Genomics

The English-language neologism omics informally refers to a field of study in biology ending in -omics, such as genomics, proteomics or metabolomics. The related suffix -ome is used to address the objects of study of such fields, such as the genome, proteome or metabolome respectively. Omics aims at the collective characterization and quantification of pools of biological molecules that translate into the structure, function, and dynamics of an organism or organisms.

Genomics is a discipline in genetics that applies recombinant DNA, DNA sequencing methods, and bioinformatics to sequence, assemble, and analyze the function and structure of genomes.

Advances in genomics have triggered a revolution in discovery-based research to understand even the most complex biological systems such as the brain.

The field includes efforts to determine the entire DNA sequence of organisms and fine-scale genetic mapping. The field also includes studies of intragenomic phenomena such as heterosis, epistasis, pleiotropy and other interactions between loci and alleles within the genome.

In contrast, the investigation of the roles and functions of single genes is a primary focus of molecular biology or genetics and is a common topic of modern medical and biological research. Research of single genes does not fall into the definition of genomics unless the aim of this genetic, pathway, and functional information analysis is to elucidate its effect on, place in, and response to the entire genome's networks.

Radiogenomics

The term radiogenomics is used in two contexts: either to refer to the study of genetic variation associated with response to radiation (radiation genomics) or to refer to the correlation between cancer imaging features and gene expression (imaging genomics).

With the advance of genomics research, there have been a new breakthrough in the molecular classification of gliomas. Glioblastoma (WHO grade Ⅳ) could be subtyped to proneural, neural, classical, and mesochymal according to the mRNA expression. Lower grade gliomas (WHO grade Ⅱ and Ⅲ) could be divided into 5 types using 1p/19q co-deletion, isocitrate dehydrogenase(IDH) mutation, and TERTp (promotor region) mutation. In 2016, a new classification of tumors of the central nervous system was proposed, and some new markers such as IDH1 mutation were introduced into the diagnosis of gliomas. Genotype and phenotype were integrated to diagnose gliomas. In the meantime, precision treatment for gliomas has also been vigorously developed [1].

Imaging genomics represents a novel entity in clinical sciences that bidirectionally links imaging features with underlying molecular profile and thus can serve as a surrogate for noninvasive genomic correlation, prediction, and identification [2].

Meningioma genomics

Meningioma gene mutations

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2)
Moton S, Elbanan M, Zinn PO, Colen RR. Imaging Genomics of Glioblastoma: Biology, Biomarkers, and Breakthroughs. Top Magn Reson Imaging. 2015 Jun;24(3):155-163. PubMed PMID: 26049819.