

Chapter 1

A Random Walk To and Through the Xanthophyll Cycle

Harry Y. Yamamoto

*Department of Molecular Biosciences and Bioengineering, University of Hawaii, Honolulu,
HI 96822, USA*

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Summary

This is an account of my personal and professional life as a student of the violaxanthin-antheraxanthin-zeaxanthin scheme for the xanthophyll cycle in higher plants. I had no early vision of becoming a scientist, but one circumstance led to another, and what began as a random walk ultimately developed into a life-long study of the biochemistry, physiology, and function of the xanthophyll cycle. The circumstances and people with whom I shared this path are described, with special attention given to the early developments.

I. Introduction

Does anyone accept an autobiographical assignment such as this without some hesitancy? I appreciated the invitation to tell my story, but wondered if I had anything worth contributing. What should I say? Who would care? After some reflection, I thought (or possibly rationalized) that my story, which is best characterized as a random walk to and through the xanthophyll cycle, may give comfort to young people whose vision of what they wish to accomplish in life may not be entirely clear. The circumstances that led to the discovery of light-induced conversions among violaxanthin (V), antheraxanthin (A), and zeaxanthin (Z)—the VAZ pathway for the xanthophyll cycle—may also be of interest. Although the walk was random, with many small and uncertain steps, it almost always carried me forward and ultimately brought me to the “right” path. As a child and even through college, I had no thoughts about becoming a scientist, only an innate desire to seek a better future as my parents had done. With luck and

help from many people, I have been privileged to the better life, better than I could have imagined possible as a child. I extend my special thanks to the book’s editors for giving me a chance to reflect and open doors to many good memories.

II. The Beginnings

To start, I can thank my father for my good fortune at being born in the U.S. Dad, the second eldest son, had to seek his independent fortune and immigrated to Hawaii while still a teenager. I grew up in the shadows of the famous Moana Hotel on Waikiki Beach. Perhaps some readers who have visited Waikiki remember the large banyan tree in the International Market Place located cater-corner from the hotel. We lived about three hundred yards from that tree; once, I fell out of it while playing Tarzan and broke my arm. Our home was provided by the hotel because Dad, a carpenter, was on call “24-7.” We were poor, but I was not aware of it; my

parents never complained, and all those around us were also poor. It was a happy and carefree time for me.

I was 8 years old when the Japanese attacked Pearl Harbor. Both my parents were treated as aliens even though Mom was a native-born U.S. citizen. Fortunately, we and many others in Hawaii were not sent to the “relocation camps” in which Americans of Japanese descent were detained on the U.S. mainland. In Hawaii, most of us were spared relocation largely by the actions of John Burns who, as police captain in charge of espionage for the FBI, vouched for the loyalty of Japanese-Americans in Hawaii. Burns was Delegate to Congress when Hawaii became the 50th state and later was elected Governor for three terms. He touched many lives. During the war, I carried a gas mask to school and my club house was the underground shelter Dad had built for our safety. The attack on Pearl Harbor had been led by Admiral Yamamoto; although he was no relation, I avoided problems by assuming the name Harry Chang when around soldiers on “R & R” (rest and recuperation) in Waikiki.

As a child I must have shown an interest in science because one of the best Christmas gifts I recall receiving was a Gilbert Chemistry Set. I can still picture it. It came in a red fold-out wooden case with rows of chemicals in small bottles, a simple balance, a watch glass, and spatulas. It had a manual from which I learned to make, among other things, black powder and “stink bombs.” My parents weren’t always pleased with the results of my experiments. These types of sets may not be available today and, if they are, their contents are probably more limited given modern concerns about hazardous substances.

III. Education

My friends are the reason I went to college. I took the entrance examination to the University of Hawaii only because they did. A few months later, I enrolled as a freshman and chose medical technology as my major because that is what a friend had selected and, much to my liking, it had a strong science emphasis. The course load was so heavy in zoology, microbiology, and chemistry that it nearly met the major’s requirement for each of those fields. However, botany was not required for obvious reasons: medical technology deals with sick people, not sick plants. I didn’t know then that I would spend my entire professional life happily working on plants.

The senior year in medical technology consisted of laboratory rounds at hospitals, public health

laboratories, and the blood bank. During that year, I took night calls at Kuakini Hospital on alternate nights to earn my tuition for the year. Working as I did, I learned that the field of medical technology, as least at the time, offered limited economic opportunities. This important realization probably came about because by then I had a steady girl friend and was thinking about how to become a good provider. After graduating with a B.S. (1955) and completing a six-month tour of duty as a 2nd lieutenant with the U.S. Army Infantry in Ft. Benning, Georgia and Fort Riley, Kansas as part of my eight-year obligation in the Army Reserves, I embarked on the next leg of my random walk. I enrolled in the M.S. program in the Department of Food Technology at the University of Illinois at Urbana-Champaign. The selection of food technology as a field of study is not as curious as it may seem. I had worked in the Del Monte pineapple cannery for three summers prior to my senior year and was promoted each year to a better paying and more responsible position. I could see that a large food processing company offered many opportunities and thought that an advanced degree in the field would be useful. In changing to food technology, I accepted the possibility of not being able to return to Hawaii since most major food industries, except for pineapple processing, were on the mainland. It was a risk that I was willing to take. As it turned out, the greater risk was the demise of the pineapple canning industry in Hawaii, brought about by foreign competition. With one exception on the island of Maui, the canneries have all since closed.

Attending the University of Illinois was a good decision in several ways. First, I learned that, contrary to what I had assumed, changing fields of study was relatively easy. I discovered it wasn’t necessary to complete all the requirements of the previous degree before starting work on a higher degree. Being the only one of three siblings to pursue graduate studies, I hadn’t known any better. Next, during my first meeting to discuss my academic program with Reid Milner, Chairman of the Department of Food Technology, he casually asked if I intended to go on for the Ph.D. Me, whose parents had little schooling, who went to college only because his friends were going, and who had decided to pursue the M.S. only as a means for gainful employment? It was an unexpected and welcome expression of confidence in my potential. Thank you Prof. Milner! Finally, while pursuing the M.S., I found that I was more interested in “Why?” than “How?” and preferred fundamentals to applications. The title of my M.S. thesis was “*Kinetic Studies on the Heat Inactivation of Peroxidase in Sweet Corn.*” Peroxidase activity was used, and is