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The SMARTS Guide to Science Fairs

From Starting a Project to Competing (and Winning)

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INTRODUCTION

SCIENCE

Science is all around us. How birds fly, how water evaporates, the way cars can move at 100 km/hr – all of it can be explained by science. Through centuries of discovery, people have continued to unravel the nature of the world through science.

However, the beauty of science lies not only in what we have discovered but in what we have yet to find! Humanity is far from reaching the ends of the universe, and there are still many mysteries left to solve on Earth alone.

There is a common misconception that only adults are scientists, that young people can't make contributions to the expanding world of science. But it shouldn't be like this!

Everyone can be a scientist. There are no limitations on who can discover something miraculous about the world around us. As students, you are not only the scientists of tomorrow – you are the scientists of today.

And that's where science fairs come in. Science fairs are some of the best opportunities for students to pursue an interest in science, make discoveries and share them with their peers as well as renowned scientists, professors and professionals.

SCIENCE FAIRS

"Argh… A science fair?"
Boy, the number of times I've heard that one! Many people – parents and students alike – share horrid stories of science fairs. I myself remember my first couple of science fairs: the last-minute touch-ups, the overwhelming research, the massive amount of work. Oh, and we can't forget parental intervention. I can't count how many times I've heard parents complain about the work they spent on their child's science fair project.

And then there are the common stereotypes about the projects themselves. Whenever people hear the words "science fair," a vast majority of them imagine Styrofoam solar systems and vinegar and baking soda volcanoes. To be perfectly honest, I'm sure there are some students who still do these types of science fair projects.

But it's not supposed to be this way!
Contrary to popular belief, science fairs aren't about repeating familiar projects. Science fairs aren't a competition to see who can paint the prettiest Jupiter Styrofoam ball or build the biggest volcano. In fact, the idea of the science fair is to encourage students to answer unsolved questions. I mean, think about it – what's the purpose of doing a project that's already been done? What does that accomplish?

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So What's the Problem?

Chances are, the only science fairs you've been to were your elementary school science fairs. When you're Grade 6 or under, most of the time you'll end up doing research science fair projects. You still haven't started to seriously learn scientific concepts in school, and as a result, you'll end up restating well-known facts and doing activities (they're not really experiments) from books you've found in the library.

And that's not your fault! No one can expect you to discover or explore scientific concepts at such a young age.

So here's where the problem lies. In those early grades your teachers were simply hoping that you'd learn something from doing the project. But let's be honest. Research projects can be boring and a burden for anyone. I mean, who enjoys just researching material and retyping it?

And look at what happens because of this:

> Students lose interest and struggle to finish their projects.
> Many parents end up doing the projects for their kids.
> Students begin to hate science fairs and vow to never participate in them again.

Science fair projects aren't just research projects. They are much more than that! In fact, research is just one of the preliminary stages of conducting a science fair project. From research, you go to developing an idea, to testing that idea, to analyzing the results and drawing conclusions.

There's nothing wrong with starting off doing research projects at a young age. In fact, it's probably good preparation for conducting science fair projects at the higher levels.

But what if a student has an interest in science, and this interest isn't nurtured? That's the beauty of science fairs. As you begin to use the scientific process and do real exploration of the world, science comes to life. You don't need to be restricted to the tedious, cookbook activities often used in schools. By exploring your scientific interests, you will develop a passion for discovery, making the process much more exciting. For many students, participating in science fairs has changed their lives and ignited in them a passion for science.

If Science Fairs Are So Great, Why Don't I Hear About Them More Often? Why Doesn't My School Take Part in Them?

You may be surprised to learn that Youth Science Foundation Canada sends out posters and flyers about the annual Canada-Wide Science Fair and Regional Science Fairs to all schools in Canada with Grade 7 to 12 students. Although they receive this information, some schools may not inform their students about science fairs. This happens in spite of the fact that the student doesn't usually need the school's support to enter a project in the Regional Science Fair.

But students have the right to know!

Since science projects are not part of the curriculum in most parts of Canada, schools may feel that the students or teachers shouldn't be doing extra work.

Science fairs are an extracurricular activity.

They aren't part of the curriculum. But what about basketball? Volleyball? Reach for the Top? Schools have clubs and teams for these activities, and they definitely aren't part of the curriculum – you can't fail Physical Education for not being on the basketball team! Let's not forget that there are even teachers who go out of their way to supervise these activities.

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So why should science fairs be any different?

Simply put – they shouldn't. It's an extracurricular activity, just like baseball or soccer. Sure it involves work, but so do all extracurricular activities.

Students should be informed about science fairs. And if they choose to participate in one, they deserve support from their school.

You are in control of your life. If you want to explore your interests in science outside the school, in an exciting and fun way, take the chance – get involved in the local science fair!

Some Incentive

I'll be honest. Besides the fact that you're learning something new, I haven't given you much incentive to participate in science fairs. Like I said before, from kindergarten till Grade 6, science fairs at the school or regional level are usually a time to share your project with others. Besides the personal reward of educating yourself on a topic of interest and having fun doing it, there's no real, tangible reward for your hard efforts. I'm sure that, for some people, simply learning something isn't enough to inspire them to explore science.

So what then? Why participate in a science fair? What if I mentioned money? Prizes? Competition?

From Grade 7 through Grade 12, the science fair becomes more than an opportunity to share your project – it becomes a competition.

Beginning in Grade 7, science fair participants have the opportunity to win awards and prizes at the local, national and international level. At a Regional Science Fair, participants are judged by teachers, university students, professors and industry professionals.

Medals and cash prizes are often handed out to participants from Grades 7 to 12. The top projects are selected to represent the region at the national championships – the Canada-Wide Science Fair – at which about 450 finalists from every province and territory compete for even more awards, prizes and scholarships.

More than $360,000 is handed out every year in prizes and scholarships at the Canada-Wide Science Fair, which has been held annually since 1962. The top project alone is guaranteed at least $16,500 in cash awards and also wins additional prizes and scholarships.

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THE STEPS TO SCIENCE FAIR SUCCESS

STEP 1: CHOOSING A TOPIC

Choosing a topic can sometimes be the hardest part of doing a science fair project. When I did my last project, I can honestly say that I probably changed topics five or six times. The easiest way to find a topic is to first find out what topics you don't like.

So how do you do this? Well, the easiest way is to first look at the general topic areas available. The Canada-Wide Science Fair has eight divisions that you can enter your project in. Here are short descriptions of each:

Automotive (Interdisciplinary Division):
Studies dealing with health, safety and injury prevention; societal issues and the future automobile; materials and manufacturing; powertrains, fuels and emissions; design processes; intelligent systems and sensors.

Biotechnology & Pharmaceutical Sciences:
Applying knowledge of biological systems to provide a service, create a product or solve a problem. Pharmaceutical sciences projects study the interaction of chemical substances with living systems. The main subject fields in biotechnology are crop development, animal science, genomics and microbial studies. Substances with medicinal properties – the potential to cure or reduce symptoms of an illness or medical condition – are considered pharmaceuticals.

Computing and Information Technology:
Computing and information technology projects concentrate primarily on the development of computing hardware, software or applications, including programming languages and algorithms, software design and databases, as well as the storage, transmission and manipulation of information.

Earth and Environmental Science:
Projects focusing on geology, mineralogy, physiography, oceanography, limnology, climatology, seismology, geography or ecology. Projects in this field generally deal with learning how the Earth works and tackling problems in the environment.

Engineering:
Projects in this field are based on using and developing innovative technology (for example, computer hardware and software), often concerning chemical engineering, electrical engineering, industrial engineering, mechanical engineering, metallurgical engineering, materials engineering and hardware/software design.

Health Sciences:
Any study dealing with human science, including the application of scientific knowledge to the health of humans.

Life Sciences:
Using experiments, innovations or studies to see how living things (non-human) work and function.

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Physical and Mathematical Sciences:
Physical science projects focus on the properties and principles of energy and matter and are often in the fields of organic or inorganic chemistry, analytical and physical chemistry, astronomy, subatomic physics and space science. Mathematical science projects generally deal with the study of mathematical theories and the use of mathematical models to simulate biological and physical systems.

Now that you know the different science fair divisions, you can figure out which field you want to do a project in by crossing out the ones you don't like.

As an example, let me show you how I chose my field. Right away, I knew I didn't want to do a project on earth and environmental sciences – it was just one of those topics I have never really had a strong interest in. Physical, mathematical, engineering and computing sciences just didn't strike a chord with me either.

At this point it was down to Health Sciences, Life Sciences, or Biotechnology & Pharmaceutical Sciences. As someone wanting to go into medicine as a career, I knew that I would enjoy Health Sciences the most. So, now it's your turn. Think about what you like. Computers? Numbers? Medicine? Animals? The Environment?

Once you know what field you want to do your project in, you can move on to narrowing that field and choosing a topic.

So for me, I knew I wanted to do a project related to health. Throughout the entire process of selecting my topic, I learned three very important things:

1. Choose a topic you're genuinely interested in.

In Grade 9, after reading an interesting article about some research that had been done, I wanted to study the effects of nicotine on diminishing the symptoms of Tourette's syndrome. It was something that really interested me, something that genuinely inspired me to learn more. But this wasn't one of those projects I could do on my own – I would need some sort of mentor with access to a laboratory, and who would be willing to take me on. After weeks and months of looking with no success, reality struck, and I realized that doing such a project was out of my reach at that point. It just wasn't doable! (More on this later.)

I knew I had to change topics.

I began to panic, thinking there's almost no time left! Instead of going back to doing something I like, I began asking people I knew for doable projects, whether or not I liked them.

Big mistake.

Because I wasn't interested in the topics, I couldn't really get into them. I went from studying the effects of nicotine on Tourette's syndrome to developing hydrogen fuel cells, to studying stomach acids and so on. But even in the presence of doable project ideas, my lack of interest in them slowly brought me back to square one – I had no project. Trying to do a project that I didn't even like simply wasn't going to work.

So I sat down and told myself, Go back to your roots! Find something you really like. I realized that with time running down, the only way I could really get immersed in a project and finish it in time was to get truly excited about it.

So I began looking back, thinking about my interests. Clearly, I was interested in Health Science (specifically neuroscience and Tourette's syndrome), but what could I do in this field? I realized that I could study memory, since memory capacity can be measured using simple recall tests. So now I had my basic topic: memory.

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The key thing to remember is that it's not enough to pick a topic in the category that you like – you have to like that specific topic itself. For instance, I wanted to do a project in Health Sciences, but I'm not interested in studying human teeth. Just because you're interested in a scientific area doesn't necessarily mean you love everything about it!

2. Aim to be innovative.

One of the goals of a science fair project is to explore your creative potential and make discoveries. As I said earlier, a science fair project isn't purely a research project – it's a project about trying to figure something out. The simplest approach to this concept is to try to do an experiment or study that has not been done before (to your knowledge).

Let me explain this by referring to my project on memory. I knew I wanted to do a project on memory, but now what? Well, I started thinking about improving or worsening memory, and thought:

Hey! Maybe I could develop a formula that could help improve memory!

So I started out by researching how memory works in the brain, and any recent studies that have shown certain drugs to improve memory. I also realized that it's a good idea to find out what worsens memory, because creating an opposite effect may increase memory.

After further research, I found that the consumption of caffeine and sugar has been found to improve cognition and memory in adults, especially in senior citizens. However, I could not find any study regarding adolescents. So I thought to myself:

Hey, why not study the effects of caffeine and sugar on teenage memory?

I mean, caffeine could affect memory in adolescents differently than in adults. So now I had my interesting and innovative topic: the effect of caffeine and sugar on teenage memory. Had similar studies already been done in teenagers, however, then my project would have been pointless. How can you discover something that's already been discovered? What would be the point?

As you can see, you don't have to be completely original. Instead, try looking at experiments or studies you are interested in, and try to put a little twist on it. In my case, I found that no studies testing the effects of caffeine and sugar on memory had been done with teenagers, so I chose to do similar memory studies using teenagers.

It's important to note that you should not finalize your topic until after you do research. In short, you don't have to know your exact topic right now! (I'll write more on this later.) At this point, knowing that you want to do a project on memory (for example) is good enough. The innovative aspect can be figured out later after doing more research.

3. Choose a topic that is within your capabilities and resources.

What do I mean by this? Let's go back to my original topic: the effects of nicotine on Tourette's syndrome. Now, first off, studying Tourette's syndrome means having access to patients with the neurological disorder. Secondly, administering nicotine (or any substance, if you're testing its effects) to human subjects requires the approval of an ethical review committee, and studying its effects would undoubtedly require medical supervision and laboratories. I wasn't able to obtain such resources, making the topic unrealistic at the time. In this case, the topic was beyond my resources – possibly even beyond my ability (I had never worked in a lab before, let alone done a study with patients).

Projects at a higher level may require having access to more intricate equipment and instruments, such as those in a laboratory. If you don't have access to such resources, then

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obviously you won't be able to do that kind of project. To be truly successful you need to do your best, and to do your best, you have to stay within your own capabilities and available resources.

That's one of the reasons why my memory project was feasible. Caffeine and sugar are used regularly by teens in the form of soft drinks, so I could easily find students who consumed these substances – and those who didn't – for my testing. (Please note: YSF Canada requires that the testing of substances for their effects by administering them to human or animal subjects be conducted under the direction of a qualified Scientific Supervisor in a laboratory or equivalent research facility and approved by a Scientific Review Committee. Testing people (or animals) who are already using (and not using) substances independent of the research project is acceptable. Always check the current rules before beginning any project involving human and/or animal subjects.)

When choosing your topic, you have to make sure it's something you can do. You definitely don't want to start a project and then realize at the very last minute that it's impossible for you to do. Sometimes you have to forgo doing a more advanced project in favour of a project that's within your resources. However, as you gain experience, you will have opportunities to do more advanced studies and projects.

STEP 2: FINDING A MENTOR

1. What is a mentor?

A mentor – just what do I mean by that? Well, a mentor is someone who is there to guide you throughout the science fair process and help you throughout your project. If you've done any projects when you were younger, your mentor was usually your teacher or your parents. However, a mentor can be any one of the following:

> Another student
> Teacher
> Professor
> Parent
> Industry professional

Ideally, your mentor should be someone who is experienced in your topic, although this usually depends on your project's level of difficulty.

At the very least, your mentor should be someone more knowledgeable than you in that scientific field.

2. What type of mentor do you need?

Senior high school students doing projects may need access to laboratories and certain more advanced equipment. As such, they may require an experienced mentor in that field, such as a grad student, a university professor, an industry researcher or a professional engineer.

On the other hand, students in Grades 7 and 8 don't usually require the use of a laboratory or access to advanced equipment. That means that high school students, who have a greater understanding of mathematics, physics, chemistry or biology, and may be more experienced with projects, can be great mentors for these younger students. Even if they don't already know the specific area you are working in, they may be able to explain the more difficult aspects of it to you. In Grades 7 and 8, your science teacher, or a high school science teacher, will often be a suitable mentor.

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There are Grade 7 and 8 students who choose to do more advanced projects – and that's great! But I must warn you that as you progress up the ladder, finding a mentor can become increasingly difficult. It's probably worth the search, though!

Before I go on, I want to mention the most important point about having a mentor: Your mentor should never be doing the project! Always remember that this is your project. Your mentor is merely there to guide you through the process.

3. Getting a Mentor

Some of you may be pursuing a project that requires knowledge or equipment that goes beyond the regular knowledge of a student your age. There's nothing wrong with being ambitious, but there's no guarantee you'll be able to do this! In fact, you may find that you have to pick a less complex topic to make use of the resources you have at hand. But don't be discouraged – there will be opportunities to pursue such projects. What you need first, however, is experience! Let me give you an example.

As I mentioned, one of the reasons I couldn't do my project on the effects of nicotine on Tourette's syndrome was the lack of resources (laboratory access, medical supervision, etc.). However, another key reason was that I couldn't find a mentor. I was mainly looking for a professor or a medical researcher, but finding one wasn't that easy.

Oh, sure, I could find them. But finding them is different from convincing them to take you on as a mentee. I remember emailing anyone and everyone I knew from universities, asking them if they knew any professor who would be willing to take me on. I got apologies from all of them, saying they couldn't find anyone for me.

But let's be honest. Imagine you were a university professor. Would you really take just anyone on – especially a student in Grade 9? For all you know, you could be wasting your time! I think that's how a lot of potential mentors feel. It's important to to understand that these are serious researchers. If you really want to catch their eye, you need to stand out somehow.

So I didn't really have a mentor while I did my project on memory. However, as it turned out, one of my judges at the regional fair was a university professor – in fact, she was one of the heads of neuroscience. She told me she was really impressed with my project, even thinking I was a senior. I was excited, so I took her name, just in case I decided to ask her anything.

When the regional fair was long over, I looked her up on the university website and found her email. I emailed her, reminding her that I was one of the students she judged at the science fair, and letting her know that I'd always wanted to do a more in-depth project in a university lab. And I asked her if she would be willing to mentor me or if she knew anyone else who would. Also (and this could be key), I emailed her my résumé – or curriculum vitae (c.v.), as it's known in scientific circles.

The response I got was amazing!

After being turned down so many times, I never expected her to say yes. But she did! And as it turns out, she had actually mentored a student in a science fair project before. From this experience, I learned two important things:

1. Just ask: It sounds simple, but sometimes it's very hard to do. Had I not sent that email, I would never have gotten the reply of a lifetime. Asking doesn't hurt!
2. Give your curriculum vitae: I only sent my c.v. along with the email because my dad suggested it. He said, "Always try to put your best foot forward," and he was right! If your c.v. is impressive, it gives the mentor more of a reason to take you on as a mentee. Now that I think of it, I highly doubt she would have said yes had she not read my c.v.

NOTE: If you are particularly interested in mentorship, and would like to know more details regarding the role of a mentor and how to connect with one, please see the SMARTS mentorship guide, "The SMARTS Guide to Mentorship: An Introduction to Mentorship Mechanics"

Furthermore, if you would like a high school mentor who has experience in the Canada-Wide Science Fair and/or Intel International Science & Engineering Fair, feel free to connect with one of our SMARTS "Science Fair Experts" at:

www.ysf.ca/ProjectHelp/SMARTS/support/askanexpert.aspx

STEP 3: DOING RESEARCH

1. Types of Resources

For a lot of people, research is one of the most boring parts of any project. One of the advantages of doing a science fair project is that the research should focus on a topic that you genuinely like. However, it's not unusual for students to start researching a topic they like, only to realize that they really don't like it after all. And that's okay! Doing a science fair project that you enjoy is the number-one priority. If you feel that you need to change your topic, then go right ahead.

However, keep in mind that it's not a good idea to change topics too often. Remember, the more times you change your topic, the less time you have to do a good project.

At this point you may only have your general topic (e.g., memory) or you could already have your finalized topic (e.g., the effects of caffeine and sugar on memory in teenagers). In either case, you still need to conduct research. Generally, you'll get your information from these main sources:

> Books
> Magazines
> Newspapers
> Scientific journals
> Internet
> People

Books are pretty self-explanatory. Yes, they are good resources, but books from the library are generally only good for background information. The problem with books from the local library is that the information is unlikely to be advanced and/or recent. However, if you have access to a better library (such as a university library), the books there could be really valuable in your research.

Magazines and newspapers are especially important since they keep you up to date on the latest advancements in your field of interest. This lets you know whether your project is relevant to the type of research occurring right now.

Scientific journals contain research papers written by university professors, students and researchers. You might need an adult or mentor to help you understand the more scientific language.

The Internet is a great resource because it often gives you access to the same information found in books, magazines, newspapers and journals! However, keep in mind that not all information that you find on the Internet may be accurate, current or even true.

And now we come to people. The funny thing about people is that they are probably the most useful source of information, yet they are probably the least used. You can not only learn things from others, but they can help you gain access to things that could help advance

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your project. Remember, people mean connections. And although contacting people may seem like the most nerve-racking thing in the world, it can also be the most rewarding! In fact, for some of you, you may require people in doing your project. (More on this later.)

You're probably thinking, how much research?

Well, to be perfectly honest, there is no straight answer. I can't say five pages of notes, or 1,000 pages of notes. In fact, research does not necessarily mean taking notes at all. It means reading and understanding work done by other people, and using relevant information drawn from it to advance your project.

So, truthfully, the amount of research you need to do varies from project to project. Most important of all, remember that research is a continuous thing. Before, during and after your study/experiment, you will probably still be doing research. Whether it is comparing your findings to similar studies, or trying to explain some unknown phenomenon you came across in your work, you should and probably still will do research. Research never really ends!

2. Good Research Leads to a Good Topic

As I said before, what you find in your research can completely change the topic you originally had in mind. You may find out that you don't like, for example, the study of memory in the first place. Or you may learn that your original topic is too hard to study, or that there's nothing you can really study about it. When this happens, you may need to change your topic or the focus of your topic. I'll give you an example.

Originally, I started out with the topic of memory. I didn't really know what I was looking for, so I started looking for any information that had to do with improving or worsening memory. Perhaps I could find a substance that could help improve memory, or discover a cause for memory loss with age. Who knows?

Then I started finding papers that talked about how the consumption of caffeine and sugar seemed to improve memory in seniors. And I began to wonder if this same effect could be found in teens. And would this differ by gender? Age? And by how much? As you can see, it wasn't until after doing lots of research that I figured out the focus for my project.

So don't worry if you don't know exactly what you want to study right away. Just continue researching, and when something sparks your interest, keep on going! Once you find something you like, start reading past research papers and begin asking yourself questions like, What if I changed this…, or if I did this instead… or if I combined these things…? Questions like these can lead to an original and innovative topic. Remember, you're not trying to copy a past study – you're trying to modify it to find out something different.

STEP 4: PICKING YOUR PROJECT TYPE

Okay, so now you know your topic. But what kind of project will you be doing? The three main types of science fair projects are:

1. Experiments

This is probably the most common type of project in the Life Science, Health Sciences and Physical Sciences divisions. Technically speaking, an experiment should include an original scientific experiment, with a specific, original hypothesis. All important variables should be controlled, and you should show a logical and systematic approach to collecting your data and a clear analysis of your results. In this type of project, the experimental design is more important than the results.

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2. Studies

Studies are probably the least common type of project. They involve the collection or use of data for personal analysis, in order to reveal a pattern, correlation or discovery. The data may be collected from outside sources, other than the student. Studies include cause-and-effect relationships and theoretical investigations of the given data. In studies, the data must have been collected with sound techniques, and the analysis must be especially profound and insightful. Many studies are carried out using surveys given to human subjects.

3. Innovations

Innovations are fairly common. They generally deal with the creation and development of new devices, models or techniques in technological fields. Usually, an original device is constructed or designed that has commercial applications or is beneficial to humans.

It's also important to note that you don't necessarily just pick one. Projects can include elements of all three types of projects. No type of project is better than the other, and every type has equal chances of winning awards at the science fair.

STEP 5: RESEARCH OBJECTIVE / PURPOSE

> Why are you doing this project?
> What do you hope to find?
> What is the importance of your results to society?

These are questions you should always be asking yourself as you conduct your science fair project. Before you even begin designing your experiment or study, you should have an idea of what you're trying to find – your research objective or purpose. I'll give you an example with my project.

As you already know, my general topic was on memory, and my specific topic was the effects of caffeine and sugar on memory in teenagers. But what exactly did I want to find? Perhaps whether caffeine and sugar affected adolescents differently in males and females? Or maybe whether different types of memory (e.g., word recall, visual recall and acoustic recall) are affected differently by caffeine and sugar?

After thinking about these types of questions, I came up with my purpose:
The purpose of this study is to investigate the effects of caffeine and sugar on the short-term memory of teenagers. The effects of caffeine and sugar on short-term memory in a particular gender or age group will also be analyzed. In this study, three methods of storing data in short-term memory are examined. Thus, it will be determined how caffeine and sugar affects each of these types of data storage methods for short-term memory. The results found could shed some light on whether the consumption of caffeine and sugar by teenagers is actually improving or worsening their ability to retain information in short-term memory. Furthermore, the results could influence a teenager's choice to consume caffeine and/or sugar in the future.

Remember, your purpose dictates what you hope to find. Don't be discouraged if you're unable to find the answers to all of your questions by the end of your project! Because, remember, the design of the project/study is much more important than the results!

For projects that are innovations – for example, the construction of a device – the purpose of the project would outline what the device would be able to do.

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STEP 6: HYPOTHESIS

Once you know what you want to find out, you have to go about making a prediction – an educated guess – a hypothesis. Based on past research, you are making on assumption about what you believe should happen. Then you conduct your study or experiment and see if you're right. Here was the hypothesis for my project:

> The consumption of caffeine or sugar individually will improve a teenager's ability to retain information in short-term memory. The consumption of caffeine and sugar in combination will improve a teenager's short-term memory more than the consumption of either of the two substances individually. Caffeine will be more effective in improving short-term memory in female teens than male teens. The effects of glucose on short-term memory will be more beneficial in male teens than female teens. The effects of caffeine, sugar or caffeine and sugar combined on short-term memory in teenagers will not differ by age.

Although it's not clear from my hypothesis, in a background section before this paragraph, I explained the results of previous, similar studies done on older adults. Based on those results, I made predictions about how the consumption of caffeine and sugar would affect the memories of adolescents.

STEP 7: EXPERIMENTAL DESIGN

This is perhaps the most important and difficult part of doing a science fair project. In the experimental design, you outline the procedures and process you will undertake to obtain results, collect data or create your innovation. Regardless of the results, the experimental design is viewed as the most important aspect of your project.

Is it original? Innovative? Scientifically sound?

No matter what type of project, all experimental designs should keep the following elements in mind:

1. Materials

What will you need to do your project? People? Animals? Lab equipment? Tools? When you design your experiment, make sure you know all the materials you'll need. Obviously, without the right and necessary materials, you cannot carry out your project. Furthermore, it's important to document how much of each material you need (for your report).

It is also vital that you know why you used the amounts that you have. For example, amounts used in my project last year were based on previous studies. It doesn't make sense for you to simply choose random numbers for amounts – there need to be reasons.

2. Variables

Often, you may end up doing a cause-and-effect experiment. In a cause-and-effect experiment, you develop an experiment in which you expect that a change in one variable will cause a change in another. In this instance, the variable that you change is called the independent variable (cause). Usually there is just one independent variable at a time.

The variable that changes in response to the independent variable is called the dependent variable (effect) because its result depends on the first variable. For example, when you go out for a run, the distance you run (dependent variable) depends on how long you run for (independent variable).

There is also a third type of variable: controlled or constant variables. These are the variables or quantities that you want to keep constant while you watch the changes in the other variables. For example, in the above scenario, the size of the person running is a controlled variable. Clearly, if we change both the size of the person and the time the person runs at the same time, we cannot make a clear determination how much of a factor each variable is on the total distance to be run. As a result, each variable should be observed individually.

Some examples of important variables that often should be kept constant can include (but are not limited to) time of day, temperature of the environment, etc.

3. Procedure

Procedure, methods or methodology – whatever you like to call it. This is one of the most important parts of your experimental design (and probably the most difficult since it really depends on each individual project). Here is where you actually develop the steps required to carry out the experiment. Feel free to look at past studies and experiments to see how certain aspects or variables can be tested, but keep in mind that you're doing a completely different project!

Once you've finished your procedure, you have also finished designing your experiment. At this point, it's time to move on and actually conduct your experiment.

Don't worry if you're still a bit confused at this point. The report for my science fair project is on the website, so you can refer to it to clear up any confusion.

STEP 8. CONDUCTING THE EXPERIMENT

This is where the paperwork ends and the hands-on activities begin. At this point, you actually conduct your experiment or study, or develop your innovation. While you're doing this, you should keep several things in mind:

1. Keep a Journal

This is not mandatory (except for the Intel International Science & Engineering Fair), but it is highly recommended. Keeping a journal of your experimental process allows you to record your thoughts and observations, so that you don't forget anything later on when you're doing your analysis or writing up your report.

2. Develop an Ongoing Database of Results

A very important and efficient method of organizing the results of your experiment is to enter them into a database or spreadsheet as you gather more and more information. Personally, I prefer using Microsoft Excel since it's great for sorting information, allows you to do calculations and prepares your data for future statistical analysis.

3. Take Photographs

Taking photographs is almost always necessary if you're doing some type of lab work. If the chemicals or specimens you use are considered hazardous, you will not be allowed to display them at the actual science fair. In that case, it's imperative that you have photographs to show the judges your procedures and the materials you used. Countless times students have had their display materials removed because they were a safety hazard You don't want this happening to you! So make sure you take photographs of everything!

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4. Don't Forge Your Results

At some point, you may be tempted to forge your results, so that they fit your hypothesis. Besides the fact that this is unethical, remember that your experimental design is much more important than your results, so there is never any need to tamper with your results.

STEP 9. STATISTICAL & DATA ANALYSIS

For experiments with numerical data, statistical analysis is an extremely important component. In fact, according to the Canada-Wide Science Fair judging sheets, top experimental or study projects should include some form of statistical analysis. In general, statistical analysis consists of examining the data, looking for patterns and drawing conclusions, though there are specific mathematical ways to do this.

The most basic forms of data analysis are bar or line graphs, in which you plot values for a dependent and independent variable to visualize your results. However, this type of analysis can only tell you so much. If you want to be successful in science fair competitions, you'll need to learn a little bit about statistics—mathematical tests that tell you how confident you can be that your results support your hypothesis. In other words, whether your results are significant or not.

Statistical tests that work for many projects include the T test and Chi-Square test. The math involved isn't difficult, so don't be scared off, but you will encounter some new terms and Greek-letter symbols (e.g., summation, standard deviation, standard error) that may look confusing at first.

Most importantly, check with someone who is knowledgeable about statistics to be sure that you select a technique that is appropriate for your type of data. The best time to do this is while you're designing your experiment. Knowing the formula for testing the significance of your data will tell you what data you need to collect.

STEP 10. DISCUSSION

The discussion portion of the science fair project is where you not only state the results you found but explain your observations and analysis. In short, this is your interpretation of your data and results – so think creatively!

Do you see any patterns? Why did a certain event occur? If you don't know, why do you think it happened? Did you find anything interesting and exciting? These are important questions you need to address when doing your discussion. Your discussion should also compare your results with those found by other scientists and researchers in similar studies.

Are your results similar? Why or why not? When drawing patterns from your results, it's also a great idea to propose theories that you can test in the future. Judges want to hear that you are interested in continuing your research, and that you already have something planned for the future.

STEP 11. CONCLUSION

What can you conclude about your topic? Did your results match your hypothesis? Why or why not? Generally, the conclusion is short and simple: a clear statement of what you found in your study, experiment or innovation. Most of the original and creative thought should have been included in the discussion portion of the project.

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STEP 12. WRITTEN REPORT

Whatever the length of your written report (at the Canada-Wide Science Fair or when applying for Team Canada to compete at Intel ISEF, a maximum five-page summary report is required.), it should contain the following sections:

Abstract

The abstract is a brief overview of your project, no longer than 50 words (except at the Intel International Science & Engineering Fair, which has a limit of about 250 words). In the abstract, you should describe what your experiment, study or innovation was about and give a quick conclusion of what you found.

Introduction

The introduction is exactly what it says – an introduction to your project. Here you talk about why you chose the project that you did, and what the results may imply for society (you don't talk about your actual results as yet).

Background

The background consists of the important information you found in your research. Usually, the background will contain a lot of facts and material from your sources. Remember to clearly cite anything that you found in another source, including quotes, statistics and results from previous experiments and studies. The information here should be relevant and important, and lead up to the purpose of your experiment.

Purpose

In the purpose, talk about what exactly you hoped to find – specifics. The purpose is generally no longer than a paragraph. Go back to Step 5 for a more detailed description of the purpose.

Hypothesis

In the hypothesis you are making an educated guess about what you believed would happen. This is generally based on your research, including previous studies. Usually, you try to predict results that answer the questions in your purpose. This is also usually no longer than a paragraph or two. Go back to Step 6 for a more detailed description of the hypothesis.

Methodology

In the methodology, state the materials and methods you used to conduct your project. State exactly how you conducted your experiment. For an innovation, describe how you designed and built your device.

Results

The results are basically the statistical data or observations drawn from your experiment. This section will generally contain graphs, charts and other forms of display data analysis. Raw data are not usually included.

Discussion

After the design of the experiment, this is perhaps the most important part of the report. The discussion section gives your interpretation of the data, including comparisons with previous studies.

Conclusion

In your conclusion, relate your findings to your hypothesis. Was your hypothesis correct? Why or why not? Also, how do your conclusions affect society? The conclusion is usually no longer than two paragraphs.

Future Directions / Improvements

Your findings in your science fair project may further drench you in curiosity. If that's the case, this is the section to talk about how you could possibly continue your project and in which direction you would go. This is also the section to talk about possible sources of error in your project, and how you could improve the experimental design or data collection to do a more accurate study or experiment. For innovations, talk about methods of improving your product.

Acknowledgements

Remember all the people who helped you throughout your project? They could have been parents, friends, family, teachers – anyone! This is where you thank them for their help and support.

References

You've undoubtedly done a lot of research during your project. You should have also used many citations within your report. Here is where you list your citations and other references you used throughout your project – a bibliography, if you will.

But remember, this is just a guide! I've given you the main sections of the written report for a science fair project. The majority of these sections are mandatory or expected. However, you may choose to add your own sections or change things around. For example, in my report, I included a section called "Statistical Analysis," where I detailed the statistical analysis I conducted on my data collection. Customize your report to fit your project.

Don't worry if you still don't understand how the entire report is put together. On the website, we have posted a handful of reports that have been presented at science fairs.

STEP 13. THE DISPLAY

Your display is an extremely important aspect of your science fair project. Why? Because as judges approach your project, or guests walk past, your display is the first thing they see. As such, you want your display not only to highlight important and relevant information, but to make an impact on your audience.

1. Display Size

Check with your Regional Science Fair for your specific display size restrictions. Generally, your exhibit will be prepared on a table (although the floor is sometimes used in exceptional cases).

If you make it to the Canada-Wide Science Fair, your display (backboards, title boards, presentation and prop material and all display equipment) must be no more than 1.2 m wide, 0.8 m deep and 3.5 m high from the floor.

2. The Science Board

The science board is one of the most typical aspects of a science fair display, and also one of the most important. There are many different sizes of science boards, most of which you can usually find in local materials stores. At the science fair, you'll see boards ranging from 1 metre to 2 metres high! Really, the size of your science board should reflect how much important information you believe should be shown on your board. If you don't need a really big board, then don't use one – your board should never have big, empty spaces. A bigger board does not mean a better project! However, if you do need a larger board but can't find one, you can always attach two boards together or build your own. Make sure you read the rules on science boards for your regional fair.

Your science board should highlight all key components of your project – meaning all of the main parts of the scientific process, including purpose, hypothesis, materials, methodology, results, discussion, conclusion, etc. However, keep in mind that the information on the science board should only be a summary of the information found in your more detailed written report. Only put the important points of each section on your science board!

Although there is no set standard for where different sections should be on the science board, typically, they are shown in logical order. For example, because we read English from left to right, it makes sense for the introduction and background to be shown on the left flap of the science board. The middle section usually contains the purpose, hypothesis, methodology and results. And the right flap usually contains the discussion and conclusion. At the same time, this also depends on how long each of your sections is. You may not be able to fit all of the purpose, hypothesis, methodology and results on one board, or in the opposite case, your introduction and background may only take up half of your left flap. The best way to figure this out is to space out your information equally, but still in a logical order.

The main title of your project is usually put on the middle section of your science board, on top of the middle section, or strung across the entire display. While this is really up to you, make sure your title not only stands out but is centred so it's easily identifiable on your project. Your title should be easy to read from at least 5 metres away.

Also, because your science board is your major visual aid, it should always include your graphs, diagrams, photographs and other visuals. This is also important since you'll be referring to your science board when presenting to your judges, and pointing to visuals on your science board is much more convenient and efficient than having to flip through your written report.

The colours you use on your science board are also extremely important! Remember that you're being judged not only on the content of your science board, but also on its aesthetics – or the way it looks. Because of this, you want to use two or three main colours that contrast well and look good together. For example, I used black, neon green and neon yellow, since green and yellow went well together and contrasted well with the black background.

Lastly, make sure that you use a larger-than-normal font size for the information on your science board! You don't want your judges straining their eyes. So for all you lovers of 10- or 12-point fonts, sorry, but this is definitely not the place for it! I would suggest at least a 16-point font.

3. The Table

Your science board will undoubtedly be propped up on some sort of table. But you're not only going to have your science board, right? For sure, you'll have your written report laid out on your table. If you have developed any other written material, also display that on the table. It's also a good idea to have all your research in a binder on the table, in case your judges want to see the depth of the research you've done.

You should put any models you've created or have for display on the table as well, along with small tent cards that describe the models. The table is also a good place for displaying flat materials, such as photographs.

Still confused? Don't worry! On the website you'll find an assortment of pictures of science displays from past winners at both the local and national level. You can use these pictures as a guide to look for elements that make a science display successful.

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For more detailed information on the rules and regulations of your project display for the Canada-Wide Science Fair, please read these official documents from Youth Science Foundation Canada:

> CWSF Display Safety: www.ysf.ca/files/PDF/cwsf/7-Display-E.pdf
> CWSF Project Displays: www.ysf-fsj.ca/files/PDF/governance/policy/3.1.2.5_Project_Displays.pdf

STEP 14. THE PRESENTATION

At your Regional Science Fair, you'll be given a certain amount of time to present your project. Each Regional Fair has its own rules, but the time given usually ranges from 10 to 30 minutes. Check with your Region to be sure. At the Regional Fair, you will normally be seen individually by two or three judges. The judges may range from teachers and university students to professors and industry professionals.

The presentation is a huge part of how you are judged. Much of the information the judges obtain about your project will come from what you say to them. Communication is an extremely important aspect of all scientific work, so if you present poorly, your project will likely score poorly. Most importantly, the presentation tells the judges whether you actually understand the science behind your project, and how much of it you actually did yourself.

How well you convey your project through speech will often determine whether or not you will move on to the next round of the science fair.

What does this mean? It means that your project doesn't necessarily have to be better than that of the next participant. If you're able to convey your project more confidently and clearly than your fellow participants, you have a huge edge. I mean, think about it. If a participant has trouble explaining his or her project to the judge, the judge might think that the participant doesn't really understand the project, and maybe didn't even do it. Trust me, you don't want something like that happening to you!

In this section, you'll learn to develop your public speaking skills, speak with confidence and convince the judges you should be picked to move on. Public speaking is a powerful tool that you can use to your advantage. When you're speaking, you want your judge to be inspired by what you say, to believe your study is important to society. Often, how you speak is more important than the words you say.

There are several key components to making a successful presentation speech:

Presentation Content
By the time you're ready for the science fair, you should know your project inside out. So much so that your head contains all the material you learned or developed through your project.

What do I mean by this? Simply put, if I asked you to tell me about your project right now, you'd be able to do so without any preparation or thinking whatsoever. I suggest you get to that level of knowledge and understanding of your project before moving on.

Once you're at that level, the next step is organizing what you should say, and when you should say it. The easiest and most effective way, I believe, is to simply explain your project straight from your introduction, all the way to your conclusion. This way you can keep yourself on track and can easily move from one topic to the next. If you've developed your science board with the different sections in a logical order, then you can also use your board to keep you on track.

For some Regional Science Fairs, you'll have only 7 to 10 minutes to present. That's not much time! Make sure you use your time well, by focusing on the parts that will make you stand out (e.g., your experimental methods, analysis and interpretation of data). So when you practise your presentation, make sure to keep it to about 7 to 10 minutes. Depending on your judge, they may or may not stop you if you go over the allotted time.

Another big tip: DON'T READ (OR SOUND LIKE A RECORDED MESSAGE)!
Chances are, if you read off a sheet for your presentation, you will get very low marks. Why? Simply because if you need to read your material, judges will assume that you either didn't do the project yourself or that you don't have a good grasp of what you did. You may be tempted to memorize your whole presentation, but if you sound like you're playing back a recorded message, it probably won't work.

Most judges have a background in science but will not be an expert in the specific area you've investigated. Focus on telling the story of your project – how you came to choose the topic, why it's important, what you did to address the question or problem and what you found out. It's often best to save most of the technical details for the questions after the presentation, when you'll be able to tell from the questions what level of detail is appropriate.

Should I create a PowerPoint presentation?
I'm asked this quite a bit, and I even asked this myself when I was preparing for my first science fair. The short answer is: only if it makes your presentation better. Simply put, don't make a PowerPoint presentation just because you think it will be impressive. If you believe you need additional visuals to help you explain your project (i.e., visuals that aren't already on your board), then by all means, use it!

But remember that a PowerPoint presentation could actually make your project worse. For instance, do you really want your judge looking at a screen instead of at you? And what will you do when the laptop hangs or crashes? The best advice: Use PowerPoint at your own discretion, but don't rely on it.

Public Speaking

1. Eye Contact You want your judges to know that you're speaking to them! It's sometimes tempting to look down or up while you speak – but it's a habit you definitely need to break. Why should the judges listen to you if you aren't even looking at them when you speak? By creating eye contact with the judges, you're letting them know that you want them to hear what you have to say – that you care what they think about your project. Also, keeping your eyes on your judges allows you to watch their reactions.

Are they interested? Or are they bored? Do they understand what you're saying?

By reading their gestures and their facial expressions, you can adjust your presentation accordingly. If they look confused, try explaining things in a more in-depth manner. If they look uninterested, try speaking with more passion about what you're saying – something that will catch their attention. Once they get back to hanging on to your every word, you'll feel more confident and comfortable speaking to them.

2. Good Voice I've learned that often what influences people is not what you say, but rather how you say it. Even if you speak clearly and confidently about your project, speaking with a monotonous voice can be rather boring for your audience. Let your enthusiasm and passion for your topic shine through! Be expressive, and make sure you pronounce your words correctly – you want your message to be clear.

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If you get rattled for a second, go ahead – take a pause. Pausing gives you time to collect your thoughts and ideas. It's better to stop and think than to babble and dig yourself into a hole.

Also, remember, if you're going too fast – slow down! Sometimes when you're in front of an audience (let alone a judge), you can get nervous and speak too fast. Try not to think of judging as an evaluation, but rather, simply as a chance to share a project with a friend. Once you get comfortable speaking with adults, you'll be able to speak more confidently.

3. Gestures and Movements Gestures are physical movements you make to help you express what you're trying to say. If you're not natural with gestures, develop them ahead of time and put them in your presentation accordingly. This might seem "scripted" at first, but over time, they'll become natural to you. Several ways to better develop your gestures and movements are to watch experienced public speakers and then start doing some impromptu speeches to a wall or a mirror, using whatever gestures come to you naturally.

Also, make sure to point to the visuals on your display when necessary. Your science board and models are there for a reason. Use them!

4. How to Stand Another key point in public speaking is the way you stand. Stand with your feet about shoulder width apart, back straight, and chest up. This posture shows confidence. Keep your hands clasped together near your waist when you're not speaking. Never, ever chew gum during judging.

Also, never, ever put your hands in your pockets! It's also a bad idea to lean against your chair or table. You want to look professional throughout the judging process. You need to look ready to speak and engage your audience.

Practice! Practice! Practice!

In spite of how well you know your project, it is imperative that you practise your presentation. A good idea is to begin by practising it on your own. Then deliver it to family and friends. It's natural to get nervous when speaking in front of other people, so don't be discouraged if you mess up the first time you speak in front of your folks. With time and practice, you'll improve. Afterwards, try practising your presentation in front of your mentors and teachers, who may be more critical of it – which is a good thing!

In fact, encourage your audience to be critical of your project. Tell them to ask questions or point out things that confuse them. You might be hurt by some comments, but take them as constructive criticism, because only then can you truly improve your project. Furthermore, your judges will be very critical of your work, so having your family, friends, teachers and mentors be critical and questioning of your work actually prepares you for judging in a setting where it doesn't actually count.

I found that my judges asked many of the questions my own family and friends asked. As a result, I was already prepared to defend my project and answer their questions. Practice pays!

STEP 15. THE JUDGING PROCESS

It's probably clear that how the judges mark your project determines whether or not you will move on to the next round of the science fair. So I'm guessing you'd like to know how they mark, right?

Your Regional Science Fair will have its own specific marking format. If possible, you should try to obtain a copy of the judging form to see what types of things your Regional Science

Fair cares more about. For example, some Regional Science Fairs may care more about your presentation and ability to speak than others, giving your presentation a higher weight. Whatever the case, it's up to you to find out.

Most science fairs have similar marking sheets, so we can still analyze a judging form. To be objective and use a standard, let's take a look at the Canada-Wide Science Fair judging form.

The five main parts of the Canada-Wide Science Fair judging form

Part A: Scientific Thought (45 marks) In this section, judges are looking at the scientific thought behind your project. As you can see, each type of project (experiment, innovation or study) has its own marking levels for Scientific Thought. Is the science in your project logical, accurate and feasible? Does it make sense? It's clear from the judging form that replicating existing projects garners lower marks, while higher marks are given to original experiments, studies and innovations.

Part B: Original Creativity (25 marks) You will also be scored for creativity. Here, the judges are looking for whether you used a novel approach and tapped into your imagination.

Judges want to see that you are scientifically skilled, knowledgeable AND imaginative, because it takes all of these characteristics together for science to truly advance.

Part C: Visual Display (8 marks) In this section, you are judged on both the content of your board and its aesthetics. Five of the eight marks are for whether your display is logical and easy to read. This also includes the legibility of your text, neatness and order of your display content.

The other three marks are for how much attention the display draws (which is why attributes such as colour are important) and the structure and neatness of your display.

Don't be worried if your display isn't the best or coolest looking. Judges tend to not care about aesthetics as much, and make their decision far more heavily on the previous sections. Remember, the judges aren't there to grade you as an artist.

Part D: Oral Presentation (8 marks) This is where you are marked on how well you speak, answer questions and explain various aspects of your project. The mark value may seem low, but remember that much of Parts A and B (worth 70 marks) is conveyed through your oral presentation.

Part E: Five-Page Report & Project Log (14 marks) At the Canada-Wide Science Fair, you're required to submit a five-page summary report of your project that your judges read in advance of meeting you and seeing your project. Here the judges are looking at your ability to communicate your work in written form and your ability to be concise. They also use the report to formulate their questions and to determine whether they need to do any background reading on your topic before judging day.

Once again, keep in mind that the judging format varies from region to region. Check with your Regional Science Fair to see what you will be judged on.

Answering the Judge's Questions

As I stated in the previous section on the presentation, you'll be given about 7 to 10 minutes to talk about your project, from hypothesis to conclusion. However, throughout your presentation, be prepared to be interrupted by questions from the judges. These questions are one way you can get into trouble if you've memorized your full presentation.

What types of questions will the judges ask?

Well, for one, definitely not comprehension questions. What do I mean by this? Well, your judges won't ask what materials you used, since this information is already on your board. What judges generally do is try to find error or potential fault in the scientific thought of your project. It's then your job to explain this error or fault.

For example, in my project, I selected students as subjects who drank soft drinks with and without caffeine..One of my judges asked me, "Why didn't you administer caffeine on its own? Wouldn't that have ruled out the possibility that caffeine could chemically react with some substances in the soft drink to create a certain effect?" As you can see, the judge tried to trap me – and was right to do so.

So I answered, "I actually wanted to administer caffeine on its own to my subjects. However, the rules for the use of human subjects in science projects prevented me from doing so, so I used whatever resources were available to me." As you can see, I had a logical answer to the question. That's exactly what you should do when confronted by "trap" questions. However, there may be times in which you realize that the judge has a valid point, and that you should have done exactly what he or she is suggesting. In this case, tell the judge just that – you never thought about that idea, but you agree that it is a good one. Explain also why you believe it would be a good idea, to show that you understand the research behind your project.

Sometimes your judge may ask you questions that you just don't have an answer for. I remember being asked, "Isn't there aspartame in diet cola? How would that affect memory as opposed to sugar?" In all honesty, I completely forgot about aspartame (which is a sugar substitute). In this case, tell the truth – that you don't know the answer. There's no point in making something up, because the judges aren't stupid and may know the answer themselves. Remember to answer confidently and clearly, and show that you believe what you're saying. You definitely don't want to sound unsure of yourself.

STEP 16. REGISTERING FOR THE REGIONAL SCIENCE FAIR

Of course, before you can even set foot into a Regional Science Fair, you must first register for it. How this happens depends on your school and your region. Generally, your school will be in the vicinity of, and thus associated with, a Regional Science Fair. Go to this web page to locate your nearest Regional Science Fair if you don't know what it is already: www.ysf.ca/Fair

Locate your Regional Science Fair from that web page. Many Regional Science Fairs have their own websites, with loads of information. Read these pages thoroughly.

Depending on your Regional Science Fair, your school may have a limit on the number of students and projects they can send to the fair – so check with your school and Regional Science Fair to see what this quota is. As a result, some schools run a school fair to determine their top projects and then send those projects on to compete at the Regional Science Fair. However, if your school does not have many science fair hopefuls, you may receive an automatic spot to represent your school at the Regional Science Fair.

So check with your school and Regional Science Fair to see what process is required to compete at the Regional Science Fair.

The following two sections give you advice on preparing for the day of the Regional Science Fair, although the tips provided would also apply to competing at your school's science fair (if you have one).

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STEP 17. THE NIGHT BEFORE THE REGIONAL SCIENCE FAIR

Before we even talk about the day of the Regional Science Fair, we need to talk about what happens the night before. You do not want to be doing any last-minute work on the day of the fair, since they usually happen first thing in the morning. On the night before the fair, you should do the following things:

1. Check to make sure that your written report is printed and put together in a respectable manner (for instance, in a duotang or binder).
2. Make sure your entire display is finished, including the science board. You may need to wrap your board in something like a garbage bag to protect it from rain.
3. Bring glue, tape, scissors and whatever equipment you might need to fix your display during the day.
4. Bring a bottle of water to keep your throat fresh during the day of the fair.
5. Check to ensure that everything you need for the fair is packed and ready to go.
6. Be sure to bring a pen or pencil and paper with you to jot down notes. Trust me, this comes in handy!
7. Bring a book, or something to amuse yourself while waiting to be judged – or for after judging. (If your judging is done early, you may still have to wait at the fair before lunch. It could get boring.)
8. Make sure that you have the directions to the site of the fair and the schedule for the day. (You should have received the schedule from your local science fair organizers or downloaded it from their website.)
9. Ensure that you have completed all the required registration forms, because if you haven't, you won't be allowed to participate in the fair. What a bummer that would be!
10. And last, but not least – get a good night's sleep!

STEP 18. THE DAY OF THE REGIONAL SCIENCE FAIR

Hopefully you've had a good deal of sleep and weren't twisting and turning, worrying about the Regional Science Fair! Make sure to have a good breakfast, because the day will be long, and you might not get lunch until 12:30 or 1:00. Depending on the schedule, you might not have time to buy your lunch, so you may want to pack one just in case. Brush your teeth well, and maybe even take a breath mint – who knows, your judges could be disgusted by your breath (you want to be safe)! Although this really isn't mandatory, I highly suggest that you dress in something more formal (e.g., a suit and tie for guys). This shows your judges that you are mature and serious about your work. Lay off the cologne – remember that your judge's noses may be sensitive, and you don't want to do anything that could give a bad first impression.

Leave early! This is important. You could get stuck in traffic on the way. Also, the later you arrive, the longer the line for registration. Getting to the fair early gives you more time to get acquainted with the environment (e.g., where the washrooms are).

Each Regional Science Fair has its own specific schedule. However, most of them have a similar format. Here's a typical schedule for a one-day Regional Science Fair:

8:30–9:30 AM:
Exhibitors arrive, register and set up their projects. Judges arrive, are welcomed and are briefed. Judges will not be looking at projects before 9:30 AM.

This is when you register and set up your project. Remember, come early so you have more time to set up and get used to the environment. Use this time to make any last-minute fix-ups to your display.

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I would also suggest making friends with the participants surrounding you. They may be your competitors, but they are still participants like you. Trust me, just introduce yourself, and you'll be glad to have someone to talk to when you're bored! Also feel free to walk around and check out other participants' projects.

Make sure that your parents leave the science fair or stay within a designated parents'/visitors' zone until lunch or the afternoon. Parents aren't usually allowed to walk around the exhibits during the judging.

9:30–10:00 AM:
Welcome Assembly for exhibitors. Judges examine projects without students present.

At this time, you'll be taken from the science fair to a separate room. Here you'll receive a short presentation about the science fair by one of the organizers and told about the day's schedule. Ask any last-minute questions.

This is also the time when safety inspections occur. The inspectors will remove anything that is not permitted, so make sure you read the rules on the website and only bring what is safe. Having one of your models removed might jeopardize your presentation and catch you off-guard.

10:00 AM–12:00 PM:
Judges interview exhibitors. Exhibitors remain at their projects.

This is your time to shine! You'll be interviewed by each judge (there are often two or three). This is basically your time to present your project and answer any questions the judges have. You don't know when your judges will come, so always stay alert. There will be participants whose judges are scheduled early, and others whose judges are scheduled late. Anything is possible! You will normally be told to alert one of the science fair volunteers if you're missing an interview by one or more judges after a certain amount of time. However, no-shows are rare.

If there's time after your presentation, you may be able to ask your judge a question or two. This is a good time to get contacts and perhaps find a mentor, if your judge is a professor, researcher or someone who works at a university or college. The judges you meet can really help you with a future scientific endeavour.

12:00–1:00 PM:
Exhibitors eat lunch. Some judging of projects may continue during this time if necessary. Exhibitors will be told if they need to be available during this time.

At this point you'll either be eating your lunch or still waiting to be interviewed by one or more of your judges. If you're eating lunch, relax and enjoy it – the judging is over! If your judging isn't over yet, hopefully you can relax soon.

1:00–1:30 PM:
Networking, tour or other activity

This may or may not happen at your fair, as judging may continue into the afternoon. Some fairs have tours of the college or university, others have an educational or entertaining presentation and some encourage the exhibitors to use the time to find about each others' projects.

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1:30–2:30 PM:
Open House. Parents and other interested members of the public are invited to visit the fair.

At this time, the science fair will be open to parents and visitors. You will have the chance to present your project to visitors walking by your display, rather than the judges you had in the morning. Here is your time to relax and just have fun. At fairs held over several days, open house is usually in the evening.

2:00–3:00 PM:
Awards Ceremony for Grade 7–12 students. At the ceremony, the names of students who have qualified as finalists for the Canada-Wide Science Fair will be announced.

Here is the moment of truth. Did you win any awards, and more importantly, did you move on to the Canada-Wide Science Fair? If you did, great! If not, still great!

Your science fair project will have been an amazing educational experience. You will have learned so many new and important skills and, hopefully, had a lot of fun and excitement doing it.

If you're bummed about not making the next round, trust me, I know how you feel. But don't worry about it! It may be your first time, and you'll learn from this and do better next time. And who knows? Maybe you'll go on next year.

STEP 19. NEXT ROUND: THE CANADA-WIDE SCIENCE FAIR

But what if you did end up doing well at your Regional Science Fair, and you're moving on to the Canada-Wide Science Fair?

First off, congratulations! It's a tremendous accomplishment that only the top two percent of all Regional Science Fair participants in Canada achieve, so regardless of how well you do at the Canada-Wide Science Fair, you have a lot to be proud of. The Canada-Wide Science Fair is an exhibition and competition of Canada's top young scientists, and you will be one of them! You will meet almost 450 other amazing young people from every province and territory who share a similar passion for science.

Best of all, you'll get an all-expense-paid trip across the country for a week! In 2007, the Canada-Wide Science Fair will be in Truro, Nova Scotia. In 2008, the CWSF moves to Ottawa.

After competing at your Regional Science Fair, you'll have up to a month and a half to prepare for the CWSF. Whether or not you have time to expand or improve upon your project is really up to you. Here are some extra tips to help you at the CWSF:

1. Follow the Instructions of Your Regional Science Fair Committee

Listen to your Regional Science Fair Committee, since they'll be the ones helping you to register for the CWSF. Make sure you do whatever they say on time, or even better, earlier than the deadline.

2. Complete All Necessary Forms

There are several forms required for attending the CWSF, including forms for animal subjects, human subjects, etc. Please consult with your Regional Science Fair Committee and/or YSF Canada to ensure you have the correct forms filled out.

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3. Read the CWSF Participant Guide

Everything you need to know as a Canada-Wide Science Fair Participant can be found in this PDF booklet. The guide is updated every year and can be downloaded from the Documents area of the CWSF online registration system.

This document provides very important information on your five-page project report, display board safety regulations, the schedule of the week, etc. Read it thoroughly and take a copy with you to the CWSF just in case you need it!

4. Awards at the Canada-Wide Science Fair

There are many more types of awards at the Canada-Wide Science Fair than at most Regional Science Fairs. Beyond the awards available to all competitors (Medals and Grand Awards), there are also Special Awards that you must nominate your project for. Special Awards are based on criteria established by the award sponsor in consultation with YSF Canada. As Special Awards are provided by specific sponsors (e.g., Canadian Mathematical Society), your project will relate only to the work of certain sponsors and thus only to certain Special Awards.

You can only nominate yourself for up to seven Special Awards, so choose wisely and please check the criteria carefully. As an example, if you know your project has nothing to do with mathematics or statistics, please do not nominate your project for the Special Award from the Canadian Mathematical Society.

5. Judging at the Canada-Wide Science Fair

Of course, this is the part of the CWSF that excites (or horrifies!) most students. As you can imagine, judging at the Canada-Wide Science Fair is much more intense than judging at your Regional Science Fair. At the Canada-Wide Science Fair, there are two days of judging. Be sure to prepare two different presentations – a longer one for Division Awards judging and a shorter one for Special Awards judging.

Day 1: Divisional Awards Judging

A judging team is assigned a specific group of projects in the same division-category – e.g., Intermediate (Grade 9/10) Health Sciences. Five different judges evaluate each exhibit. Divisional judging is a three-step process.

First, judges read the project reports in advance and view the exhibit without the finalists being present.

In the second part of judging, finalists are interviewed at their exhibits. These interviews are the most important part of the process and approximately 20 minutes is allocated for each one. Plan to describe your project for no more than 10 minutes and be prepared for the judges to ask questions for a further 10 minutes. Trust me when I say that judges at the Canada-Wide Science Fair are much more sensitive to time than they may have been at your Regional Science Fair. If your presentation takes longer than 20 minutes and your judges have no time for questions, this could adversely affect your results.

After the finalists have left the exhibit area for the day, each judging team meets to rank the projects assigned to it. Representatives of each team within a division-category meet to select the medal recipients and honourable mentions. This step involves discussion among the judges and often requires another viewing of the projects without the finalists present.

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Day 2: Special Awards and Grand Awards Judging
Day 2 of judging can be much more tiring and stressful than Day 1, depending on how many Special Awards you nominate yourself for. Furthermore, if you are one of the top projects from Day 1, you could be a candidate for a Grand Award and have even more judging.

First, let's look at the Special Awards Judging. Special Awards judges spend approximately 10 minutes with each project (some even spend less!). Plan to tell the judge what you did and why you deserve that particular award in about five minutes, to leave some time for questions. Most Special Awards judges have a lot of projects to see, so you really need to sell yourself here. Most importantly, you need to sell how your project relates to their Special Award and that sponsor more than any other project.

The reason Day 2 of judging is more tiring than Day 1 of judging is that you will often see two or more judges for each Special Award. This means that for Special Award judging alone, if you nominate yourself for seven Special Awards, you could be seeing 14 or more judges. That is a lot!

Of course, your day could become even more tiresome (yet more exciting!) if you are a finalist for the Grand Awards. Grand Awards judging takes place at the same time as the Special Award judging.

The Grand Awards include the EnCana Platinum Awards, presented to the best Junior, Intermediate and Senior projects, as well as the EnCana Best-in-Fair Award. All gold medal-lists are automatic candidates for these awards.

6. Mentorship for Canada-Wide Science Fair Finalists
Starting in 2007, Youth Science Foundation Canada is developing a Mentorship Program that will work to connect interested Canada-Wide Science Fair finalists with a mentor who can help them take their project to a higher level. The goal of this program is to help Canada's top young scientists achieve their potential.

STEP 20. THE INTEL INTERNATIONAL SCIENCE & ENGINEERING FAIR (ISEF)

Perhaps you want to take your project beyond the national level and on to the international stage. Thanks to YSF Canada's Team Canada–ISEF program, you can do just that!

The Intel International Science and Engineering Fair (ISEF) is the world's largest pre-college/university science fair. It brings together about 1500 young scientists from more than 40 countries to share ideas, to showcase cutting-edge science and to compete for over $3 million (US) in awards and scholarships.

Applications for Team Canada–ISEF are welcomed primarily from Canada-Wide Science Fair finalists who are currently in high school. They are usually required to design and conduct a new project, adhering to a set of rules that is slightly different from those used at Canadian fairs.

Team selection is made by an expert panel in March. After that, members are coached in preparation for this prestigious international competition. Team Canada has proven quite successful, earning a disproportionate share of awards at ISEF each year.

For information on how to apply for a spot on Team Canada, please visit:
www.ysf.ca/Competitions/TeamCanada/Apply

A FINAL NOTE…

I hope that this Science Fair Guide has helped you discover, or in some cases, rediscover your love for science and technology through participation in science fairs. Regardless of your success at the fair, your achievement in conducting a novel, comprehensive project is tremendous, and I hope your scientific endeavours continue for years to come! A science fair project is just the beginning to a wonderful life filled with science.

ABOUT THE AUTHOR

This guide was prepared by **Joshua Liu**, founder of SMARTS, and a passionate proponent of project-based science. In addition to winning a Bronze Medal in the Life Sciences division at the 2005 Canada-Wide Science Fair, he has participated in the ASM Materials Camp Canada and Shad Valley. While still in high school, he was the recipient of the CIBC Young Miracle Worker Award, the Millennium National Excellence Award, the York University Murray Ross Award of Distinction and the TD Canada Trust Scholarship for Community Leadership.

Joshua intends to pursue a career in medicine, and in September 2006, he began studying Biomedical Sciences at York University in Toronto.

ABOUT SMARTS

SMARTS (Student Mentorship Association Regarding Technology and Science) is YSF's for-youth, by-youth network that connects young Canadians with science – and one another.

For more information visit www.ysf-fsj.ca/smarts

ABOUT MOTOROLA'S RAISE YOUR VOICE PROGRAM

Motorola Canada's Raise Your Voice initiative is a national philanthropy program that urges youth to ask for help when they need it. Driven by a strong belief that no one should feel alone when facing problems, Raise Your Voice aims to empower young people to speak up when they are struggling and to create communities that support youth when they do request help. Raise Your Voice partners with organizations in Canada that understand the problems young people face, and provide resources and support to help them be heard.

For more information visit www.raiseyourvoice.ca

ABOUT YSF CANADA

Since 1962, Youth Science Foundation Canada has played a vital role in nurturing the scientific impulse of our youth – encouraging them to develop scientific and technological knowledge and skills. Every year, half a million young Canadians – as many as play hockey – participate in project based science. Fired by the energy of over 8,000 volunteers: educators, scientists and parents across a network of over 100 local organizations, YSF works to capture their imaginations and broaden their access to science. Our goal is to ensure all young Canadians have the chance to peer through the lens of a microscope and be mesmerized by what they see.

For more information visit www.ysf-fsj.ca

YSF Canada's SMARTS gratefully acknowledges the support of Motorola's Raise Your Voice Program.

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