Research Trends

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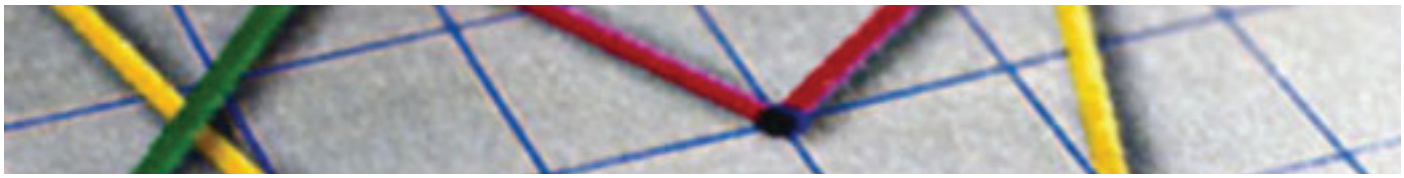
Research trends



"Omics": genomics' offspring shed light on biodiversity

ANDREW PLUME

The United Nations has declared 2010 the International Year of Biodiversity. To many, "biodiversity" simply means the number and variety of species. But biodiversity actually refers to all life on Earth, from molecules all the way up to entire ecological communities.

Over the past 30 years, our understanding of biodiversity has evolved, informing and being informed by parallel developments in the study of systems within cells; that is, of genomes, protein pathways, and metabolites. These fields of study are often collectively referred to as "omics".

From genomics to omics

Fuelled by technical and methodological advances since the 1970s, notable landmarks have been achieved in the study of the genome, or the complete set of genetic information that makes up an organism, over the last 40 years (see box). This has been matched by a significant and steady increase in the number of publications in this field (see Figure 1).

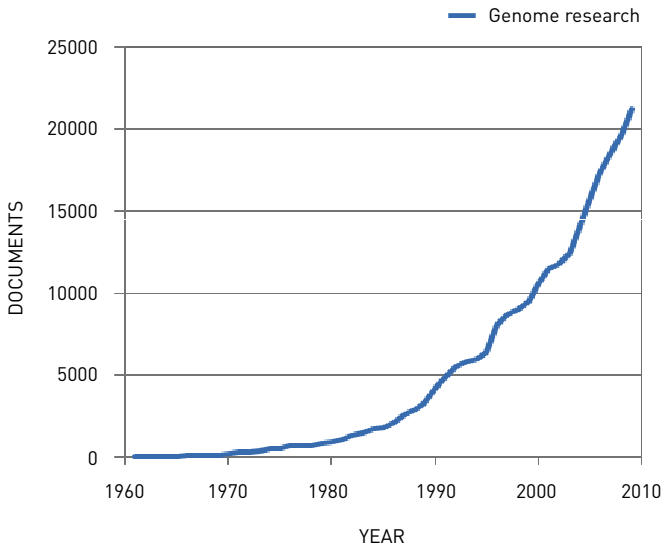


Figure 1 – Publications in the research field of genomes (later known as genomics) soared between 1960 and 2009.
Source: keyword search in Scopus.

The genomics explosion

1976: First virus genome sequenced

1987: "Genomics" coined to describe this growing research field

1995: First genome of a living organism published (of the bacterium Haemophilus influenzae)

2000: First draft of the human genome published, swiftly followed by numerous other genomes

The growth in genomics research, and its maturation as a scientific field, has led to the creation of a number of offshoot "omics" research fields, each of which is also experiencing a steady rate of growth (see Figure 2).

These new fields are information intensive and build on the large quantities of data produced by genomics research. The first fields to enter strong growth phases on the back of genomics research were proteomics and transcriptomics. Both these fields are concerned with the direct products made from the recipes encoded in the genome: proteins (via mRNA) and RNA transcribed directly from the genomic DNA code. Proteomics and transcriptomics were first featured in the peer-reviewed literature circa 1997 and 1998 respectively.

Many proteins and RNA molecules shepherd processes within a cell: making new molecules, breaking them down and facilitating interactions. Intense study into these phenomena within genomics, proteomics and transcriptomics has, in turn, spawned three more research fields, stimulated by the wealth of research on which they can build (see Figure 2). Metabolomics is concerned with small molecules, glycomics with carbohydrate molecules, and interactomics with the interactions between large molecules.

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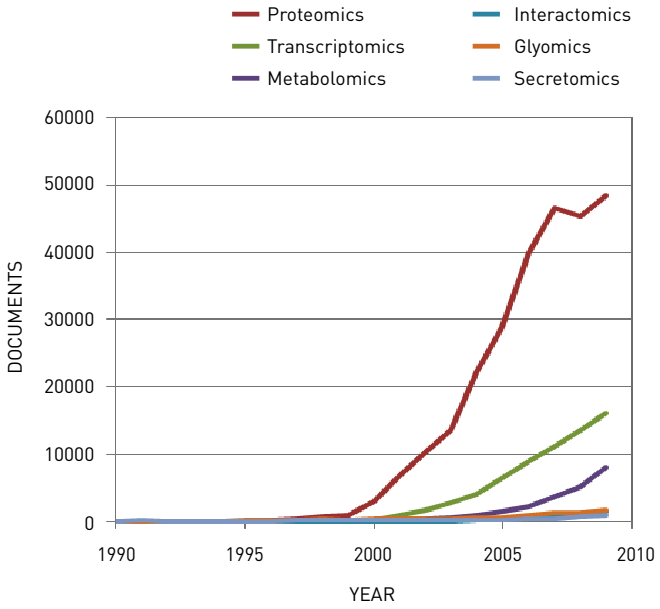

Figure 2 – Output in several sub-fields of genomic research has seen marked growth in just five years.
Source: keyword search in Scopus.

And still growing...

The next stage, of course, is to extend studies to beyond the boundaries of a cell. "Secretomics" is the study of gene products secreted from the cell. In the last five years, research output has begun to grow rapidly in this area, with 99 research papers published in 2009. And, if the growth trajectories of transcriptomics (1,615 documents in 2009), proteonomics (4,828 documents in 2009) and genomics (21,229 documents in 2009) are good indicators, there is a lot of potential ahead for these new fields, and by extension, for our understanding of biodiversity in general.

Omics has already shown us that the full range of biodiversity on planet Earth extends from molecules up to communities so any knowledge about the variety of systems and networks within cells can only further enhance our insights into how best to preserve the biodiversity around us. Genomics, for instance, informs decisions in conservation biology.

But what is also very exciting about this remarkable growth in omics is that it reminds us how new fields of study are all based on research done in the past and that can open numerous avenues of research, furthering our understanding of the world around us.

Source for all publication records: Scopus