EDITORIAL

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Year's comments for 2012

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As the end of the year approaches, it is always exciting to look back at the main scientific events and discoveries of the past twelve months. In 2012, in addition to the wealth of knowledge published in the academic journals, microbiology also occupied the media spotlight on many occasions, a sure sign of the growing interest in the applications, implications, and challenges of our discipline. Nonetheless, as science breakthroughs go, 2012 will certainly be remembered as the year in which scientists at the European Organization for Nuclear Research (CERN), in Geneva, Switzerland, finally caught a glimpse of the long-sought Higgs boson. The excitement was well-justified, as this was the last missing cornerstone of the Standard Model, the best theory we have so far to describe the building blocks that make up the Universe and how they interact with each other. But aside from being an important year for particle physics, from the Encyclopedia of DNA Elements (ENCODE) Project to NASA's Curiosity rover landing on Mars, there were fascinating developments in all scientific disciplines.

Fig. 1. Interactions between microorganisms and the human body. Left: *Adam and Eve,* by Albrecht Dürer (1471–1528; Prado Museum). Right: Three plates with nutrient medium showing the growth of microorganisms normally present on the armpit, palm and leg of a healthy person (plates and photographs by M. Berlanga).

A hot topic in microbiology was that the full microbial make-up of healthy individuals, the microbiome, was mapped for the first time. It was published as a series of coordi-

Fig. 2. Logo of the Human Microbiome Project.

nated scientific reports—the results of five years of work—by the Human Microbiome Project (HMP), a consortium of 200 researchers from nearly 80 scientific institutions and universities, in an effort to characterize the role of microbes in the human body [4]. Now we know that we harbor ten times more microbial cells than human cells, about 1–3 % of the body's mass (or 10 % of our dry weight). Until very recently, though, very little was known about the contribution of this gargantuan number of microorganisms to human health. By sequencing and analyzing the bacterial DNA of over 5000 samples from up to 18 body sites in 242 healthy volunteers, researchers from the HMP were able to calculate that over 10,000 microbial species, with as many as 1000 different strains per person, colonize the vast range of habitats that make up the human ecosystem. These microbes carry approximately eight million genes, a contribution that is crucial for our survival. If it were not for the bacteria in our gastrointestinal tract, for example, we would not be able to digest food and absorb nutrients nor to synthesize certain vitamins and anti-inflammatory compounds [5].

The human microbiome is 'acquired.' As a baby passes through the birth canal it picks up bacteria from the mother's vaginal microbiota, and shortly afterwards from the immediate environment. This person's microbiome will then continue to be shaped throughout their life. Our diet, our health, and our lifestyle choices will determine the communities of microorganisms that flourish (interestingly, microbiota was first known as 'microflora') in our bodies. Researchers also found that almost everyone carries pathogens, but in the healthy host these disease-causing microbes simply coexist with the rest of the microbiota. Another discovery was that the distribution of metabolic activities carried out by microbes matters more than what species are actually providing them. In the gut, for example, there will always be a population of bacteria digesting fats, but it may not always be made up of the same species. This implies that the microbiome can and does change over time. It is modifiable in a way that the human genome is not—an observation that has many clinical applications. By better understanding what is normal in healthy populations, scientists can now start to learn how changes in the microbiome correlate with our physiology, in order to look for associations of the microbiome with health and disease [1].

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In last year's editorial [2] we remembered Lynn Margulis (1938–2011), one of the most outstanding biologists of the 20th century, and cofounder of this journal. Just over a year later, on 30 December 2012, the American microbiologist and biophysicist Carl Woese passed away, at the age of 84. Woese, together with Margulis, is considered one of the most important bacterial evolutionary scientists of the 20th century. In 1977, Woese and his collaborators introduced the 16S rRNA–18S rRNA phylogenetic taxonomy, whereby comparisons between these RNA molecules, rather than phenotypic similarities, were used to elucidate the evolutionary relationships between organisms. This method led him to split living beings into three lineages or 'Domains': Eubacteria, Archaeobacteria, and Eukaryotes, from 1991 onwards, *Bacteria*, *Archaea*, and *Eukarya*. Originally thought to be the 'more obscure' relatives of bacteria, living only in extreme environments, today we know that *Archaea* have a unique evolutionary history, with several molecular characteristics more closely related to *Eukarya* than to *Bacteria*.

Despite the fact that Woese and Margulis for the most part did not agree about his taxonomy based on three Domains as opposed to Margulis' five Kingdoms (Monera, Protoctists, Plants, Fungi, and Animals), Woese's methods and tools for comparing genes from different species were essential for demonstrating the endosymbiotic origin of organelles, that Margulis proposed (in 1967, when she was 29 years old! [8]) and staunchly defended. The DNA sequences of chloroplasts in a species of *Euglena* that Woese

was studying [9] differed from those comprising the nuclear DNA of the protist itself and were shown to actually have originated from a prokaryote. The implications of his work were, and continue to be, far-reaching. Indeed, his 16S rRNA–18S rRNA-based molecular methods are actively used today, more than 30 years after their introduction, to study the aforementioned human microbiome. Surely, we will continue to discover practical applications for his work in the years to come.

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INTERNATIONAL MICROBIOLOGY strongly promotes open access (OA) [3]. According to the collective declarations of the Budapest Open Access Initiative (2002), the Bethesda Statement on Open Access Publishing (2003), and the Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities (2003), OA must (i) provide free, immediate access and unrestricted reuse of scientific literature, while (ii) giving authors control over the integrity of their work and the right to be properly acknowledged and cited.

As we approach the end of 2012, the debate about whether the results of research that has been publicly funded should be freely accessible has largely been put to rest. Research is not complete until results have been fully communicated and are openly available for others to build upon; thus, OA plays a central role in the research infrastructure as a whole. Freely available research supports a greater global exchange of knowledge; it directly benefits not only researchers, through the greater distribution, exposure, and recognition of their work, but also funding agencies and research institutions, through the acceleration of discoveries and increased returns on their investments. But OA ultimately benefits society, as research becomes more efficient and delivers better outcomes, creates new business opportunities, and contributes to our overall welfare.

In July, the European Commission outlined measures to improve access to scientific information and made OA to peer-reviewed publications the default setting for Horizon 2020 (the EU's Framework Program for Research and Innovation), as a means to boost Europe's capacity for innovation and to provide citizens with quicker access to the benefits

Fig. 3. Word cloud of topics related to Open Access.

of scientific discovery. The goal is for 60 % of European publicly funded research articles to be made available under OA, either by the publisher (gold OA) or through an OA repository (green OA), by 2016. The United Kingdom has been a pioneer in this effort. In 2012, it was announced that beginning in April 2013, free access would have to be granted to all papers funded by the Research Councils UK or the Wellcome Trust. To implement this policy, the two institutions will provide the necessary resources by introducing a new funding mechanism: a block grant to eligible research organizations and universities to cover the cost of article processing charges.

As for commercial publishers, many—and not without reason—are skeptical regarding the feasibility of this model, as the publication landscape has been clearly disrupted by OA. Academic institutions whose main income is based on their journals' revenues are also understandably concerned. In these cases, a solution remains to be worked out. Nonetheless, new journals are being launched and others are being published based on OA business models, which now represent the fastest growing segment of the scholarly journal market [6]. The financial viability of OA is evidenced by the fact that, as of 2012, the three largest OA publishers, BioMedCentral, PLoS, and Hindawi, have been profitable, albeit with much lower margins than 'subscription' journals. Many of the concerned parties agree that the challenge is in the transition—the coming period of relative uncertainty in which traditional publishing and OA coexist—as it will result in short-term increases in the cost of access for university libraries and in publication expenses for scientists, to cite a couple of examples. Despite these and other concerns, gold OA is expected to account for 50 % of scholarly journal articles by 2017, and 90 % of the articles as soon as 2020 [7]. These predictions reflect the recognition that this model will eventually become sustainable for all parties (researchers, funders, publishers, and society) and that initial transition costs will translate into social and financial benefits in the not too distant future.

Finally, for OA to reach its full potential and maximize the return on the public's investment, it must be possible for scientists, engineers, programmers, etc., to be able to build on that research. By granting more flexible and permissive copyright licenses, Creative Commons (CC) enables scientists and organizations to offer access to and reuse of their research and data, while being properly attributed. Only when reuse without restrictions is granted will the goals of OA be fulfilled.

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From A Coruña to Cadiz, from Palma de Mallorca to Badajoz, in 2012 most of the specialized groups of the Spanish Society for Microbiology (SEM) held their biennial meetings. Across the Atlantic, on 28 October–1 November 2012, the 21st Congress of the Latin American Association for Microbiology (ALAM) took place in the city of Santos, Brazil. The event's main objective was to connect colleagues from Latin America and the Iberian Peninsula in order to encourage and support microbiological research. The Congress in Santos was a great success, with participants from the 13 member societies—and the largest representation hailing from Brazil, Chile, Uruguay, and Argentina—coming together to take part in lectures, workshops, symposia, parallel sessions, and social events, the topics of which were as varied as the field of microbiology itself. Unfortunately, due to a lack of financial resources, only two of the ALAM's societies have an international journal of their own. These are the BRAZILIAN JOURNAL OF MICROBIOLOGY and our own INTERNATIONAL MICROBIOLOGY. During the round table discussion attended by the presidents and vicepresidents of the member societies, special mention was given to the SEM, congratulating it on its well-indexed journal and acknowledging the efforts of INTERNATIONAL MICROBIOLOGY to publish articles authored by Latin American researchers. As previously agreed upon, the SEM and the Portuguese Society for Microbiology (SPM) held a joint Portuguese-Spanish Symposium during the ALAM Congress, featuring two Portuguese and two Spanish speakers. It is the wish of both societies that future editions of the ALAM will include a joint symposium. Also, given the continued involvement of these two societies with ALAM activities, it was proposed that the Association's name be changed to the 'Ibero-American Association for Microbiology,' a proposal that will be raised in a timely manner and voted on during the next Congress, to be held in Cartagena de Indias (Colombia) in 2014.

July 2013 will be a very active month for Spanish and European microbiologists respectively, with the 24th SEM National Congress, which will take place in L'Hospitalet (Barcelona) on 11–13 July, and the 5th Congress of European Microbiologists, organized by the Federation of European Microbiology Societies (FEMS), to be held in Leipzig on 21–25 July. Both forums will cover key microbiology-related disciplines, such as clinical microbiology, pathogenesis, biodiversity, bioremediation, food microbiology, molecular microbiology, and genomics, to provide a comprehensive overview of the current state of the field. They will also include discussions of the many current challenges in

our world in which microbiology can contribute to finding a solution and those that can be anticipated in the future.

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In 2012, INTERNATIONAL MICROBIOLOGY was one of the 31 Spanish journals recognized with a prestigious award from the Spanish Foundation for Science and Technology (FECYT), the Excellence in Scientific and Editorial Quality Diploma. This is a seal of quality that certifies excellence, over a three-year period, after journals have undergone a strict evaluation process (ISO 9001). Spain is currently 12th in journal rankings and 9th in scientific production worldwide. The goal of the FECYT is to recognize the best scientific journals published in Spain, to actively promote the inclusion of Spanish journals in accredited databases such as the Web of Knowledge and Scopus, and to ensure that evaluation agencies include, among the specific criteria for researcher evaluations, articles published in these certified journals.

As recognized by this award, INTERNATIONAL MICROBIOLOGY has worked hard to comply with the international standards of quality for scientific journals. In addition to our staunch support of OA beginning in 2004 [3], we introduced digital object identifiers (DOI) for all articles in 2007, have provided CC licenses for all the research we have published since 2008, and, more recently, have placed online as-soon-as-publishable versions of the articles, i.e., before the print issue becomes available, with page-flip displays of each issue. These innovations, together with other indexing measures to increase the journal's online presence, would not have been possible without the collaboration, during the past three years, of the Institute for Catalan Studies (IEC), the Catalan Academy for Sciences and Humanities. Moreover, they resulted in 101,783 article PDFs having been downloaded during 2012 (almost twice as much as the previous year), a figure that encouraged us to take these efforts one step further, by offering our authors, readers, and reviewers easier and more effective ways to access and share contents. It is for this reason that two significant changes in the journal will see the light in 2013. First, we will begin using *ScholarOne Manuscripts*™ to manage article submission and peer review. Many of the journal's authors and reviewers are already familiar with this system, but even for those who are not the online workflow is straightforward, with users led step by step through either process. Second is a completely renovated website, in which its overall navigation is improved and recent developments in web technologies are implemented to expand the user's experience. Among some of the most important novelties, we will introduce HTML and ePUB versions of articles, which facilitate sharing and visualization via mobile devices. We will also provide statistics on the most visited, cited, and shared articles. This is just the beginning. Our goal, in the near future, is to join some of the biggest and most important publishers in the world to provide article-level metrics.

Until recently, an article's impact was gauged by the impact of the journal it was published in. Alternative metrics (*altmetrics*) are a more comprehensive set of indicators in which scholarship is measured and analyzed through the social web instead of by traditional citation. Altmetrics thus include usage such as HTML views and PDF downloads; citations in CrossRef, PubMed, Scopus, or the Web of Science; mentions or shares on social networks such as Facebook and Twitter, in blogs, and in the media; and captures and saves in online reference managers such as Mendeley. By considering all these possible sources, altmetrics provide a more broadly based set of tools to measure the varied forms of scholarly communication in our diverse academic ecosystem.

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During 2012, INTERNATIONAL MICROBIOLOGY received 190 manuscripts (from 30 countries), twenty-two of which were published in the 222 pages of our four issues. These articles were authored by teams working in Argentina, Brazil, Bulgaria, China, Germany, France, Japan, Mexico, Poland, Spain, Sweden and the United States, and they covered a variety of subjects, ranging from bacterial regulation, survival, and phylogenetic diversity to antimicrobial and antibiotic resistance; from starvation stress to lignocellulose digestion and lithobiontic microorganisms. They also discussed topics such as bioremediation, food safety, and proactive (P4) medicine.

The four micrographs (representing viruses, bacteria, protists, and fungi) that regularly appear as the background of the front cover of INTERNATIONAL MICROBIOLOGY were provided by microbiologists working in Spain. In 2012, four landscapes were featured as the central cover image: an evaporitic flat in Laguna San Ignacio, Baja California Sur, Mexico; the Ter Vell lagoon in the Empordà region of Girona, Catalonia, Spain; the Araruama Lagoon, close to Rio de Janeiro, Brazil; and Timna Park in the Negev desert, Israel.

Latin American countries have had a plethora of researchers in public health and infectious diseases since the early

18th century until now. Continuing our tradition for the promotion of microbiology in the region—those pioneers from the 'South'—, our back covers featured the portrait and signature of the Colombian pioneer of medicine and public health, Antonio Vargas Reyes (1816–1873), in March and June, and the Cuban physician and early advocate of vaccination, Tomás Romay Chacón (1764–1849), in September and December.

As in previous years, on behalf of the publication and editorial board, I would like to thank and recognize the efforts carried out by the many researchers who voluntarily devoted part of their time and expertise to reviewing the manuscripts received by our journal. Their work is of utmost importance in sustaining the quality and validity of INTERNATIONAL MICROBIOLOGY. A list of their names and affiliations can be found on page 200 of this issue.

As of December 2012, we leave our publisher since 2004, Viguera Editores, who provided the journal with technical support for the past nine years. We would also like to acknowledge our new publisher, the IEC. The IEC currently publishes more than 40 academic journals covering all branches of knowledge and it has vast experience in the digital management, editing, and promotion of publications. We look forward to a long and fruitful collaboration with this institution.

Finally, 2012 also marked the 15th anniversary of INTERNATIONAL MICROBIOLOGY. The journal has definitively come a long way and has consolidated itself as a respected international publication in its field. This has only been possible thanks to the countless efforts of a small team of people that put all their goodwill, effort, love—and many of their free hours—into the journal. To them, thank you and may INTERNATIONAL MICROBIOLOGY continue for many years to come!

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