The Changing Landscape of Neuroscience Research

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It is beneficial to evaluate changes in neuroscience research field regarding research directions and topics over a defined period. Such information enables stakeholders to quickly identify the most influential research and incorporate latest evidence into research-informed education. To our knowledge, no study reported changes in neuroscience literature over the last decade.

Neuroscience is an exciting research field, and many recent discoveries have informed paradigm-shifts and innovations. For instance, the 2014 Nobel Prize in Physiology or Medicine was awarded to Professors John O'Keefe, May-Britt Moser and Edvard Moser, neuroscientists who discovered place cells and grid cells that form a built-in, global positioning system inside the brain. Indeed, neuroscience research has received substantial support across the globe. In the United States, the Human Connectome Project was launched in 2009 followed by the Brain Research through Advancing Innovative Neurotechnologies (BRAIN) Initiative in 2013. Concurrently, the Human Brain Project was initiated in Europe. In Japan, the Brain Mapping by Integrated Neurotechnologies for Disease Studies (Brain/MINDS) program started in 2014, and the Brain Science and Brain-Like Intelligence Technology project will soon be officially launched by China, though significant preliminary research has already been done. With these abundant investments in neuroscience in recent years, more explorative, fundamental or basic research could be conducted, which eventually led to today's paradigm shifts—or paradigm shifts yet to come. For instance, the emergence of brain connectivity studies in recent years may enable us to compare the normal and diseased brains, and thus identify abnormal brain connectivity patterns as potential biomarkers for neurologic diseases. These advances in the neuroscience field not only drive significant progress in brain biology but also confer practical implications to medicine. We should evaluate and track the changes regarding the landscape of neuroscience research, to indicate evolution regarding research directions, health care priorities and prime translational research topics over a defined period. Such information enables stakeholders to clearly and quickly identify the most influential research works and incorporate the latest evidence into research-informed education.

While neuroimaging studies may continue to unveil the brain function or neural mechanism of relevant physiological processes, animal models and in vitro studies may also be required to explore and explain the details down to genetic, cellular or molecular levels.

Moreover, with the increasing publication count and wider distribution of publications among neuroscience journals, future publications should devise keywords, titles and abstracts more thoughtfully. Search strategy of fellow researchers should be taken into careful consideration so that the relevant works can be identified/retrieved from search engines or databases. By considering the specific hot topics having high relative citation scores altogether, future work may focus on utilizing brain imaging and connectivity analyses to identify biomarkers that may signify neurodegenerative or neuroinflammatory tendency among the aging population.

The rise in relative citation impact of brain connectivity terms was consistent with the launches of several research funds, including the aforementioned BRAIN Initiative, Human Brain Project and Human Connectome Project. There were two other terms related to brain connectivity among the top 10 highest impact terms (diffusion tensor imaging and fractional anisotropy). One popular research topic was to investigate the co-activation of different brain regions. One such network of co-activation during a resting state is called the default mode network, which is believed to be robust across populations, and, as a result, it has gained attention in recent years. Another area that merits mention is the advancement in the use of statistics, such as the implementation of dynamic causal modeling to neuroimaging data in 2003, which have enabled an inference of effective connectivity. This application illustrates the directionality of communications between brain regions during experimental tasks. Though the terms related to effective connectivity were not in the annual top 10 lists of high-impact terms during the survey period, they may well be a potential hot spot in the field in the future

Conclusion:

To conclude, our findings revealed changes in the landscape of neuroscience research over the study period and provided a contemporary overview of neuroscience research for researchers and health care workers interested in this field. Brain imaging and brain connectivity have been shown to be hot topics, and Alzheimer's disease and associated topics have recently gained traction.