Podcast script: Keith Kelley

Pronunciations
PNIRS *"P – N – I – R – S"*
Tu Youyou "TOO yoyo"
SARS-CoV-2 "SARZ-koh-VEE 2"

Script begins:

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

[1 second pause]

The field of psycho-neuroimmunology – the study of relationships between the nervous and immune systems – has pioneered significant discoveries in areas like stress, mindfulness, ancient exercise and dietary interventions.
The Psycho-neuroimmunology Research Society (PNIRS) formed a Chinese branch in 2012, and following its success, expanded to include all of Asia-Oceania. Keith W. Kelley of the University of Illinois and collaborators review the growth of this endeavour and recent contributions to biomedical research from the countries of Asia-Oceania.

[1 second pause]
Psycho-neuroimmunology is a relatively new field of biomedical scientific research that explores the relationship between the nervous system and the immune system. In recent years, countries in Asia-Oceania have made significant strides in this field.
The Psychoneuroimmunology Research Society created an official Chinese regional affiliate in 2012, which was so successful in advancing science in this area that it expanded to the whole of Asia-Oceania. Here, we take a closer look at the growth of this endeavour, as well as recent developments of research in China, Taiwan, Australia and Japan.

RESEARCH EXPENDITURE
Expenditure on biomedical research and development is an indicator of a country's wealth and the value it places on the health of its citizens. In addition to the country's total spend, the trend in expenditure over time is an important indicator of development.
The most recent summary of a six-year period from 2007 to 2012 shows that public and private research expenditures declined in all of Europe and the USA, but increased in Japan, Taiwan, India, Australia, Singapore, South Korea and China. Thanks to this increase in biomedical investment, psycho-neuroimmunology research is on the rise in the Asia-Pacific region.

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

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

PNIRS CHINA

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

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

The main goals of $PNIRS_{China}$ were outlined at its first meeting in Dalian, China, in 2013 and were threefold:
(1) to conduct basic research that could be translated into clinically relevant health applications;
(2) to promote relationships between scientists of different disciplines; and
(3) to build a platform of academic communication for psycho-neuroimmunology researchers.
A committee was formed to organise symposia and other outreach approaches to share psycho-neuroimmunology knowledge between Chinese and Western scientists. Since the initial meeting, six more symposia have taken place across China.

BRAIN, BEHAVIOR, AND IMMUNITY

Brain, Behavior, and Immunity became the official journal of PNIRS in 2000. Year after year, it is ranked in the top 15% of worldwide immunology and neuroscience journals, and the top 10% of all psychiatry journals. As such, *Brain, Behavior, and Immunity* continues to be recognised globally as "the best immunology journal in the neurosciences."
Initially, American scientists were the main contributors to the journal. Now, 17% of all submissions originate from China, making it the second leading country to submit content to the journal. The papers published are of high quality, as shown by the number of citations (three of the top 10 most highly 2014 papers cited between 2015 and 2016 were from Chinese laboratories).

PNIRS ASIA-PACIFIC

Following seven successful symposia in China, efforts expanded to the whole of Asia-Oceania, including countries in North, South and Southeast Asia, as well as Australia and New Zealand. $PNIRS_{China}$ was therefore rebranded as $PNIRS_{Asia\text{-}Pacific}$ in 2017. Since then, nine further symposia have taken place in countries outside of mainland China, including Taiwan, Australia, Japan, South Korea and New Zealand.

GLOBAL RESEARCH CONNECTIONS

According to data on post-doctoral training, collaborative studies and scientific meetings, very few Western scientists spend time working in Asia, although the study of psycho-neuroimmunology is taking place worldwide.

The PNIRS$_{\text{Asia-Pacific}}$ committee pioneered a strategy to connect psycho-neuroimmunology laboratories in Asia-Oceania with those in other countries, entitled **PNIRS$_{\text{Asia-Pacific}}$ Global Research Connections.** A website was developed that allows scientists to join the initiative by providing a few simple details. The goal is to facilitate global biomedical research by bringing together psycho-neuroimmunology scientists in Asia-Pacific countries, both with each other and with laboratories around the world. Any interested scientist can register online.

CHINA

China is now the second leading country publishing in top-ranked scientific journals and third in life science publications, thanks to increased expenditure on medical research and development. The Chinese Academy of Sciences is now the fifth most prestigious institution in the world. The first Chinese academic to receive a Nobel prize in Physiology or Medicine was Professor Tu Youyou in 2015. Her interest in Chinese herbal medicine contributed to the discovery of a plant extract known as artemisinin, which is effective against the organism responsible for malaria.

TCM is one of the world's oldest medical approaches and is based on achieving balance between the mind and body. Some practices include Tai chi, herbal medicine, acupuncture, meditation and massage. Integrative medicine takes into account all aspects of lifestyle and combines alternative therapies with conventional medicine. Research in the past two decades has produced increasing evidence that immune disorders can be a featureof nervous system diseases and that abnormalities in the nervous system can lead to immune system dysfunction. Several important studies on this topic originated from China and are published in *Brain, Behavior, and Immunity*.

TAIWAN

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

AUSTRALIA

Australia continues to be a key player in advancing the goals of PNIRS$_{\text{Asia-Pacific}}$. Psycho-neuroimmunology research has been present in Australia since the beginning of the field in 1987. Australian authors contribute the fourth most published papers in *Brain, Behavior, and Immunity*,

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

JAPAN

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

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

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

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

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