

Professor Datin Dr. Indra Vythilingam: Pioneer of Tropical Vector Biology and One Health in Southeast Asia

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PROFILE OVERVIEW

Few scientific careers illustrate the evolution of tropical disease research as clearly as that of Professor Datin Dr. Indra Vythilingam, an internationally recognised medical entomologist whose work has shaped understanding of vectors and vector-borne diseases in Malaysia and Southeast Asia. With approximately four decades of experience in vectors of medical importance, Indra has built a distinguished career at the interface of entomology, parasitology, epidemiology, public health and disease surveillance.

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From Medical Entomology to Tropical One Health

Professor Datin Dr. Indra Vythilingam's (**Figure 1**) scientific journey began with postgraduate training at Victoria University of Wellington, New Zealand, where she obtained her MSc (Honours). She subsequently pursued her doctoral studies at Universiti Malaya, earning her PhD from the Faculty of Science in 1983. She later joined Malaysia's Ministry of Health (Selangor Health Department) and Institute for Medical Research (IMR), where she served in the Division of Medical Entomology from 1990 to 2004. During her tenure at IMR, she also served as Head of the Parasitology Unit (2005-2008), contributing to the development of research and expertise in medical parasitology and entomology. She subsequently joined the Environmental Health Institute in Singapore, further broadening her regional experience in tropical disease research and public health.

In 2011, Indra returned to Universiti Malaya, where she has continued to advance research and capacity building in medical entomology and tropical vector-borne diseases. At the university, she played an instrumental role in establishing an Arthropod Containment Level 2 (ACL-2) laboratory within the Department of Parasitology. The facility provided an important platform for controlled experimental investigations involving infected mosquitoes and strengthened institutional capacity for research on

mosquito-borne pathogens. This infrastructure has supported the development of a research environment in which vector biology, pathogen transmission, and public health can be investigated in an integrated manner.



Figure 1. Portrait of Professor Datin Dr. Indra Vythilingam.

A Pioneer in *Plasmodium knowlesi* and Zoonotic Malaria

Indra's scientific legacy is particularly associated with the emergence of zoonotic malaria caused by *Plasmodium knowlesi*. Her research helped establish the importance of mosquito vectors in the transmission of this nonhuman primate (NHP) malaria parasite to humans and contributed to the recognition of *P. knowlesi* as a major public-health concern in Malaysia.

In a landmark study published in 2006, Professor Indra and colleagues provided evidence incriminating *Anopheles latens* as a vector transmitting *P. knowlesi* among humans and monkeys in Sarawak (Vythilingam et al., 2006). Subsequent investigations in Peninsular Malaysia demonstrated the presence of *P. knowlesi* in humans, macaques and mosquitoes, extending the understanding of the parasite's transmission ecology beyond Malaysian Borneo (Vythilingam et al., 2008).

Her subsequent research and synthesis of the evidence emphasised an important One Health principle: malaria transmission cannot always be understood solely as a human disease. Instead, it may involve complex interactions among humans, non-human primates, mosquitoes and changing environments. Indra's work helped establish that *P. knowlesi* infections occur across Malaysia and highlighted the importance of vector surveillance in areas undergoing ecological and environmental change.

Her research has also contributed to understanding the biology of *Anopheles cracens*, another important *P. knowlesi* vector. The successful colonisation of this mosquito under laboratory conditions provided an important experimental platform for studying vector biology and susceptibility to malaria parasites. More recent collaborative work has expanded this research towards other NHP malaria parasites, including *P. cynomolgi* and *P. inui*, reinforcing the importance of non-human primate malaria as a continuing zoonotic threat (Jeyaprakasam et al., 2025).

From Reactive Surveillance to Proactive Dengue Prevention

Another important contribution of Indra is her work on arbovirus vector surveillance. Conventional public-health surveillance frequently responds to human cases after transmission has already occurred. Indra's research has advocated a more proactive approach in which infected mosquitoes are detected before increases in human cases become apparent (Selvarajoo et al., 2022). Her research established a proactive dengue surveillance paradigm and demonstrated its effectiveness through a cluster-randomised controlled

trial. This work provides an important conceptual shift towards using mosquitoes themselves as early indicators of transmission and potential dengue outbreaks.

Such an approach exemplifies the practical value of One Health: disease prevention can be strengthened by integrating entomological surveillance, pathogen detection, epidemiology and public-health decision-making, rather than treating each component independently.

Building Scientific Capacity and a Culture of Mentorship

Indra's influence extends beyond her own research publications. She has supervised numerous postgraduate researchers, including at least 11 PhD students, three MSc students and 29 postgraduate diploma students (DAP&E) and has contributed extensively to the development of tropical medicine and parasitology research capacity. She has published more than 200 scientific articles, together with books and book chapters.

Her international engagement has also been substantial. She has served on the WHO Expert Advisory Panel on Vector Biology and Control since 1998, and worked as a WHO malaria consultant for Lao PDR, where she identified *Anopheles dirus* as the vector of malaria for the first time. She also served as a temporary WHO adviser on multiple occasions, and was a member of the WHO Vector Control Advisory Group on new vector-control tools from 2013 to 2016.

Her contributions have been recognised through several distinctions, including the Sandosham Medal in 2006, Malaysia's Research Star Award for Tropical Diseases in 2017, and the SOMA Global Leadership Award in 2025. Universiti Malaya also announced that she has been recognised among the world's top 2% of scientists in her field for 2022–2025.

Indra has additionally contributed to scientific publishing and research communication. She served as Editor of Tropical Biomedicine from 2006 to 2014, during which she played a pivotal role in securing the journal's inclusion in the Web of Science and establishing its impact factor. She subsequently served as a Subject Editor for the internationally recognised journal *Parasites & Vectors*. Her editorial leadership contributed to strengthening the visibility and international standing of tropical biomedical research from the region.

Looking Ahead: Tropical One Health in a Changing Environment

The future of tropical vector-borne disease research will increasingly require researchers to move beyond traditional disciplinary boundaries. Climate variability, deforestation, urbanisation, biodiversity loss, changing land use and increasing human–wildlife contact can reshape interactions between pathogens, vectors, animal reservoirs and human populations.

Indra's recent research continues to reflect this perspective. Her work has examined the implications of deforestation and non-human-primate malaria for malaria elimination in Southeast Asia, while recent collaborations have investigated vector incrimination using both classical mosquito dissection and molecular approaches (Vythilingam et al., 2026) (**Figure 2**).



Figure 2. Professor Datin Dr. Indra Vythilingam performing mosquito dissection under a microscope.

The continuing emergence of zoonotic malaria demonstrates why disease elimination must be viewed as an ecological and evolutionary challenge as well as

a clinical one. Surveillance systems capable of linking vector populations, wildlife reservoirs, pathogens, environmental change and human disease will be increasingly important.

For early-career researchers, Indra's distinguished career offers an enduring lesson: impactful tropical research begins with careful observation of problems in the field but achieves lasting influence when scientific evidence is translated into surveillance, policy, capacity building, and practical public-health action. Her career demonstrates how medical entomology can serve as a powerful foundation for One Health research, connecting biodiversity, vectors, pathogens, human health, and environmental change within an integrated scientific framework.

Her advice to the younger generation is simple yet powerful: be proactive, think ahead, and always stay prepared for the opportunities and challenges that lie ahead.

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