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Editorial

Bacterial and Viral Infections Impact on Human Health

Muhammad Mukhtar*

Department of Biotechnology, American University of Ras Al Khaimah, Ras al Khaimah, UAE

***Corresponding Author:** Muhammad Mukhtar, Department of Biotechnology, American University of Ras Al Khaimah, Ras al Khaimah, UAE.

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Several infectious diseases among humans and plants are caused by microscopic organisms like viruses and bacteria. Although records of human viral and bacterial diseases date back to 3.5 billion years ago, the first physical evidence of viral disease - the smallpox - was found in mummified body of Pharaoh in the form of small pustules manifestation of the infection [1]. Historically, characterization of microscopic organism is linked with the discovery of microscope in 17th century. Microscopy complemented by advancement in optics and allied technologies helped the field of bacteriology to keep prospering and pathogenesis of several bacterial diseases were deciphered. Two contemporaries, Robert Koch (1843-1910), a German bacteriologist, and Louis Pasteur (1822-1895), a French chemist, are credited with advancing the field of bacteriology.

As far as virology is concerned, experiments of an English Physician Edward Jenner provided initial clues for two interdisciplinary fields of science, virology and immunology. His findings of inoculating material from cowpox lesion endowing protection from smallpox led to eradication of this human viral disease from the Earth. However, the real advancements in the field of virology ensued subsequent to an interesting observations in the year 1892 providing initial evidence of viral diseases in plants: tobacco plants suspected to be infected with bacteria upon filtration through bacterial resistant filters retained the potential to infect other plants later identified as the first plant viral disease caused by tobacco mosaic virus (TMV). As far as human viral disease are concerned yellow fever virus discovery in the year 1900 by US Army physician as causative agent for viral disease is also linked with the ferrying of disease causing microorganism passage through bacterial proof filters exactly as the paradigm of TMV discovery [2]. Yellow fever virus discovery was followed by an effective vaccine development recognized through Nobel Prize in Physiology and Medicine of the year 1951 awarded to Max Theiler. Later on advancements in molecular and cellular techniques helped in several ground breaking discoveries relevant to the field of bacteriology and virology and few recognized through Nobel Prizes in physiology or medicine category are listed in Table 1 and 2 manifesting equal share of both these fields (9 in bacteriology and 10 in virology).

There are over 200 viral species found in humans [3] and several bacteria causing diseases among humans and plants. Besides these, two microscopic groups of organisms: protozoa, fungi and parasitic organisms are associated with infectious diseases also. Viruses need living cells to propagate; however, the other infectious diseases agents like bacteria have capability to survive in varied environments either in the presence (aerobic) or absence (anaerobic) of oxygen endowing this group of microorganisms a versatility in their pathogenesis processes. Among the infectious disease pandemics both viruses and bacteria share a major proportion. The medieval black death also known as bubonic plague, a bacterial infection is recognized as one of the highly devastating epidemic in the history killing millions of individual during the years of 1347-1351 [4]. Similarly, a nasty strain of flu virus, historically known as 1918 Spanish Flu pandemic linked with deaths of over 50 million individuals is also believed to be viral pandemic worsening with bacterial pneumonia infection [5]. Unfortunately, both the bacterial and viral disease have been changing and evolving their pathogenesis with the passage of time. (Common cold virus) The discovery of zoonotic, vector borne and emerging infectious disease is continuously threatening human health [6]. There is a long list of bacterial zoonotic infectious disease [7], however, viral zoonotic infections like bird flu, Middle East Respiratory Syndrome Virus (MERS), and very recently EBOLA viral disease and associated morbidity and mortality rates are wake up calls for continued surveillance and global programs aimed at curbing these diseases [8].

Year	Discovery
1901	Emil Adolf von Behring "for his work on serum therapy, especially its application against diphtheria, by which he has opened a new road in the domain of medical science and thereby placed in the hands of the physician a victorious weapon against illness and deaths"
1905	Robert Koch "for his investigations and discoveries in relation to tuberculosis"
1928	Charles Jules Henri Nicolle "for his work on typhus"
1939	Gerhard Domagk "for the discovery of the antibacterial effects of prontosil"
1945	Sir Alexander Fleming, Ernst Boris Chain and Sir Howard Walter Florey "for the discovery of penicillin and its curative effect in various infectious diseases"
1952	Selman Abraham Waksman "for his discovery of streptomycin, the first antibiotic effective against tuberculosis"
1958	One half jointly awarded to George Wells Beadle and Edward Lawrie Tatum "for their discovery that genes act by regulating definite chemical events" and the other half to Joshua Lederberg "for his discoveries concerning genetic recombination and the organization of the genetic material of bacteria".
1978	Werner Arber, Daniel Nathans and Hamilton O. Smith shared prize “for the discovery of restriction enzymes and their application to problems of molecular genetics"
2005	Barry J. Marshall and J. Robin Warren "for their discovery of the bacterium *Helicobacter pylori* and its role in gastritis and peptic ulcer disease"

Table 1: *Bacteriology - Major Nobel Prizes in Physiology or Medicine.*

Year	Discovery
1951	Max Theiler "for his discoveries concerning yellow fever and how to combat it"
1954	John Franklin Enders, Thomas Huckle Weller and Frederick Chapman Robbins shared prize "for their discovery of the ability of poliomyelitis viruses to grow in cultures of various types of tissue"
1965	François Jacob, André Lwoff and Jacques Monod"for their discoveries concerning genetic control of enzyme and virus synthesis"
1966	Peyton Rous"for his discovery of tumor-inducing viruses" Charles Brenton Huggins”for his discoveries concerning hormonal treatment of prostatic cancer”
1969	Max Delbrück, Alfred D. Hershey and Salvador E. Luria"for their discoveries concerning the replication mechanism and the genetic structure of viruses"
1975	David Baltimore, Renato Dulbecco and Howard Martin Temin"for their discoveries concerning the interaction between tumor viruses and the genetic material of the cell"
1976	Baruch S. Blumberg and D. Carleton Gajdusek received a shared award "for their discoveries concerning new mechanisms for the origin and dissemination of infectious diseases"
1989	J. Michael Bishop and Harold E. Varmus shared prize “for their discovery of the cellular origin of retroviral oncogenes”
1996	The Nobel Prize in Physiology or Medicine 1996 was awarded jointly to Peter C. Doherty and Rolf M. Zinkernagel "for their discoveries concerning the specificity of the cell mediated immune defence"
2008	HaraldzurHausen received one half “for his discovery of human papilloma viruses causing cervical cancer”, the other half jointly to Françoise Barré-Sinoussi and Luc Montagnier “for their discovery of human immunodeficiency virus

Table 2: *Virology - Major Nobel Prizes in Physiology or Medicine.*

Data source for Table 1 & 2: http://www.nobelprize.org/

Both scientific disciplines virology and bacteriology are interdisciplinary and complement each other. The 1969 Nobel Prize in Physiology or Medicine jointly awarded to Max Delbruck, Alfred D. Hershey and Salvador E. Luria for their discoveries leading to the identification of viruses infecting bacteria, the bacteriophages, opened up new vistas both in virology and bacteriology. Findings about the lysogenic and lytic mechanisms of bacteriophages infections were translated into several subsequent research avenues. Bacteriophage lysogeny, a mechanism of viral infections in which viruses co-exist with the bacterial host that they infect helped in understanding

several persistent viral infections among humans. Of importance, the lytic infection mechanism of bacteriophage is being exploited to engineer phages capable of destroying specific disease causing bacteria (phage therapy) through molecular techniques [9]. The phage therapy holds a great promise for the superficial bacterial infections afflicting millions all across the globe. Furthermore, according to the National Institute of Allergy and Infectious Diseases (NIAID) of National Institutes of Health (NIH), USA, phage therapy is one of the most viable alternatives for circumventing the issue of antibiotic resistance worldwide developed widely among patients suffering from bacterial disease [10]. Similar approaches are being utilized by health biotechnology entrepreneurs to develop oncolytic viruses that can specifically kill cancerous cells. This modality is being developed to treat human cancer. Particularly, results are being anxiously awaited from an ongoing phase III clinical trials of head and neck cancer treatments through cancer destroying engineered viruses [11].

Both disciplines - virology and bacteriology - have also helped in advancing molecular sciences, particularly molecular biology and biotechnology benefitted to a great extent. Discovery of restriction endonucleases, the enzymes capable of cutting deoxyribonucleic acid (DNA) at particular place isolated from bacteria is a major factor advancing molecular sciences and deciphering of human and several other organisms genome. A highly controversial human gene editing method with highest precision the Clustered Regularly Interspaced Short Palindromic Repeat (CRISPR) technology is mainly a bacterial process of self-protection being used in humans and plants. Utilization of this technology in editing human genome the concept of "*designer babies*" which is being highly debated now a day [12] is an advancement emanating from bacteriology. Along with similar lines, the capability of viruses to infect animal cells has been exploited to develop viral vectors for gene therapy purposes. Targeted gene delivery will circumvent issues relevant to delivery of therapeutic agents into inaccessible regions of human body [13]. Gene therapy though having few bottlenecks is progressing day by day along with virology and bacteriology.

Due to overlapping scientific discoveries and methodologies relevant to the field of virology and bacteriology and particularly co-infections with bacterial and viral disease needed a scientific journal with a scope of publishing basic and applied research in both these fields individually or in combination. The *EC Bacteriology and Virology Research (ECBVR)* will be a forerunner to fill this gap and provide opportunities for scientists aspiring to publish their work in these fields.

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