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## Mentoring High School Students

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Dr. Robin Cooper is a faculty member in the Department of Biology and teaches physiology and neurobiology courses at the University of Kentucky. His research is in comparative physiology. He received a double major with a B.S. in Chemistry and Zoology from Texas Tech in 1983 and a PhD in Physiology from Texas Tech Medical School in 1989. He has had postdoctoral training in Switzerland and Canada for 7 years before joining the University of Kentucky in 1996.

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I have been fortunate enough to have my 6<sup>th</sup> entry to the INTEL International Science and Engineering Fair (INTEL-ISEF) from high school students conducting research within my research group. Many faculty and high school students do not realize the magnitude of the INTEL-ISEF activity. This brief write-up is to help bring attention to other researchers on campus the joy of the students in being able to attend this international science activity and to inform them about the prestige for the students by going to this competition. To gain a flavor of international activity one should see the promotional video produced by INTEL-ISEF

[http://www.youtube.com/watch?v=2-c0gGIMI\\_s](http://www.youtube.com/watch?v=2-c0gGIMI_s)

A brief explanation of this international competition is well described on their web page:

<http://www.intel.com/about/corporateresponsibility/education/isef/index.htm?wapkw=science+fair>. “The Intel International Science and Engineering Fair, a program of Society for Science & the Public <<http://www.societyforscience.org/>>, is the world's largest pre-college science fair competition. Each year, more than 7 million high school students from around the world compete in local science fairs with the dream of reaching Intel ISEF. Only 1,500 of these young innovators become finalists, invited to attend the event to share ideas, showcase cutting-edge research, and compete for over USD 4 million in awards and scholarships. More than 1,000 science, engineering, and industry professionals volunteer at Intel ISEF to judge the student projects ....”

When high school students ask about conducting research in the lab, one of my first questions is likely, “Is this for a science fair project or for gaining research exposure?” One might think that there is no difference but there is in the approach of conducting the research and intensity of the project. If a student would like a research exposure, then I have them rotate around with the different undergraduates and graduate students in the lab and possibly encourage students to see research activities ongoing in other research labs in the department or across campus with colleagues. Students gain valuable research exposure with this approach. Students flourish with this approach and exposure to a variety of projects and experimental approaches as well as interaction with researchers at various levels. However, if a student is interested in a science fair based project then a student needs to focus on a project to obtain data and to be able to have time to research the topic as well as follow up on tangents that might result from the initial research activities. It is very easy, as a judge, to dig into a student’s research project and determine if a student really conducted the various aspects of the project or if a lab tech conducted an aspect of the research in conjunction with the student. For example, I recall one year, a student in another lab not being able to explain how a culture media was made or controlled for pH variation during

an interview with science fair judge. The student obviously was not involved in that part of “their” research activity. I generally expose a student to various projects which are possible and reasonable to conduct on their own. Many times a student might even suggest a deviation of the suggested projects which I welcome, as this boosts a student’s interest and drive to conduct a project. They may require some skill or technique training but after they master the skills they need to be let loose on their own. This will allow a student to have a sense of ownership and mastering of the project. When they are being judged in a local science fair to be selected, the student’s familiarity with the project is apparent by the judges.

Serving as a judge myself at INTEL-ISEF a few times, I have seen the level of competition and the very subtle aspects that separate students from placing at the international level. This has given some insight to help direct students that they need to research their subject with primary papers and really understand how their project can contribute to an aspect of the science they are conducting. They need to demonstrate that they are working on an aspect of research that has not been fully understood or how their project is unique while also fitting into the grand scheme of the scientific arena. So, faculty would benefit greatly by serving as science fair judges in fairs at all levels (school, county, regional and state as well as at the INTEL-ISEF level) to gain some experience in how students are judged. Many of the local science fairs for elementary and middle schools are hurting to get enough qualified judges to help with their fairs. Any undergraduate or graduate student in my research group quickly learns that I will strongly encourage them to participate as a judge in local fairs. Not only does the activity help the university students participate in outreach activities but it helps them understand what a science fair participant has to go through while working in the lab for a science fair project.

In the past few years, five high school students from my group have been able to go on to the INTEL-ISEF with one student participating two years in a row. Some of these students have placed in this very competitive fair and have won not only recognition but financial gains as well for recruitment by various universities. These are the past students and the year from my research group that have gone to Intel:

- 1. Clay Turner 2005.**
- 2. Ann Cooper 2007 (4th place in Behavioral Sciences category at the International INTEL)**
- 3. Ann Cooper 2008 (2nd place in Animal Sciences category at the International INTEL)**
- 4. Curtis Northcutt 2009**
- 5 Shelly Xu 2009 (3rd place in Animal Sciences category at the International INTEL)**
- 6. Valerie Sarge 2012**

Most of these students have also presented at state (Kentucky Academy of Science) and national (Society for Neuroscience) meetings to prepare them for INTEL. If the students can handle presenting their research at a national meeting as a 1<sup>st</sup> author on a poster or an oral presentation, then the students have gained the confidence and the experience of being grilling on their projects. The judging at INTEL is not so frightening with such past experiences.

As for student feedback by attending INTEL, students comment that they like traveling to the ISEF with Team KY to get to know other participants in the state. The regional fairs and the state fair winners travel together and work as a team helping each other for the pinnacle of

competitions. In addition, students like meeting international students at the various activities that INTEL-ISEF has for the participants. Student's comment they are amazed at the level and depth of many of the projects at INTEL. A good number of the students, particularly the engineering participants, have patents on some of their creations. There are a number of stories that the students have, such as being interviewed on the TODAY show and conversing with Nobel Prize winners that interact with students at INTEL-ISEF. Students comment that attending INTEL-ISEF is one of the highlights in their high school years and that being around other students interested in science helps to drive their passion for continuing with research. They also have less inhibition dealing and engaging with scientists and engineers during their college years. Some of the high school students that worked in my lab have come back to complete their projects and see the project through to completion to publish in a peer reviewed scientific journal such as the European Journal of Neuroscience and the Journal of Visualized Experiments.

A point to also make is that the science fairs within the state are generally run and managed by volunteers as well as by donations. This past year, the 10<sup>th</sup> annual KY State Fair has had hard financial times and was stressed if they would have enough funds to even send students to the INTEL-ISEF. If people can help with fund raising and help to gain corporate sponsorship for the State and Regional fairs within the state, this would help ensure Kentucky's place at an international level in High School science and engineering activities. We were fortunate this past year LEXMARK became one of the official sponsors of the state science and engineering fair.