

1 **Podcast script: Keith Kelley**

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3 **Pronunciations**

4 **PNIRS** "P – N – I – R – S"

5 **Tu Youyou** "TOO yoyo"

6 **SARS-CoV-2** "SARZ-koh-VEE 2"

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8

9 **Script begins:**

10

11 Hello and welcome to Research Pod! Thank you for listening and joining us today.

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13 *[1 second pause]*

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15 The field of psycho-neuroimmunology – the study of relationships between the nervous and immune  
16 systems – has pioneered significant discoveries in areas like stress, mindfulness, ancient exercise and  
17 dietary interventions.

18 The Psycho-neuroimmunology Research Society (PNIRS) formed a Chinese branch in 2012, and  
19 following its success, expanded to include all of Asia-Oceania. Keith W. Kelley of the University of  
20 Illinois and collaborators review the growth of this endeavour and recent contributions to  
21 biomedical research from the countries of Asia-Oceania.

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24 *[1 second pause]*

25 Psycho-neuroimmunology is a relatively new field of biomedical scientific research that explores the  
26 relationship between the nervous system and the immune system. In recent years, countries in Asia-  
27 Oceania have made significant strides in this field.

28 The Psychoneuroimmunology Research Society created an official Chinese regional affiliate in 2012,  
29 which was so successful in advancing science in this area that it expanded to the whole of Asia-  
30 Oceania. Here, we take a closer look at the growth of this endeavour, as well as recent developments  
31 of research in China, Australia and Japan.

32

### 33 **RESEARCH EXPENDITURE**

34 Expenditure on biomedical research and development is an indicator of a country's wealth and the  
35 value it places on the health of its citizens. In addition to the country's total spend, the trend in  
36 expenditure over time is an important indicator of development.

37 The most recent summary of a six-year period from 2007 to 2012 shows that public and private  
38 research expenditures declined in all of Europe and the USA, but increased in Japan, India, Australia,  
39 Singapore, South Korea and China. Thanks to this increase in biomedical investment, psycho-  
40 neuroimmunology research is on the rise in the Asia-Pacific region.

41

42 The increased prosperity of the biomedical research industry in the countries of Asia-Oceania has  
43 facilitated competition between countries for the best research scientists. It has provided more  
44 opportunities for Asian-Oceanian scientists who have trained elsewhere to return to their home  
45 countries to work. Many have developed collaborative research programmes with Western scientists  
46 with whom they trained. The increased investment in biomedical research in Asia has therefore

47 increased opportunities for scientists worldwide and resulted in advancements in biomedical  
48 discoveries.

## 50 **PNIRS CHINA**

51 Biomedical research efforts in China and in Western countries were relatively independent of each  
52 other until the early 21<sup>st</sup> century. In 1993, a global non-profit society called the Psycho-  
53 neuroimmunology Research Society (PNIRS) was formed to promote the study of interactions between  
54 the nervous and immune systems and the relationship between behaviour and health. The society  
55 formed the Chinese branch of PNIRS in 2012 to recognise the growing importance of biomedical  
56 research in China.

58 Traditional Chinese medicine (TCM) encompasses the balance between body and mind - namely the  
59 communication between the brain, hormonal and immune systems. TCM has formed a conceptual  
60 basis for modern psycho-neuroimmunology, so collaboration between Eastern and Western scientists  
61 enables better understanding of effective health practices for populations worldwide.

63 The main goals of PNIRS<sub>China</sub> were outlined at its first meeting in Dalian, China, in 2013 and were  
64 threefold:

- 65 (1) to conduct basic research that could be translated into clinically relevant health applications;
- 66 (2) to promote relationships between scientists of different disciplines; and
- 67 (3) to build a platform of academic communication for psycho-neuroimmunology researchers.

68 A committee was formed to organise symposia and other outreach approaches to share psycho-  
69 neuroimmunology knowledge between Chinese and Western scientists. Since the initial meeting,  
70 six more symposia have taken place across China.

## 72 **BRAIN, BEHAVIOR, AND IMMUNITY**

73 *Brain, Behavior, and Immunity* became the official journal of PNIRS in 2000. Year after year, it is ranked  
74 in the top 15% of worldwide immunology and neuroscience journals, and the top 10% of all psychiatry  
75 journals. As such, *Brain, Behavior, and Immunity* continues to be recognised globally as “the best  
76 immunology journal in the neurosciences.”

77 Initially, American scientists were the main contributors to the journal. Now, 17% of all submissions  
78 originate from China, making it the second leading country to submit content to the journal. The  
79 papers published are of high quality, as shown by the number of citations (three of the top 10 most  
80 highly 2014 papers cited between 2015 and 2016 were from Chinese laboratories).

## 82 **PNIRS ASIA-PACIFIC**

83 Following seven successful symposia in China, efforts expanded to the whole of Asia-Oceania, including  
84 countries in North, South and Southeast Asia, as well as Australia and New Zealand. PNIRS<sub>China</sub> was  
85 therefore rebranded as PNIRS<sub>Asia-Pacific</sub> in 2017. Since then, nine further symposia have taken place in  
86 regions and countries outside the Chinese mainland, including the Taiwan region of China, Australia,  
87 Japan, South Korea and New Zealand.

## 89 **GLOBAL RESEARCH CONNECTIONS**

90 According to data on post-doctoral training, collaborative studies and scientific meetings, very few  
91 Western scientists spend time working in Asia, although the study of psycho-neuroimmunology is  
92 taking place worldwide.  
93 The PNIRSA<sup>Asia-Pacific</sup> committee pioneered a strategy to connect psycho-neuroimmunology laboratories  
94 in Asia-Oceania with those in other countries, entitled **PNIRSA<sup>Asia-Pacific</sup> Global Research Connections**.  
95 A website was developed that allows scientists to join the initiative by providing a few simple details.  
96 The goal is to facilitate global biomedical research by bringing together psycho-neuroimmunology  
97 scientists in Asia-Pacific countries, both with each other and with laboratories around the world. Any  
98 interested scientist can register online.  
99

## 100 **CHINA**

### 101 **The mainland of China**

102 China is now the second leading country publishing in top-ranked scientific journals and third in life  
103 science publications, thanks to increased expenditure on medical research and development. The  
104 Chinese Academy of Sciences is now the fifth most prestigious institution in the world. The first  
105 Chinese academic to receive a Nobel prize in Physiology or Medicine was Professor Tu Youyou in 2015.  
106 Her interest in Chinese herbal medicine contributed to the discovery of a plant extract known as  
107 artemisinin, which is effective against the organism responsible for malaria.  
108 TCM is one of the world's oldest medical approaches and is based on achieving balance between the  
109 mind and body. Some practices include Tai chi, herbal medicine, acupuncture, meditation and  
110 massage. Integrative medicine takes into account all aspects of lifestyle and combines alternative  
111 therapies with conventional medicine. Research in the past two decades has produced increasing  
112 evidence that immune disorders can be a feature of nervous system diseases and that abnormalities in  
113 the nervous system can lead to immune system dysfunction. Several important studies on this topic  
114 originated from China and are published in *Brain, Behavior, and Immunity*.  
115

### 116 **The Taiwan region**

117 Authors from the Taiwan region published more than 30 papers in the past 33 year in brain, behavior,  
118 and immunity. Thirteen of these were published in the last two years, indicating the upward trend in  
119 psycho-neuroimmunology research in Asia. Scientists gather in the Taiwan region every year at the  
120 Mind-Body Interface International Symposium to share research discoveries in neuroscience. This  
121 society encourages a global approach to medicine via research focused on patients. Approaches that  
122 bridge the gap between research laboratory and hospital setting are becoming more relevant. Eastern  
123 medicine focuses on mind and body as an inseparable entity as opposed to separate anatomical  
124 structures. The aim of such treatments is to restore balance to the mind and body as a whole. Findings  
125 from biomedical research strongly support this approach. However, the effect of a single lifestyle  
126 intervention is much more difficult to detect than that with a large randomised controlled trial. East-  
127 West biomedical collaborations can therefore support traditional medical practices with clinical trials  
128 using advanced scientific methodologies.  
129

## 130 **AUSTRALIA**

131 Australia continues to be a key player in advancing the goals of PNIRSA<sup>Asia-Pacific</sup>. Psycho-  
132 neuroimmunology research has been present in Australia since the beginning of the field in 1987.

133 Australian authors contribute the fourth most published papers in *Brain, Behavior, and Immunity*,  
134 covering topics such as Alzheimer’s disease and traumatic brain injury. In 2019, 16 papers were  
135 published in *Brain, Behavior, and Immunity* with Australian first or senior authors. An additional four  
136 had Australian collaborators and at least 10 employed diverse internationally collaborative research  
137 teams. Importantly, many of those articles are examples of the truly global nature of current psycho-  
138 neuroimmunology research. Several featured upwards of five nations in the author list, integrating  
139 technologies, ideas, personnel and student experiences towards research outcomes that could not be  
140 achieved by one group alone. Two of the Associate Editors of *Brain, Behavior, and Immunity* are  
141 Australian and multiple symposia have showcased Australian psycho-neuroimmunology research.  
142

143 **JAPAN**

144 The Japanese Society for Neuroimmunology was formed in 1988 by physicians specialising in certain  
145 neurological diseases. This society and PNIRS-Asia-Pacific plan on holding joint symposia in the future  
146 to highlight relevant research. Japanese immunologists have made ground-breaking discoveries in  
147 molecular immunology, including Tadamitsu Kishimoto. His work led to the development of an  
148 important antibody (a protein which attacks viruses, bacteria and other chemicals) in the treatment of  
149 rheumatoid arthritis (a disease in which the immune system attacks the joints). Notably, as it has  
150 actions that suppress certain aspects of the immune system, this antibody has also been approved for  
151 clinical trials as a treatment for SARS-CoV-2, the virus causing the current coronavirus pandemic.  
152

153 Psycho-neuroimmunology is expected to become more specialised to benefit different international  
154 communities; for example, by studying diseases like malaria in Southeast Asia and novel coronaviruses  
155 in China. Exciting new developments in understanding the gut-immune-brain axis now make it possible  
156 to better understand the actions of ancient herbal medicine.

157 The strong social support networks of indigenous communities have major implications for stress and  
158 mental health management. Air pollution has psychoneuroimmunology implications worldwide, but  
159 the specific type of pollution is likely to differ from country to country. Globalisation of psycho-  
160 neuroimmunology research means advancement in our approach to understanding how where we live  
161 influences our brains and bodies. In light of the current coronavirus pandemic, it is more necessary  
162 than ever to promote global collaboration to find solutions to worldwide health concerns. PNIRS<sup>Asia-</sup>  
163 <sup>Pacific</sup> continues to lead this effort by bridging the gap between Eastern and Western scientists with an  
164 interest in psycho-neuroimmunology.

165  
166 *[1 second pause]*

167  
168 That’s all for this episode – thanks for listening, and stay subscribed to Research Pod for more of the  
169 latest science. See you again soon.

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171 **Script ends**

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