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### Preface

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# Preface

This book on early research has been eighteen years in the making. It emerged, in part, from the confluence of my teaching both college and high school students simultaneously over the past twenty years. The nascent idea for the book grew with my realization that engaging students in research earlier than is conventionally done makes perfect sense and should be common practice.

Having an active research program is deeply important to me. I constantly scribble organic “stick figures” of new project ideas on yellow pads or paper napkins while lying in bed or waiting for food at my favorite restaurant. Giving birth and breath to these ideas is as exhilarating and rewarding as walking barefoot along a Caribbean beach at sunset. Their journey from muse to round bottom flask and to the revelations of their NMR spectra holds my curiosity and keeps me engaged professionally. I am as excited and invested as my students in knowing if the reaction worked or not. The challenge for me has never been generating research ideas but finding the best ways to actively nurture unsure and inexperienced pre-college and college students into becoming independent researchers and critical thinkers.

As the years passed, different layers of early research were continually added and improved upon. It included developing course-based undergraduate research experiences (CUREs) for spring semester sophomore organic labs starting in 1998, and implementing course-based independent research periods for my Grade 12 chemistry class since 2005. Students - high school, undergraduates and graduates - were provided various opportunities to conduct organic synthesis research in both curricular and non-curricular settings. Whether students were science or humanities majors or whether they had good grades or not, I had one unwritten rule: no student was turned away from conducting research. Sometimes, this meant personally driving students back and forth from the neighboring southwest Michigan community of Benton Harbor to my lab at Andrews University in Berrien Springs.

With almost 1,000 students having been involved in early research projects, I thought it was time to share the passion and the journey with a bigger audience. But, I knew I was not alone. There were and are others who have also been tearing down the barriers that have traditionally delayed students from early engagement in authentic research. We are part of a movement that will not take no as the final answer. We are the new open doorways to science; we envision research not as a requirement for college upperclassmen or as a reward for students with the best grades. Rather, we see research as fundamental to the educational experience of all students.

Because it aligns with basic human curiosity, we are convinced that this open gateway to research is right pedagogically and makes sense economically. Curiosity, the foundation of research and all learning, is as primal as hunger or thirst. With curiosity, we've looked, in awe, outward to the heavens and inward to our consciousness. Indeed, without curiosity about our world and universe, that are often at odds with our very own existence, we may literally not survive. Research allows us to see patterns and understand, predict and control the world around us. It allows us to attain a better standard of living; to make us better today, as a species, than we were yesterday. So, pursuit of our curiosity should not be restricted to a few of us – some mythical or privileged critical mass – but should be part of how we all make sense of our world.

In view of these thoughts, a few years ago, I began speaking with one of my co-editors and a longstanding research collaborator, Sherine Obare, about the process for being part of the American Chemical Society Symposium Book Series. This resulted in organizing the Early Research symposium at the 2014 Biennial Conference on Chemical Education held at Grand Valley State University in Allendale, Michigan. At that meeting all the speakers were in agreement about moving forward to publish a book on early research. However, we opened up the process so that others, who were not speakers at our symposium, but who had equally compelling stories to tell from the frontiers of early research would also be involved and included.

As Lead Editor, I give special thanks to my two able co-editors, James Hageman and Sherine Obare. Both of whom also have the passion, commitment and experience in mentoring students, including from historically underrepresented groups. They share with me the game-changing vision of universal adoption of early research. Together we thank all our chapter authors and co-authors: Brenda B Harmon, Bruce Alberts, Cecilia Hernandez, Erin Wasserman, Glenn D Kuehn, James Hewlett, John Tierney, Joseph Dunbar, Julie O'Connor, Kevin C Cannon, Lee J Silverberg, Mark S Hannum, Melissa McCartney, Nichole L Powell, Princella Tobias and Steve Sogo.

In addition, we especially thank the authors of our student testimonials, affectionately called *Lab Tales*, for sharing their own personal journey in early research: Ginger Anderson, Wendy Bindeman, Aaron Cali, Keith Campbell, David Chavez, Charlotte Herber, Deepa Issar, Natalie King, Felicia McClary, Samantha Piskiewicz, Javon Rabb, Elizabeth Snyder, Michelle Stofberg and Yusheng Zhang. It is our deepest wish that their powerful yet relatable stories would inspire another generation of scientists, engineers and innovators across all demographics.

We are very appreciative of all who provided quotations in support of our book: Mitch Aiken, Elizabeth L. Ambos, Len Archer, Oneida Arosarena, Michelle Ann Bakerson, Bal Barot, Deborah Blum, Novella Bridges, Sylvia T Callender-Carter, Roberta Cramer, JM Crisman, Marc A. Edwards, Joseph M Fortunak, Lebert Grierson, Darci J. Harland, Shawn Hitchcock, Freeman Hrabowski, Rosemarie Jahoda, Nigel Jalsa, Cathy Middlecamp, Sally Mitchell, Dorothy J. Phillips, Megan Schraub, Bradley D. Tait, Janice Hall Tomasik, Margaret Daniels Tyler, Cardinal Warde, and John C. Weber.

We thank George Shields, 2015 American Chemical Society recipient of the Award for Research at Undergraduate Institutions, for an insightful book foreword. There are also many names that do not appear in the book but have contributed as chapter reviewers, formally and informally. We acknowledge your invaluable service and thank you kindly.

I give very special mention to my awesome friend Ms. Princella Tobias, publisher of the award-winning *Benton-Michiana Spirit Community Newspaper*. Together, as her volunteer editor since the inception of the newspaper in 2002, we developed and implemented a new type of public science that is featured in Chapter 12 of this volume. Local readers were our first audience of *Lab Tales* and other public science articles. Not infrequently, we would see these feature stories on the walls of barbershops, high school classrooms or City Hall. For close to 15 years now, she willingly, without remuneration, published articles written by my early researchers with the hope they would inspire by example other students to experience the thrills and spills of research for themselves.

I also thank my Department of Chemistry and Biochemistry, Andrews University Office of Scholarly Research, supportive colleagues and external funding agencies: National Science Foundation, American Chemical Society, Project SEED and Michigan Works' Benton Harbor Summer Youth Program.

Finally, to all my early researchers from high school and college, from 1998 to my present 2016 crew, I thank you from the bottom of my heart. I hope that your early experiences doing organic chemistry will have indelibly taught you one thing above all else: whatever and wherever you find yourself, you have what it takes to meet the challenge. For in the end, research may reveal more about us than about organic molecules and their reactions.

Through all the cold Michigan winters and increasing gray hairs, this has been my labor of love. I thank my loving parents, Auldith and Hartwell Murray, for all their sacrifices and untiring support as I pursued my childhood dream of being a scientist.

I hope you, the reader, are inspired "to go about seeking," early and often, inward and outward.

**Desmond H. Murray**

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