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The year of immunopsychiatry: A special issue that foresaw the future

One year ago, *Psychoneuroendocrinology* launched this Special Issue on Immunopsychiatry, which I have had the pleasure to guest-edit, with a specific focus on understanding 'how relevant is the interface between the immune and neuroendocrine system for psychiatric disorders'.

I have already discussed extensively the notion that the recent introduction of the term 'immunopsychiatry' to describe this area of research defines a different, although obviously overlapping, theoretical framework compared with 'psychoneuroimmunology' (Pariante, 2018, 2015): it represents a hierarchical shift, from using psychological interventions to affect immunity (and hence health and disease) to targeting the immune system in order to have therapeutic benefits for both behaviour and emotions (and hence mental health and mental disorders).

As the Editor of the Special issue, I have been delighted with the response of the scientific community: the Issue contains 35 research papers and six reviews, with a breadth and depth spanning from **A**ntenatal (Osborne et al., 2018) to **Z**ebrafish (de Abreu et al., 2018). A few more papers were submitted and rejected following peer-review.

While the papers are so numerous that cannot be all discussed individually in this short editorial, it is possible to identify some overarching themes, reflecting the state of the art in the field.

From a clinical point of view, the relationship between immune biomarkers and psychopathology is no longer examined solely in cross-sectional comparisons but rather in longitudinal studies to predict future outcomes, being these outcomes the severity of future depressive (Herder et al., 2018) or psychotic (Nettis et al., 2019) symptoms, babies' behaviour (Osborne et al., 2018), the development of chronic fatigue (Russell et al., 2018) or the levels of inflammation themselves (Niles et al., 2018; Penz et al., 2018).

In addition, methods in immunopsychiatry have moved beyond serum and plasma proteins measurements, to include approaches as diverse as electronic health records (Osimo et al., 2018), multi-system physiological stress reactivity (Auer et al., 2018; Penz et al., 2018), functional (Conejero et al., 2019) and structural (Doolin et al., 2018) magnetic resonance imaging, positron emission tomography (Prossin et al., 2018), cerebrospinal fluid sampling (Agorastos et al., 2019), and blood mRNA (Amoli et al., 2019).

The most translational papers directly refer to novel therapeutic strategies that can modify the brain-immunity interaction, ranging from prebiotics (Kao et al., 2018) to drugs affecting the kynurenine pathways (Garrison et al., 2018), the inflammasome complex (Bhattacharya and Jones, 2018; Farooq et al., 2018) and synaptic plasticity (Innes et al., 2018), to even a complex rehabilitation program that includes medical, psychiatric, psychological and psychotherapeutic treatments, as well as occupational therapy, physiotherapy and diet counselling (Reininghaus et al., 2018).

Novel, special populations are examined, including women and babies in the perinatal period (Osborne et al., 2018; Rackers et al., 2018), children and adolescents (Lipschutz et al., 2018; Michels et al., 2018; Yirmiya et al., 2018), people with obesity or diabetes (Delgado et al., 2018; Herder et al., 2018), as well as patients with mental disorders whose immune correlates have been less studied so far, such as panic disorder (Petrowski et al., 2018), autism (Basheer et al., 2018; Marazziti et al., 2018), drug addiction (Kuo et al., 2018), bipolar disorder (Ozpercin et al., 2018; Queissner et al., 2018), and patients with late-onset (Rozing et al., 2019) or treatment-resistant (Bekhbat et al., 2018; Haroon et al., 2018) or anxious (Menke et al., 2018) or anhedonic (Jha et al., 2018) depression.

The animal studies confirm that basic science can give us important, clinically- and translationally-relevant information. For example, zebrafish models can be used to study pharmacological modulation of the immune response (de Abreu et al., 2018), olanzapine increases IL-6 and macrophages in rat adipose tissue (Calevro et al., 2018), pyridostigmine and stress interact in a rat model of Gulf War Illness (Macht et al., 2018), microglia cells from mice challenged with the peripheral Bacille Calmette-Guerin (BCG) show blood proteomics changes relevant to alcoholism (Rodriguez-Zas et al., 2018), and retrieving memory for a single traumatic experience induces a peripheral proinflammatory response in mice (Young et al., 2018).

Finally, the geographical distribution of the papers we have received testifies that this is a world-wide interest. In addition to established European and American research groups, we have published papers from Poland (Pawlowski et al., 2018), Turkey (Ozpercin et al., 2018), India (Basheer et al., 2018), Iran (Amoli et al., 2019), Brazil (de Abreu et al., 2018) and Russia (de Abreu et al., 2018).

As if this Special Issue were not enough, the goods news keeps rolling in for 'immunopsychiatry': in 2019, the journal *Brain behaviour and Immunity* (BBI), devoted to studies on behavioral, neural, endocrine, and immune system interactions, and of which I am the Editor-in-Chief, will be listed in the Psychiatry category in Clarivate's Journal Citation Index, recognising officially that the investigation of the relationship between the immune system and the brain is an essential aspect of psychiatry research and practice. [The readers of *Psychoneuroendocrinology* will forgive me if I mention another journal here, but I reciprocate this in another editorial that I have just published in BBI and where I talk about this Special Issue (Pariante et al., 2019).] Truly, this Special Issue foresaw the future, and it especially foresaw the recognition of immunopsychiatry as an essential aspect of mainstream psychiatry research and clinical practice.

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