

Success With Science: The Winners' Guide to High School Research

Five Harvard students and research competition winners
reveal how to succeed at high school research.

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www.successwithscience.org



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Foreword

This is an admirable and unique book. It is a gem among several ambitious projects undertaken by the Harvard College Undergraduate Research Association. The HCURA was founded in 2007 by a group of students, largely freshmen and sophomores. Led by Shiv Gaglani ('10) as president, the basic aim was to foster and broaden opportunities for undergrads to pursue research "early and often." I gladly agreed to be a faculty advisor, much impressed with the evangelical fervor of HCURA members. Soon HCURA launched workshops designed to improve presentation and writing skills, journal clubs to discuss exemplary papers, and faculty seminars and lab tours to acquaint members with research prospects. The Association also inaugurated annual symposia presenting undergraduate research. In April 2009 HCURA extended its research symposium to bring together students from eight colleges in the first such Boston-area meeting.

Meanwhile, Shiv had recruited a team of colleagues that began work on this *Guide*, designed to help high school students develop suitable projects for top-notch science fairs. This was entirely on their own initiative, motivated by appreciation for how much they had benefited from their precollege experience in such fairs. Shiv's team took a novel approach by sending out an email questionnaire to a host of students and faculty mentors (many not at Harvard). Thereby the *Guide*, as well as offering much useful information and advice, has been enhanced by many personal commentaries that provide insightful perspectives on all aspects of science fairs and kindred activities.

Also cited abundantly in the *Guide* are lively interviews of students on site at science fairs, filmed by Dr. Jeffrey Seeman of the University of Richmond. These are available on a website (Archimedesinitiative.org) as a set of 17 five-minute videos, each comprised of responses addressing a specific theme. Among the themes are: Decoding the Data; (Self) Discovery Channel; Eureka! Cornering Conclusions; Holding Court with Judges; Conquering Fear, Building Confidence. Like the commentaries in the *Guide*, these interviews bring forth the earnest joy that students get in probing a question of their own choice. And then being rewarded, often after overcoming puzzlement by much effort, with genuine insight and the pleasure of sharing it with others.

I have shown the *Guide* manuscript to numerous faculty colleagues as well as to people long involved in conducting science fairs. All find it remarkably well done and are impressed that Shiv and his team produced this book while also engaged in much else, not least their demanding academic programs. Several faculty asked for copies to give to their graduate students, saying that the *Guide* can surely boost their research by virtue of both its practical advice and its zestful spirit.

The *Guide* is also heartening in the wider context of improving science education, today a vital national goal. The importance of informal modes, allied to but outside schools, is increasingly recognized. It is a privilege to applaud the *Guide*, the enterprise of its youthful authors, and the support given with alacrity by the Research Corporation for Science Advancement.

Dudley Herschbach

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Preface

Welcome to *The Winners' Guide to High School Research*! First, congratulations are in order because you have already taken the first steps towards succeeding with science by picking up this book. There are many ways to succeed in high school, though there are few that can parallel science research in terms of the widespread opportunities and immense benefits it provides to students who excel in it—hence the title *Success with Science*. The tagline is *The Winners' Guide to High School Research* because this is a guide written by, and containing the advice of, students who have performed extremely well in science research competitions such as the Intel International Science and Engineering Fair, Siemens Competition, and Intel Science Talent Search, among many others.

By reading this book and using the advice within it, you will learn how to formulate a research project idea, find people who can help you complete it, effectively present it to diverse audiences, and participate successfully in research competitions. This guide was written for any high school student interested in science research: from the freshman rookie with a vague interest in science to the senior veteran striving for first place at the Intel Science Talent Search. With its testimonials from high school students whose lives were positively changed by their research experiences, this guide also aims to motivate and empower students who otherwise would not pursue science and research opportunities. In doing so, this book seeks to encourage more students to pursue science and technology, or at least to think creatively and take initiative.

With these ambitious goals in mind, what is the best way to use this book? When I developed the idea and outline of this guide, I chose to divide it into five distinct parts that may be read sequentially or separately depending upon your interests and needs. I recruited four of my peers to be contributing authors based on their experiences and strengths, which are reflected in each part. Part I details the many individual benefits you can realize from participating in science research. For example, many high school students who do research get into top colleges, win scholarships, learn about career options, make lifelong friends, and develop qualities and skills that will help them throughout their life—the chapters in Part I describe each of these benefits in depth.

After Part I whets your appetite to do research, Part II describes the nuts and bolts of getting started by forming an idea, finding a lab or mentor, working in the lab, impressing your mentor, and keeping records of your research in a logbook. Once you make some progress on your project, Part III will help you present your research—in both written reports and oral presentations—to your teachers, science competition judges, and the general public. Part IV not only describes the major research competitions in which you can enter your project and the summer research programs in which you

can participate, but also provides advice from actual winners and participants on how to do your best in those venues. Finally, Part V provides a glimpse of what research is like after high school, because there are key differences in college, and knowledge of these differences will help you hit the ground running when you are an undergraduate.

One important note that cannot be overemphasized is that your science research experience will prime you for success, especially if you approach it with a genuine interest in research and discovery rather than an interest in winning competitions. Though the awards and prestige that come with winning are great byproducts of excellent research, the research experience itself is far more valuable in the long-term. Best of luck with your research career!

Shiv Gaglani

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