EDITORIAL

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Year's comments for 2009

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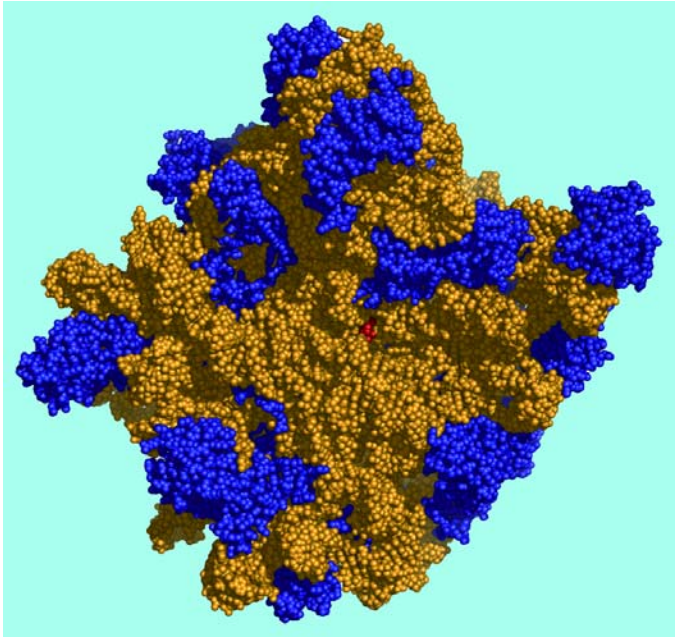
The year 2009 has been full of events in which the ever-expanding field of microbiology has been the focus of attention. In its Year's comments for 2008, INTERNATIONAL MICROBIOLOGY noted that microbiology was the subject of the Nobel Prizes in Physiology or Medicine and in Chemistry. In 2009, these two prizes once again offered proof of the broad implications of microbiology and of the interdisciplinary nature of this field of science.

Elizabeth H. Blackburn, from the University of California at San Francisco (CA, USA), Carol W. Greider, from Johns Hopkins University School of Medicine (MD, USA), and Jack W. Szostak, from Harvard Medical School, Massachusetts General Hospital (MA, USA) and Howard Hughes Medical Institute (MD, USA), shared the Nobel Prize in Physiology or Medicine "for the discovery of how chromosomes are protected by telomeres and the enzyme telomerase." Blackburn and Szostak first identified telomeres when they were trying to understand why chromosomes did not become shorter after successive cell divisions. Working together, the two researchers sought to answer this question in the unicellular ciliate *Tetrahymena thermophila*. They isolated the repeated CCCCAA sequences found at the end of this protist's chromosomes, coupled them with rapidly degraded mini-chromosomes, and inserted them into yeast cells (another microorganism). Surprisingly, the end sequences of *Tetrahymena* DNA protected the mini-chromosomes against degradation. The fact that the conferred protection crossed the species barrier suggested that Blackburn and Szostak had likely identified a universal mechanism. Further experiments showed that these protective sequences, the telomeres, were present in most plants and animals. Meanwhile, Greider, then a graduate student of Blackburn's at the University of California at Berkeley, began to study whether the formation of these apparently ubiquitous sequences at the ends of chromosomes proceeded enzymatically. She indeed found evidence of an enzyme, which she and Blackburn called telomerase, that was subsequently shown to consist of proteins and RNA. The latter contained the CCCCAA sequence, thus serving as a template for telomere construction. Telomerase



Source: Wikimedia Commons

Fig. 1. Atomic structure of the 50S large ribosomal subunit at 2.4 Å resolution of the archaeon *Haloarcula marismortui* (*Science* 289:905-920, Aug 11, 2000). Proteins are colored in blue, and RNA in orange. The active site, adenine 2486, is shown in red.

provides a platform whereby DNA polymerases are able to copy the entire length of the chromosome without missing the portion at the very end. The discovery of this fundamental cell mechanism has had a major scientific impact, because it provided a mechanism explaining why cells cannot divide indefinitely. Both telomeres and telomerase are key elements in the regulation of cell aging, and defects in the enzyme are related to many inherited diseases. Furthermore, it has been shown that cancer cells often have increased telomerase activity, allowing them to replicate indefinitely while escaping cellular senescence. Overall, the work of these scientists has paved the way for many new lines of research as well as the development of therapeutic agents expected to have a significant impact on clinical medicine. This work might not have been possible without microbial "collaboration."

The Nobel Prize in Chemistry was shared by Ada E. Yonath (the fourth woman to become a Nobel laureate in chemistry, and the first since 1964), from the Weizmann Institute of Science (Rehovot, Israel), Thomas A. Steitz, from Yale University (CT, USA) and Howard Hughes Medical Institute (MD, USA), and Venkatraman Ramakrishnan, from the MRC Laboratory of Molecular Biology (Cambridge, UK), "for studies of the structure and function of the ribosome." Again, microorganisms served as the source of their research, aimed at unraveling the mechanism behind one of life's core processes and a key aspect in the central dogma of molecular biology: the RNA-mediated translation of DNA into proteins. The three Nobel laureates were rewarded for successfully mapping, at the atomic level, one of the largest and most complex cellular components that can be studied by X-ray crystallography, the ribosome. And, again, the model system was prokaryotic. Yonath's pioneering studies in X-ray crystallography had allowed her to analyze the structure of the 50S large ribosomal subunit of *Geobacillus* (formerly, *Bacillus*) *stearothermophilus*, a bacterium, and of *Haloarcula marismortui*, an archaeon from the Dead Sea (Israel) (Fig. 1). There was, however, an obstacle to interpreting the results: while Yonath's crystals had clear patterns of black dots, the "phase angles," which provide information on the location of atoms in X-ray crystallography images, were lacking. Using electron microscope images from Joachim Frank, Thomas Steitz was able to solve the phase problem and thus to derive the structure of the large ribosomal subunit of *H. marismortui*. Independently, and almost simultaneously, Yonath and Ramakrishnan obtained the structure of the small ribosomal subunit of the bacterium *Thermus thermophilus*. By incorporating the results of work in other bacteria, such as *Escherichia coli*, they were able to elucidate the structure of the ribosome at the finest atomic level (2.4 Å or 3.5 Å). Furthermore, Ramakrishnan's crystal structures of the small subunit were crucial in explaining the ribosome's precision and accuracy during mRNA translation. Finally, the work of Steitz allowed the identification of those atoms important to the reaction whereby peptide bonds form between amino acids, thus furthering our understanding of protein synthesis.

As on many other occasions, the Nobel Prize has not been exempt from controversy—it is always possible to single out other significant research that would have been equally worthy of recognition. However, the detailed 3D models generated by the Yonath, Steitz, and Ramakrishnan have broad-ranging implications, as they provide insight into exactly how antibiotics bind to and block the functions of the microbial ribosome. This, in turn, will facilitate the design of new and more effective antibiotics.

In awarding the 2009 Nobel Prize in Chemistry, the Swedish Academy joined in the worldwide celebrations recognizing the sesquicentenary of the publication of Charles Darwin's *The Origin of Species*. The Academy pointed out that this year's prize is the third Nobel Prize to confirm Darwin's theories at the atomic level. The first was the 1962 Nobel Prize in Physiology or Medicine, awarded to Francis H.C. Crick, James D. Watson, and Maurice H.F. Wilkins for their elaboration of an atomic model of the double-stranded DNA molecule. In 2006, Roger D. Kornberg received the Nobel Prize in Chemistry for showing how genetic information is copied from DNA to the messenger RNA molecule. This year's Chemistry award completed the series by showing the structure of the ribosome, which reads the mRNA and translates it into proteins.

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INTERNATIONAL MICROBIOLOGY joined the commemoration not only of the 150th anniversary of the first publication of *The Origin of Species* but also of Darwin's 200th birthday. A drawing titled "Darwin and diversity" by the young artist J-A Ros, from Barcelona, was featured on the March 2009 cover of the journal. Furthermore, in a year in which the achievements of three women scientists were recognized by the Nobel Committee, INTERNATIONAL MICROBIOLOGY published an article by Mercè Piqueras, devoted to Emma Wedgewood, Darwin's dedicated wife, mother to their ten children, his essential source of support, and his great friend and caretaker, without whom it is unlikely that Darwin would have been able to achieve many of the things that he did [Piqueras M (2009) More about Mrs. Darwin than about Mr. Darwin, *Int. Microbiol.* 12:69-74].

One of the most commented upon events of this year has been the global outbreak of influenza due to a new strain of influenza virus A (H1N1), which by the end of November had caused approximately 12,000 deaths worldwide. On 24 April, 2009, Mexican health officials confirmed an outbreak

of what had become known as "swine flu," which had killed some 20 people. The disease quickly spread to other Latin American, North American, European, and Asian countries. By early June, the World Health Organization (WHO) had already raised the level of alert for the H1N1 influenza virus to phase 6, and declared the outbreak to be a pandemic. The virus is a novel strain of influenza, and contains genes from five different influenza viruses: North American swine influenza, North American avian influenza, human influenza, and two swine influenza viruses typically found in Asia and Europe.

Steadily confronted with many scientific, health-related, and socially relevant questions that have arisen as a consequence of the H1N1 pandemic, two biomedical journals, *The Lancet* and the *New England Journal of Medicine*, created web sites offering scientific publications, expert analyses, and general advice regarding the prevention, detection, diagnosis, and treatment of H1N1 flu (*H1N1 Flu Resource Centre* [http://www.thelancet.com/H1N1 -flu] and *H1N1 Influenza Center* [http://h1n1.nejm. org/], respectively.)

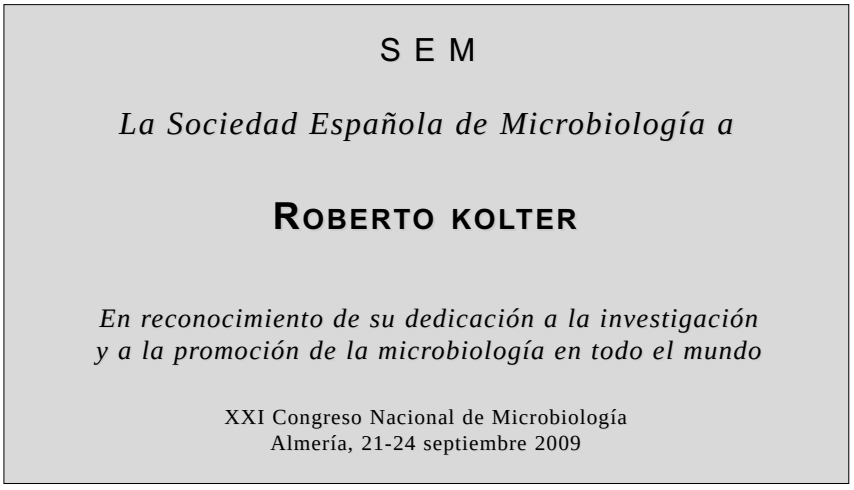

Fig. 2. Inscription on the three silver plaques presented by the Spanish Society for Microbiology to Roberto Kolter, Nubia Muñoz and Regina Revilla, "in acknowledgement of [their] dedication to research and promotion of microbiology all over the world."

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Several meetings, including two biennial congresses of great importance to Spanish and European microbiologists, coincided in 2009. The first was the 3rd Congress of the Federation of European Microbiological Societies (FEMS), *Microbes and Man: Interdependence and Future Challenges*, which took place 28 June–2 July in the beautiful Swedish city of Gothenburg. The 1746 attendees from 85 countries included 127 from Spain, the country with the second-highest number of participants, trailing only Sweden, the host country. The great number of Spanish scientists reflects the potential of microbiology in Spain, and the interest that Spanish microbiologists have in contributing to networks and forums involving international science centers and researchers. A few weeks later, on 10–12 September, the Spanish Society for Microbiology (SEM) hosted the 36th FEMS Council Meeting, celebrated in Barcelona. The meeting was held at the historic Institute for Catalan Studies and was presided over by the current president of FEMS, Milton da Costa, from the University of Coimbra, Portugal. FEMS has 46 member societies in 36 European countries, and 40 of these societies were represented at the Council Meeting.

On 21–24 September, the 22nd National Congress of the SEM was held at the University of Almería, in Andalusian Spain, along the Mediterranean Sea. Through 70 lectures clustered in 18 symposia, 1 seminar, 54 oral communications, and 297 posters, the more than 500 attendees learned about the latest research results, ideas, and trends in the numerous areas of microbiology. Roberto Kolter, president of the American Society for Microbiology (ASM), gave the inaugural lecture.

The Congress in Almería was outstandingly well organized by Joaquín Moreno, from the University of Almería, and his collaborators. By offering first-class lectures and a wealth of activities aimed at promoting scientific discussion, the program was able to address the many sub-specialties that make up the field of microbiology. Most of the research reported at the Congress belonged to one of three mainstream areas: environment (microbial ecology, symbioses and evolution, extremophiles, quorum sensing and quorum quenching, and stress and evolution in bacteria); health (gene transfer and resistance to antibiotics, viruses and infectious diseases); and biotechnology (industrial microbiology and microbial biotechnology, microbial biofactories and biosensors, and bioremediation).

Among the participants in the SEM meeting were world-renowned scientists, including the Colombian epidemiologist Nubia Muñoz, from the International Agency for Research on Cancer (Lyon, France), who discussed her research on cervical cancer and the human papillomavirus, the subject of the 2008 Nobel Prize in Physiology or Medicine. Her lecture was a part of a Symposium sponsored by Merck, Sharp & Dohme (MSD) of Spain, one of the partners in the MEDINA project [www.medinaandalucia.es]. During the Congress, the SEM presented three commemorative silver platters to Roberto Kolter, Nubia Muñoz, and Regina Revilla, Communications Director of MSD of Spain (Fig. 2).

Scientists from several European countries were also present at the event, as were members of the ASM, who organized

an informational session "ASM: Promoting scientific exchange and collaborations worldwide," dedicated to furthering cooperation between the ASM and other microbiology societies, including the SEM. A formal collaborative agreement between SEM and ASM was signed at the meeting to translate the ASM's MicrobeWorld podcasts into Spanish, thus making them accessible to people in Spain and Latin America.

During the closing ceremony of the Congress, awards were given to the best communication in each of the SEM's ten Specialist Groups: Biodeterioration and biodegradation, Filamentous fungi and yeasts, Clinical microbiology, Industrial microbiology and microbial biotechnology, Food microbiology, Molecular microbiology, Microbiology of aquatic systems, Plant microbiology, Protistology, and Taxonomy, phylogeny, and biodiversity. The 13th "Jaime Ferran Award," given to young researchers (under the age of 40) for career excellence in the field of microbiology, the 4th "Federico Uruburu Prize" for photography, and awards for the three best communications during the Congress were also presented. Overall, the Congress was a great success, testifying once again to the high level of microbiology in Spain.

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In 2009, 210 manuscripts were submitted to the journal. The four issues published during the year consisted of 30 articles adding up to 280 pages. The articles were authored by teams working in Spain, Argentina, Brazil, Canada, Chile, China, Colombia, France, Germany, Italy, Mexico, Portugal, Sweden, the UK, and the USA.

INTERNATIONAL MICROBIOLOGY is able to publish high-quality peer-reviewed articles thanks to the efforts of those researchers who devoted part of their time to reviewing the manuscripts received by the journal. Once again, we would like to thank them for their work and feedback in improving the quality of the manuscripts. Although individual reviews are performed confidentially, the names of most of the reviewers that collaborated with the journal in 2009 can be found on p. 261 of this issue. Finally, we also thank both the authors that have considered this journal for publication of their work and our readers. Without them, we would not be able to fulfill the goal of publishing a journal that seeks to advance and disseminate high quality, internationally based information in the fields of basic and applied microbiology among scientists around the world.