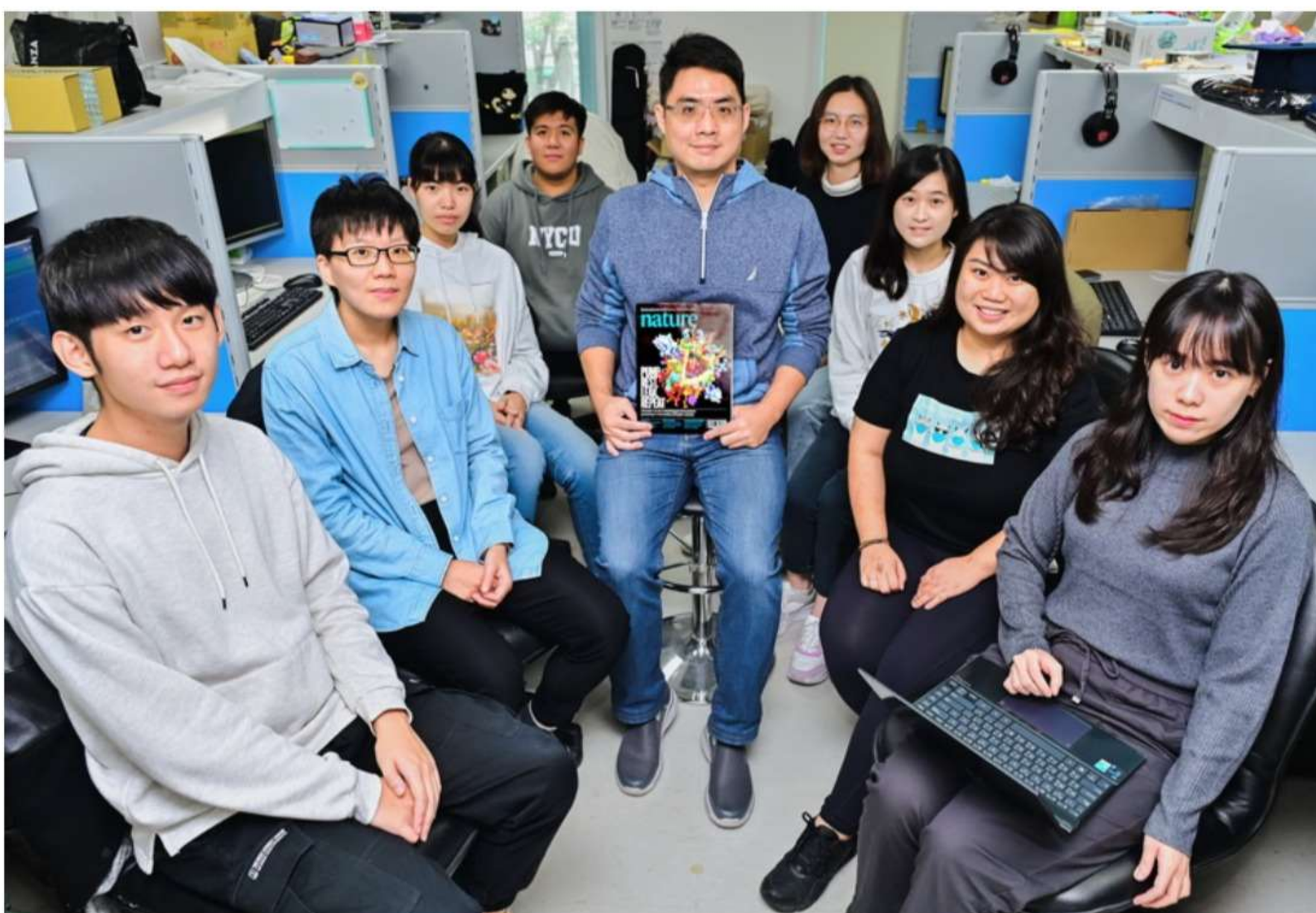


Herbicides are discovered to stimulate immune responses and deteriorate intestinal inflammation

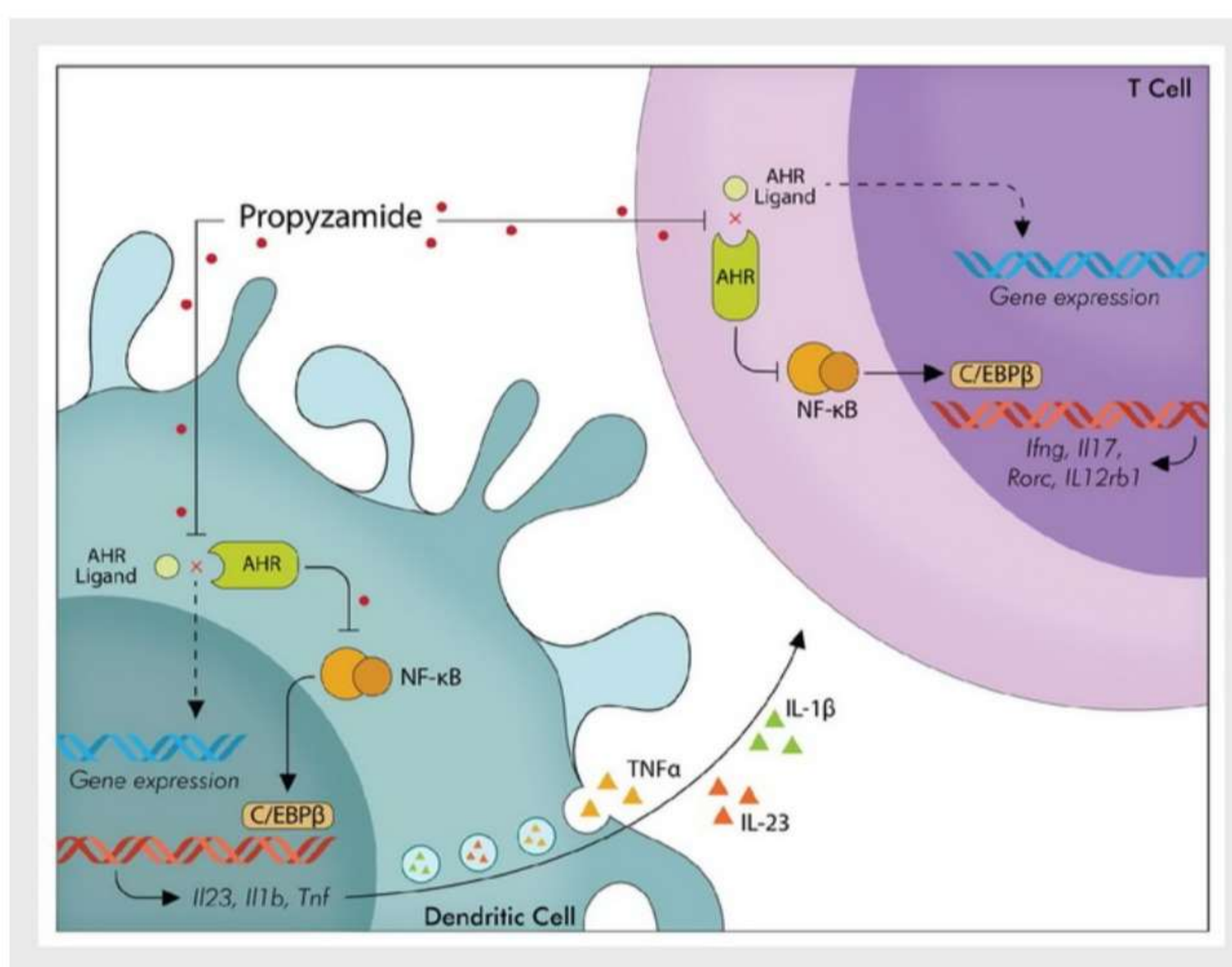
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Western food and genetic inheritance are considered the main risk factors of intestinal inflammation, which has become increasingly prevalent in Taiwan. The research collaboration between National Yang Ming Chiao Tung University (NYCU) and Harvard University identified herbicides as a risk factor that deteriorates such inflammation. This discovery marks a breakthrough regarding the effect of environmental factors on inflammatory bowel disease (IBD) and has therefore been published in *Nature*.



IBD mainly includes ulcerative colitis and Crohn's disease. In Taiwan, the prevalence of ulcerative colitis increased from 2.1 patients per 100,000 population in 2001 to 12.8 patients per 100,000 population in 2015, demonstrating a five-fold increase in 14 years^[1]. Previously, IBD was mostly observed in Western countries. Although scholars have confirmed approximately 200 genes related to this type of disease, their understanding of relevant environmental factors is limited.

Associated Professor Yu-Chao Wang from the Institute of Biomedical Informatics, NYCU collaborated with Harvard Medical School and used zebrafish to examine chemical substances that potentially affect intestinal inflammation, thereby creating a prediction model for compounds that deteriorate IBD. The model was applied to the ToxCast database of the US Environmental Protection Agency to identify more compounds that potentially lead to the deterioration of IBD.

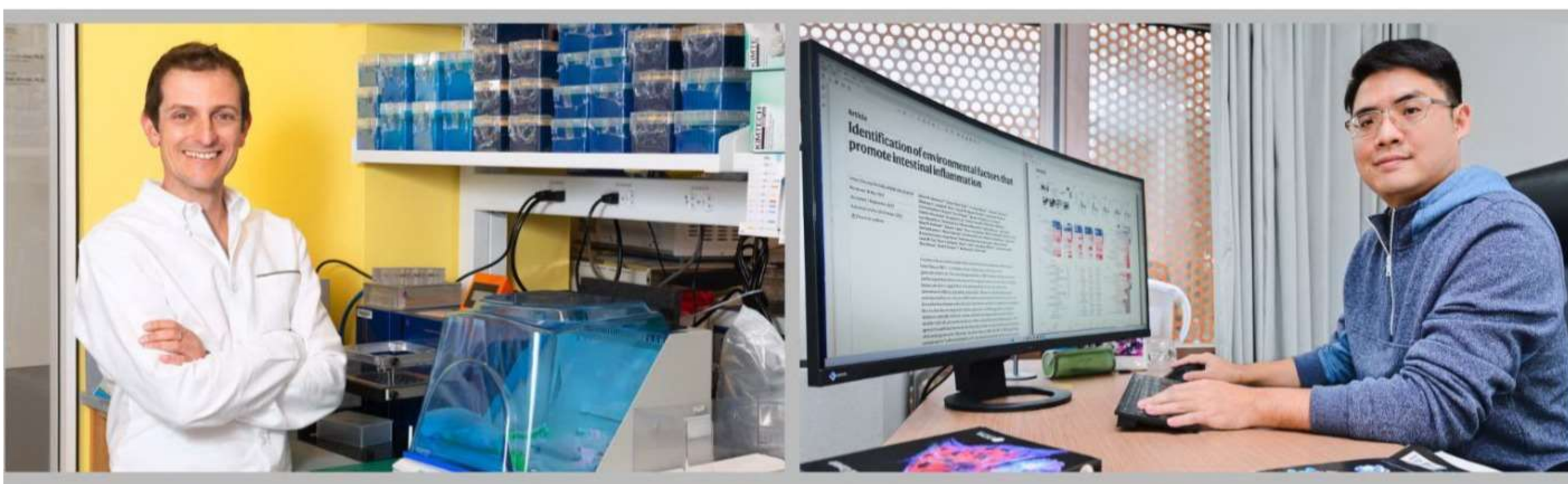


Among the top 20 most influential compounds identified by Dr. Wang, more than half were associated with agriculture. The research team further examined propyzamide, a type of herbicide commonly used to remove weeds in sports venues and gardens, by conducting *in vitro* and *in vivo* experiments. They confirmed that this compound disturbs dioxin receptors that maintain intestinal stability and induces immune responses associated with T cells and dendritic cells, causing the deterioration of IBD.

Propyzamide decomposes slowly when used on plants; after 50 days, 60% of the compound can remain on plants. Consequently, individuals who frequent grass sports fields or gardens are at risk of being exposed to propyzamide. Dr. Wang stated that the research team is currently developing nanoparticles and probiotics to alleviate IBD caused by herbicides.

This research project involves interdisciplinary efforts between dry labs and wet labs. In general, dry labs focus on the use of computer simulation, whereas wet labs mainly conduct conventional biochemistry analysis. In the current research collaboration between Taiwan and the United States, the NYCU research team mainly uses big data from relevant databases to create disease prediction models. The Harvard research team, led by Dr. Francisco Quintana, then verifies the models by using conventional laboratory techniques and large samples.

Dr. Wang noted that interdisciplinary research is a common and crucial approach in biomedicine. It has been prevalently applied in the research of various diseases. Bioinformatics involves the use of big data analysis to quickly identify potential treatment methods, which are then verified through laboratory experiments. This in turn reduces the substantial human resources, time consumption, and costs that are otherwise needed in conventional biological research. The finding of the research team received the attention of *Nature* because it identified an environmental factor of IBD and demonstrated the viability of combining bioinformatics with *in vitro* and *in vivo* experiments through interdisciplinary collaboration.



[1] Yen et al. (2019). Epidemiological trend in inflammatory bowel disease in Taiwan from 2001 to 2015: a nationwide populationbased study. *Intestine Research*, 17(1).
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