

# Medicine from Nature and Harnessing Toxicity

## Indigenous Medicine

### Learning Outcomes

- Define the terms Ethnopharmacology and Pharmacognosy.
- Use specific examples to discuss the importance of global Indigenous knowledge in the discovery and development of therapeutic drugs.
- Understand that Indigenous Australians have a rich history of the use of 'bush medicines' and consider ethical/cultural issues around obtaining and utilising this knowledge.
- Discuss the emerging mechanistic basis for understanding how such therapies might produce therapeutic benefits.

### Ethnopharmacology and Pharmacognosy

Ethnopharmacology and pharmacognosy are fields dedicated to studying the pharmacologically active components found in natural resources, primarily plants, but also insects, animals, soils. Historical records, such as the *Materia Medica*, document the uses of plants and their therapeutic properties.

### Transmission of Indigenous Knowledge

Indigenous knowledge about medicinal plants has been passed down through generations, often within families of healers. This knowledge includes information on where to find plants, how to extract their active components, and their uses. Such records were typically transmitted verbally, especially in cultures like that of Australia.

### Case Study: Digitalis Purpurea and Digoxin

One significant example is the use of *Digitalis purpurea* (foxglove) for treating heart failure. William Withering, an English doctor, discovered that herbalists were using foxglove extracts to treat dropsy, a condition related to heart failure characterised by pitting edema, fatigue, and shortness of breath. Withering's research led to the isolation of digoxin, a cardiac glycoside that increases calcium levels in cardiac myocytes, enhancing heart contractility.

- Inhibit  $\text{Na}^+/\text{K}^+-\text{ATPase}$  = increased  $[\text{Na}]_i$  decreases  $\text{Ca}^{2+}$  extrusion = increased  $\text{Ca}^{2+}$  in sarcoplasmic reticulum = increased  $\text{Ca}^{2+}$  release with each AP = increased contractility

## Case Study: Artemisia Annua and Artemisinin

Another important case is the discovery of artemisinin from *Artemisia annua* (sweet wormwood) for malaria treatment. In the early 20th century, Chinese scientists sought traditional remedies for malaria. They found references to this plant in historical texts and conducted experiments to test its efficacy. Initially, results were inconsistent until they realised that cold water extraction was necessary for optimal results. Artemisinin was identified as the active component, which interferes with the malaria parasite's ability to detoxify iron, leading to its death.

## Overview of Australian Traditional Medicines

Australia has a rich history of traditional medicines derived from its native plants, often referred to as bush medicines. These practices are deeply rooted in the knowledge of First Nations peoples, who have inhabited the land for at least 60,000 years. However, much of this medicinal knowledge is not documented in written form but is passed down orally through generations.

### Examples of Australian Medicinal Plants

- **Eucalyptus:** Commonly used for its therapeutic properties, particularly in treating respiratory issues.
- **Tea Tree:** Known for its antiseptic and anti-inflammatory properties.
- **Yam Daisy:** A staple food for Aboriginal people, rich in carbohydrates and nutrients.

### First Nations Knowledge Transmission

The knowledge of bush medicines is traditionally shared within families and communities, emphasising oral traditions rather than written records. This has led to challenges in accessing and understanding the full scope of traditional medicinal practices, especially given the historical context of colonialism in Australia.

### Impact of Colonialism

When Western colonists arrived in Australia, they often dismissed the knowledge and practices of Indigenous Australians, failing to recognize their sophisticated agricultural and hunting techniques. This lack of understanding has contributed to the ongoing challenges faced by First Nations peoples in preserving their medicinal knowledge.

### Health and Well-being Pre-Colonization

Before colonisation, First Nations peoples were among the healthiest populations globally, primarily due to their diet, which included lean meats and nutrient-rich plants. Traditional medicines were mainly used for treating injuries rather than chronic diseases, which were less prevalent at the time.