. The congress was extremely well organized by the local organizing committee under the leadership of Rameshwar Adhikari (Central Department of Chemistry, Tribhuvan University, Kathmandu) of the Nepal Polymer Institute and Santosh Thapa (Department of Microbiology, Trichandra Campus, Tribhuvan University, Kathmandu, Nepal) of the Nepalese Association of Medical Microbiology.

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