CANADA

# 4-H CANADA SCIENCE FAIR GUIDEBOOK 2020-2021

SPARKING SCIENCE; CULTIVATING CURIOSITY

#4HCanadaSF

4-h-canada.ca

# WELCOME

The 4-H Canada Science Fair is an opportunity for you to explore, experiment and discover! This resource will guide you in creating your very own 4-H Canada Science Fair project. It includes information about developing your idea, on registering, project requirements and additional tools for support.

Spark your curiosity for science and creativity as you explore a topic you are passionate about with the 4-H Canada Science Fair. What are you waiting for? Registration opens September 1, 2020 and closes January 11, 2021, so start building your project today!

PAGE 2

## WHY SHOULD I GET INVOLVED?

Learn about the many advantages to getting involved with the 4-H Canada Science Fair.

PAGE 4

## REGISTRATION & GETTING STARTED

Register as soon as you're committed to participating!

PAGE 5

## PROJECT TYPES & COMPONENTS

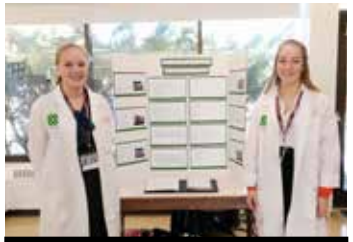
A successful 4-H Canada Science Fair project includes your project display, logbook and report!

PAGE 6-12

## MENTORSHIP

A mentor can be anyone looking to support you and your project.

PAGE 12



PAGE 13

## SAFETY

4-H Canada encourages you to take all safety precautions in your science fair project.

## ETHICS & PLAGIARISM

Understand the important rules around right versus unethical project conduct!

PAGE 14

## GLOSSARY

Key terms to keep in mind for your science project.

PAGE 15

## RESOURCES

A list of additional resources we recommend when building your project.

PAGE 17

## FREQUENTLY ASKED QUESTIONS

Common questions answered about the 4-H Canada Science Fair.

PAGE 18

## ACKNOWLEDGEMENTS

We recognize the support of our generous partners for this program!

PAGE 19

# WHY GET INVOLVED?

- You are a 4-H member in good standing and in grade 7-12 or CÉGEP.
- To have fun and to make new friends with similar interests!
- To challenge yourself and to discover something new!
- To explore your passions and a possible career path.
- To get creative and to solve problems!
- To build leadership, scientific inquiry and other important life skills.
- To develop an idea that could improve your home, your club, your community and even your country!

"It is totally worth it! You get to make friends and learn new things about yourself, science and 4-H."

# CULTIVATE YOUR CURIOSITY

- It's a fantastic experience to put on your résumé.
- You'll have opportunities to make great connections with peers, mentors and experts in the Science & Technology field.
- It's your chance to win great prizes, including travelling to different parts of the country!

# EXPLORE YOUR INTERESTS

Many of the world's greatest scientists, inventors and engineers, have asked themselves questions like, "Why are peas either smooth or wrinkled?", "How do burrs stick to me and my dog?" or "What causes some of the stars to move differently in the sky?" In fact, people of all ages, from different backgrounds have asked, why, what or how which has led to brilliant results like the discovery of genes and agricultural breeding, the invention of Velcro or an understanding of black holes and supernovas.

Beginning your 4-H Canada Science Fair project by asking similar questions about why things exist, how they can be improved or what makes them work will help lead you into identifying a project topic.

Explore your interests, ask yourself questions about the world around you and use the 4-H Canada Science Fair to offer solutions to these challenges. With your project, the sky is the limit!

# WHAT'S INVOLVED IN A PROJECT?

Below are important project components needed to develop a successful 4-H Canada Science Fair project. All 4-H Canada Science Fair participants have from now through January 11, 2021 to complete each piece.

1. ***Project display.*** This is a summary of your project including what you designed, researched or the findings of your experiment. For the 4-H Canada Science Fair: First Round, it is presented on PowerPoint.
2. ***Logbook.*** This is like your diary. In a notebook, track everything you do for your project from beginning to end (e.g. ideas, research, notes, observations or mistakes) and date every entry.
3. ***Report.*** This is a one page report summarizing your project and findings.
4. ***Application.*** All of the above pieces will be uploaded to register.4-h-canada.ca.


## Use Your Resources!

Find other project resources at 4-h-canada.ca/sciencefair:

- Logbook Guide
- Teacher Information
- Invitation to Mentor

## Questions? Contact Us!

Lina Saigol
Youth Programs Manager
lsaigol@4-h-canada.ca
613-899-7459

"If you could invent something that would change the world of science, technology, engineering, agriculture or math, what would it be?"

**Register as soon as you are committed to participating. The sooner we know you are interested, the sooner we can support you in completing your 4-H Canada Science Fair project!**

## INDIVIDUAL OR PARTNER PROJECT?

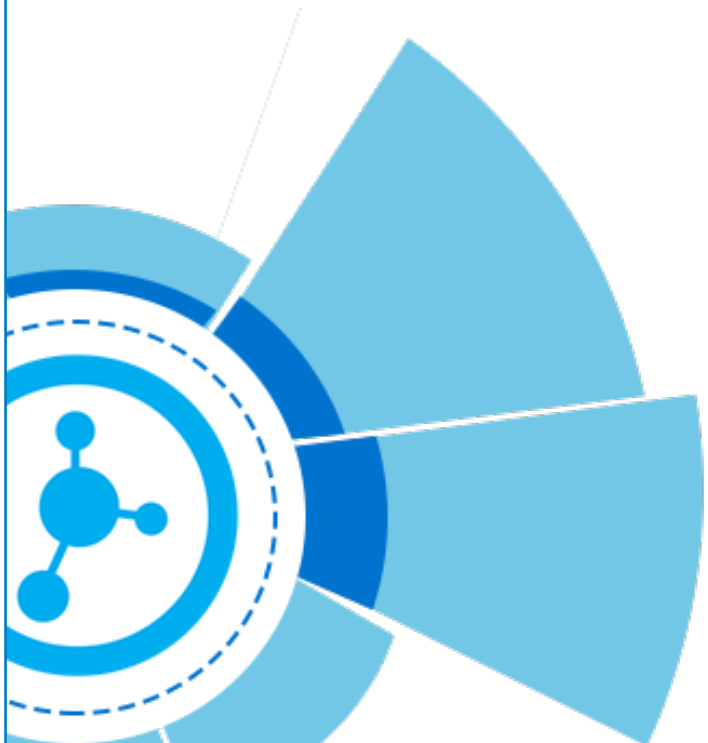
Projects may be done on your own or with a partner. Consider the following points before choosing between an individual or partner project:

- Partnered projects and individual projects are all judged in the same category and in the same way.
- You may work individually or in pairs. Groups may not have more than two people per project.
- 4-H Canada Science Fair participants must be 4-H members in good standing.
- 4-H Canada Science Fair participants must be in grades 7-12 or studying in CÉGEP.
- If you choose to do a partner project, only one of you needs to register your project at register.4-h-canada.ca/, although both of you should have access to the account.

## STEPS FOR REGISTRATION

register.4-h-canada.ca

September 1, 2020 to January 24, 2021



1. Visit register.4-h-canada.ca and either sign in or register a new account.
2. Select "4-H Canada Science Fair" from the dropdown menu and complete all necessary steps.

Questions? Contact us!

Lina Saigol
Youth Programs Manager
lsaigol@4-h-canada.ca

# GETTING STARTED

### Brainstorm

When going through the brainstorming process, we encourage you to write down your ideas in your logbook. This will allow you to refer back to them later on in your project and keep a record of your thought process.

### Think about your interests

What are your hobbies? If you had a free afternoon, what would you spend it doing? Ask yourself these questions and once you've come up with an answer, see if there is something you could test, invent or study that is related to your passion.

### Get inspired by your 4-H Club or Project

If you're already involved in 4-H, seek inspiration from your club or project topic! Use your 4-H experiences to inspire your 4-H Canada Science Fair project and use the resources around you.

## PROJECTS TO AVOID AND WHY

- **Product testing asking, "Which is best?"** While many products are easy to use, the science behind them is often complicated. Comparisons (e.g. of popcorn, detergent, cleaning products) only have scientific merit if you fully understand the science behind why the product works and preference testing (e.g. which tastes better, Coke or Pepsi?) is only looking at opinion, not measurable data.
- **The effect of coloured light or music on plants.** This has been done before and you can be more creative!
- **The effect of running, music, video games or any other activity on blood pressure.** The result is either obvious (e.g. your heart beats faster when you run) or difficult to measure (e.g. the effect of music).
- **Any topic that creates risk or pain (physical or psychological) to a human or animal, or involves tissue samples from living humans or animals.** The ethical rules of any science fair strongly prohibit this type of experimentation.
- **Any topic you can't measure with the equipment you have available or the results can't be repeated.** A true science experiment cannot exist without measurement and a repetition of results!

Source: http://www.sciencebuddies.org/science-fair-projects/project_question.shtml#examples

### Idea Generators and Previous Projects

While you wouldn't want to copy a project that has already been done, you might get some inspiration from these resources:

- www.googlesciencefair.com/make-better-generator/en/
- www.sciencebuddies.org/science-fair-projects/recommender_register.php
- www.juliantrubin.com/fairencyclopedia.html
- www.secure.youthscience.ca/virtualcwsf/

### ASK QUESTIONS

Once you identify an idea for your project, start asking questions and make sure to record them in your logbook! What's the best way of doing this? Does it affect the world around me? What are the effects? How can this be done better?

### KEEP IT SIMPLE

Remember, your project doesn't have to be complicated! Some of the best projects look at simple concepts but the experiment, innovation or study itself should be complete and precise.

# SELECT A PROJECT TYPE

## EXPERIMENT (pg 7-8)

An experiment involves testing a hypothesis through a specific method. An experiment has one variable that is changed and the rest stay the same. The best experiments are original and are carefully planned, so that the results are as accurate as possible.

## INNOVATION (pg 9-10)

An innovation involves creating a new product, technique, technology or scientific method. An innovation needs to be tested – is it better than what already exists? Why? The best innovation projects have a real world application and will have human or commercial benefit.

## STUDY (pg 11)

A study involves researching and analysing data or facts. This involves looking at a variety of scientific studies and yearly records. Looking at all of the information and comparing it, allows you to draw new conclusions or recommend one study over the others.

# DO YOUR RESEARCH

### Why is it important?

Background research is an important step for understanding your topic and for learning how to best design your project. A project built upon the information you researched will show judges you understand your topic inside and out!

### Build a Research Plan

The Science Buddies website (sciencebuddies.org) offers the following advice for coming up with a background research plan:

- Identify the keywords in your science fair project question.
- Use "question words" (why, how, who, what, when or where) to generate research questions.
- Identify other research studies to inform and support your project.
- Building an innovation? Research and understand how similar designs work.

### Make Notes

All research notes should be written down in your logbook as you do your research. These notes track where you got the information you've looked at or referenced. When you create your PowerPoint and report, refer back to your notes to reference key pieces of information, and to create an accurate account of what the process of doing the project looked like.

### Choose Reliable Sources

When doing your research, use sources that are reliable and trustworthy. Information from government, university or academic sources are likely reliable.

Blogs, YouTube or Wikipedia can be great starting points but should not be used as a primary resource in your bibliography. Remember to track all of your research in your logbook!

# CITE YOUR SOURCES

When referencing research in your project, it is important to give credit to the original source. Cite your sources in a bibliography following APA formatting. A bibliography is a list of all of the sources you reference in your project and it should be included in your logbook, project display and report. When to cite:

- **All information you quote directly.**
  For example: "There was a 20 per cent increase in growth..." (Brown, 2015).
- **All information you generally mention.**
  For example: This process has been used since the 1920s (Smith, 2011).
- **Any images you use, including your own.**
  For example: Figure 1 – Sample of seeds sprouting (Brown, 2015).
  Ideally, you should be using your own pictures, diagrams, charts or graphs you've created with your own data.

## CONSTRUCT A HYPOTHESIS

A hypothesis is an 'educated guess' that can be measured and used to test your experiment. Based upon your research, create a cause and effect statement such as: "If [I do this] _____, then [this] _____ will happen." This is the statement you will test in your experiment, so ensure it is something you can measure.

Results in an experiment can either support or oppose your hypothesis. If the results oppose your hypothesis, explore why they didn't match. If you change your experiment or do more research to create a new and improved hypothesis, explain your reasoning in your conclusion.

## VARIABLES AND FAIR TESTS

Fair tests are experiments where you change one variable at a time while keeping all other variables the same. The variable you change is the independent variable, the variable you want to measure is the dependent variable and all of the other variables you keep the same are your control variables.

If we want to measure whether or not the amount of water affects the height of corn, for example, we can only change the amount of water (independent variable) each corn plant receives. We measure the height (dependent variable) and we don't change the amount of fertilizer or sunlight (control variables). Changing more than one variable makes it difficult to identify whether it was the different amounts of water, fertilizer or sunlight that caused the corn to grow the way it did.

## MAP OUT YOUR PROJECT PROCEDURE

A procedure is like the recipe or instructions for your experiment. After you have developed your hypothesis, map out your experiment (in your logbook!) with a detailed procedure. Describe your independent, dependent and controlled variables.

When looking up other experiment methods online, you'll notice that other examples clearly explain the steps involved in the process and what is required to do the experiment so that anyone could follow along and get the same results. After identifying the steps of your experiment, include how you are going to measure your results or collect data. Charts or spreadsheets are helpful approaches for collecting and interpreting data.

## CREATE A MATERIAL LIST

A material list is included before the procedure and is a list of all items needed for the experiment. Anything included in the material list should be mentioned in the procedure and be specific.

If you list a battery, for example, be precise and list details, "two 9 volt Duracell batteries fully charged."

## REPETITION

After completing your experiment, do it again! Imagine if you did an experiment and the results showed that corn grows best when watered with vinegar. If you didn't repeat the experiment, you might think you discovered a new way to grow corn! Repeating an experiment helps identify any mistakes that were made throughout the project and it helps strengthen your projects' validity.

Include at least three repetitions in your experiment procedure. Consider how long it will take you to repeat your experiment and the resources required and then come up with an appropriate number of times to repeat your experiment.

# DESIGNING AN EXPERIMENT

You've picked your topic, done some research and have decided to do an experiment for your 4-H Canada Science Fair project! But where do you start? Read through the following checklist to build a strong experiment project.

1. Ask a Question
2. Research
3. Construct a Hypothesis
4. Test Your Variables
5. Map Out Your Project Procedure
6. Create a Material List
7. Test Experiment and Repeat x 3
8. Remember to Take Notes!
9. Opposing Results? Troubleshoot!
10. Analyze Data and Draw Conclusions
11. Build Your PowerPoint Presentation

## DURING YOUR EXPERIMENT, TAKE NOTES!

Your logbook should contain all of the information about your project including ideas, notes and research from beginning to end! Make sure that you write down all of your observations and data in detailed notes. If you make a mistake or something goes wrong, it is important to include it in your results analysis and conclusion.

## ANALYZE YOUR RESULTS

Once you've completed your experiment and repeated it as many times as necessary, take a look at your results. There are different ways of analyzing data but two of the most common ways are with graphs or charts.

## CONCLUSION

You've analyzed your results but what do they mean? In your conclusion explain what your hypothesis was, how you tested it and the results you've analyzed. Consider your research and the results of your experiment and make a decision about why your results either support or oppose your hypothesis and why this is important.

## PRESENT YOUR RESULTS

Once you've finished your experiment, analyzed your results and written your conclusion, add these pieces to your PowerPoint project display. Use your logbook to look back on your notes, research, data and conclusions and share any relevant information in your display.

## TAKE THIS QUIZ

Which hypothesis is stronger?

1. "If corn plants are grown with fertilizer the corn will taste better."
2. "If fertilizer is used on the corn, the starch content in the kernels will increase."

## TAKE PICTURES!

Throughout your experiment, take pictures or record a video. These visuals will help explain your project in your PowerPoint project display making it easier for judges to understand what you did and how you reached your conclusions.

## QUIZ ANSWER:

Hypothesis #2 is stronger as it is something that can actually be measured (i.e. the amount of starch in corn kernels). Hypothesis #1 needs to be more specific and measurable - how do you measure tastiness? Remember you need to have research to back-up your hypothesis! Make sure your hypothesis isn't just a guess, but an educated guess.

# DESIGNING AN EXPERIMENT

You've picked your topic, done some research and have decided to do an experiment for your 4-H Canada Science Fair project! But where do you start? Read through the following checklist to build a strong experiment project.

1. Ask a Question
2. Research
3. Construct a Hypothesis
4. Test Your Variables
5. Map Out Your Project Procedure
6. Create a Material List
7. Test Experiment and Repeat x 3
8. Remember to Take Notes!
9. Opposing Results? Troubleshoot!
10. Analyze Data and Draw Conclusions
11. Build Your PowerPoint Presentation

## DEFINE A NEED AND AN OBJECTIVE

When designing an innovation, think about a need for the world around you and how your project can offer a solution. After you've defined a need, develop an objective statement: the goal or purpose of your project.

If you realize there's a need for a more durable cellphone case, for example, then your objective is to create one that is more durable than what currently exists. Or, if you are concerned by the global issue of food waste, what could you design that could address and hopefully solve this?

## S.C.A.M.P.E.R.

This is a process you can use to build ideas for your innovation. Go through each letter and apply it to the world around you (e.g. objects or activities) to help develop new ideas for an innovation.

S – Substitute – could it be used for something else?
C – Combine – could it be mixed with another product or activity?
A – Adapt – could you change or borrow ideas from another object or activity?
M – Minimize or maximize – what would happen if it was made really small or really big?
P – Put to other uses – could this object or activity be used for a different purpose?
E – Eliminate – can you remove parts of the object or activity?
R – Rearrange – can the object work or the activity happen in a different order?

## MAP OUT YOUR PROJECT PROCEDURE

Map out how you will design your innovation with a detailed procedure in your logbook. A procedure can be seen as the recipe or instructions for your design process.

When looking up other design methods online, you'll notice that other examples clearly explain the steps involved in the process and what is required to do the experiment so that anyone could follow along and get the exact same results.

After identifying the steps of your innovation, include how you are going to measure your results or collect data. Charts or spreadsheets are helpful approaches for collecting and interpreting data.

## CREATE A MATERIALS LIST

A materials list is included before the procedure and is a list of all items needed for your design. Anything included in the material list should be mentioned in the procedure and be specific.

If you list water, for example, be precise and list details:"250mL distilled water, at 25°C".

## TESTING YOUR DESIGN

The first model of a design is a prototype. Test it to see how it works and identify any changes you can make to improve the design.

It is unlikely that you will create the perfect design on your first try, so continue this process of creating a prototype and then making improvements until you've created the best possible design.

When you've found the best possible design, test this final prototype to confirm that it works as you expect. This may mean real-world testing (using it in the actual situation or environment the real innovation would be used in), running a computer model or having people test it and give you feedback. This process of designing, testing and redesigning is essential to the innovation process!

# DESIGNING AN INNOVATION

You've picked your topic, done some research and decided to do an innovation for your 4-H Canada Science Fair project! But where do you start? The best innovation projects have a real-world application. Read through the following checklist to build a strong innovation.

1. Define a Need
2. S.C.A.M.P.E.R.
3. Map Out Your Project Procedure
4. Create a Materials List
5. Test Your Design
6. Remember to Take Notes!
7. Prototype Issues? Redesign it!
8. Analyze Data and Draw Conclusions
9. Build Your PowerPoint Presentation

## DURING YOUR DESIGN, TAKE NOTES!

Your logbook should contain all of the information about your project including ideas, notes, research or prototype testing from beginning to end! Make sure that you write down all of your observations and data in detailed notes. If other people are testing your innovation, record their observations too! If you make a mistake or something goes wrong with the design, it is important to include it in your results analysis and conclusion.

## ANALYZE YOUR RESULTS

Once you've designed your best prototype and tested your innovation, use the test results to identify how successful your innovation is. There are different ways of analyzing data but two of the most common ways are with graphs or charts.

## CONCLUSION

You've analyzed your results, but what do they mean? In your conclusion, explain what your innovation goal was, how you designed and tested it and the results you've analyzed. This final project component involves you considering your entire project and making a decision about why your innovation was either successful or unsuccessful and why this is important.

## PRESENT YOUR RESULTS

Once you've finished your experiment, analyzed your results and written your conclusion, add these pieces to your PowerPoint project display. Use your logbook to look back to your notes, research, data and conclusions and share any relevant information in your display.

## COLLECTING DATA

Look back at your objective to identify ways to collect data for your innovation. This data will help prove why your innovation is better than what currently exists!

- Designing new type of footwear? Test the durability! How many steps before it breaks? How does it affect posture?
- Designing a new type of farm machinery? Test how efficient it is! How much faster does it complete the task compared to a traditional machine? Or identify how much more affordable it is compared to machines currently on the market.
- Designing a training halter for cattle? Test how effective it is! Survey users on how easy it is to put on or take off.

# DESIGNING AN INNOVATION

You've picked your topic, done some research and decided to do an innovation for your 4-H Canada Science Fair project! But where do you start? The best innovation projects have a real-world application. Read through the following checklist to build a strong innovation.

1. Define a Need
2. S.C.A.M.P.E.R.
3. Map Out Your Project Procedure
4. Create a Materials List
5. Test Your Design
6. Remember to Take Notes!
7. Prototype Issues? Redesign it!
8. Analyze Data and Draw Conclusions
9. Build Your PowerPoint Presentation

## ASK A QUESTION

First you need to ask a question about the topic you've selected. Making your question specific helps avoid researching too broad a topic. For example, if the study is about corn, and specifically the planting of corn, a research question might be: "How have corn planting methods in Ontario changed in the past decade and what is the result in yield?" Figure out what specific question you want to explore and then start narrowing down your research!

## DO YOUR RESEARCH

This will be the backbone of your project. In a study, instead of doing an experiment or inventing something, you will be researching information to answer the question you've asked. As you collect information, look for patterns and begin to draw your own conclusions. The best study projects use high-quality information from scientific journals and then carefully analyze the data.

When doing your research, use sources that are reliable and trustworthy. Information from government, university, or academic sources are likely reliable (just ask a librarian for some help!). Blogs, magazines, or YouTube may not reference where they got information, and may not be very reliable. Wikipedia can be a great starting point because they include references and links at the bottom of every article. You shouldn't use Wikipedia as a resource in your bibliography, but it may lead you to other reliable sources.

## DURING YOUR STUDY, TAKE NOTES!

Your logbook should contain all of the information about your study including ideas, notes and research from beginning to end! Take detailed notes, write down all of your research findings and keep an organized record of where you find the information. If you make a mistake with your research, it is important to include it in your results analysis and conclusion.

## ANALYZE YOUR RESULTS

Once you've completed your research, take a look at the results. Did anything stand out? Are there patterns that you've noticed? Any new information you've found by comparing different studies? Analyze the information you've looked at to highlight any pattern or trends. This may involve having a mentor help you perform a statistical analysis. After analyzing your research, find the clearest way of showing your results (e.g. a chart or a graph).

## CONCLUSION

You've analyzed your research, but what does it mean? Your conclusion explains your question, how you researched it and the results you've analyzed. This final project component involves considering the different parts of your study and making a decision about why your results are important.

## PRESENT YOUR RESULTS

Once you've finished your study, analyzed your results and written your conclusion, add these pieces to your PowerPoint project display. Use your logbook to look back to your notes, research, data and conclusions and share any relevant information in your display.

# DESIGNING A STUDY

You've picked your topic, done some research and have decided to do a study for your 4-H Canada Science Fair project! But where do you start? Read through the following checklist to build a strong research study!

1. Ask a Question
2. Do Your Research
3. Remember to Take Notes!
4. Opposing Results? Troubleshoot!
5. Analyze Data and Look for Patterns
6. Draw Conclusions
7. Build Your PowerPoint Presentation

# PROJECT COMPONENTS

## PROJECT DISPLAY

For the 4-H Canada Science Fair: First Round, your project display will be a PowerPoint presentation (keep it simple). It should cover everything about your project from start to finish to help judges understand your process, results and conclusion. It can include text, photos, video or anything that helps explain your project. Upload your project display to register.4-h-canada.ca.

**INCLUDE THE FOLLOWING:**

- Background
- Purpose
- Hypothesis or Objective
- Procedure
- Results or Observations
- Conclusions
- Acknowledgements
- Bibliography
- Format (Save as a PPT)

## LOGBOOK

Logbooks don't have to be pretty, just detailed! Jot down notes, draw diagrams, insert pictures and make mistakes. Use headings to keep yourself organized but make it your own. In the end, your logbook should contain enough information that a stranger could understand your project and repeat what you did. Upload pictures of your logbook to register.4-h-canada.ca.

**INCLUDE THE FOLLOWING:**

- Brainstorm, Topic Ideas, Questions
- Research
- Hypothesis or Objective
- Materials and Prototype Designs
- Procedure and other Processes
- Observations and Data
- Conclusions
- Roadblocks or Challenges
- And more...
- Format (In a notebook)

## REPORT

Your one page report will summarize your project. It is similar to your PowerPoint project display but brief, and without visuals. References should be included on a second page. Upload your PDF report to register.4-h-canada.ca. The font should be 12-point Times New Roman or Calibri, single-spaced with margins of 1 inch (2.5 cm). Include your project title and your name at the top.

**INCLUDE THE FOLLOWING:**

- Background
- Purpose
- Hypothesis or Objective
- Procedure
- Results and Observations
- Conclusions
- Acknowledgements
- Bibliography
- Format (Saved as a PDF)

## JUDGING NOTES

To understand the importance and emphasis placed on the different criteria, please note the following score breakdown (rubric available at 4-h-canada.ca/sciencefair):

- Part A: Scientific Thought – 50%
- Part B: Originality and Creativity – 30%
- Part C: Communication (PowerPoint, Project Report, Logbook) – 20%

## MENTOR & MEMBER RESPONSIBILITIES

- Treat your mentor/member with respect;
- Commit sufficient time and effort to your mentorship.
- Set clear expectations for each other;
- Do not accept/offer any kind of payment for your mentoring relationship;
- Maintain the confidentiality of the mentoring relationship;
- Read, sign and respect the mentor-member code of conduct.

## MEMBER RESPONSIBILITIES

- Clearly communicate your goals and needs for your project to your mentor;
- Communicate regularly and openly with your mentor;
- Complete any tasks you have agreed to do with your mentor in a timely manner;
- Hold all sensitive information provided through the mentorship in strict confidence;
- Maintain a professional relationship with your mentor.

# MENTORSHIP

## CONNECTING WITH A MENTOR

A mentor is a teacher, leader or advisor who works with you to support your science fair project and helps take it to the next level. They may have a science background or they may just be supportive of your passion! Mentors may provide you with space to work (e.g. access to a science lab) or help you meet experts in the field of your project. It is your responsibility to come up with the project idea, conduct the experiment/design the innovation/research the study, write your report and create your display.

## FINDING A MENTOR

There are many places you can find a mentor. Ask someone you think would be able to support your project like your science teacher, your 4-H club leader, a parent or even contact someone who works at a local university or company. Find more mentor resources at 4-h-canada.ca/sciencefair.

## WORKING WITH YOUR MENTOR

Share your topic and project design information, ask them to provide constructive feedback and use these suggestions to improve your project. Connect with your mentor as much as you need to but make sure you set up a schedule that works for you both.

## MENTOR GUIDELINES

When participating in a mentoring relationship, 4-H Canada asks that all mentors and members read and sign the code of conduct available at 4-h-canada.ca/sciencefair.

# SAFETY

**4-H Canada on Safety**
4-H Canada encourages you to take all safety precautions for your project. If you are using chemicals, materials or tools, it is important to read all instructions, have been trained how to use them safely and have supervision. Talk to your parents, 4-H leader or teachers before starting your project so they are aware of what you are doing. If your project feels unsafe, it probably is, do not continue.

**Chemical Safety and MSDSs**
MSDSs – Material Safety Data Sheets provide information about chemicals or materials, including dangers and how to handle them safely. Before working with chemicals please look them up here and follow the safety guidelines: ccohs.ca/oshanswers/legisl/msdss.html. Make sure you work in an appropriate environment (e.g. lab, fume hood) with appropriate tools (e.g. clean glassware that won't react with chemicals). Take precaution by wearing protective clothing and safety glasses, working on a clean surface, and keeping long hair or loose clothing tied back. Have your local Poison Control number handy in case you accidentally inhale or ingest chemicals. This includes a sink for eye-washing. You should always have adult supervision when chemical safety is a concern.

**Fire Safety**
If you are working with an open flame, using flammable materials or a chemical reaction where heat is produced, make sure you have a proper fire extinguisher within reach. Take precaution by wearing protective clothing and safety glasses, working on a heat-resistant surface and keeping long hair or loose clothing tied back. You should always have adult supervision when fire safety is a concern.

**Electrical Safety**
If you are working with an electrical current, even if it is from a small battery, you should always know when the electricity is "on" or "live," and how to shut it off. Take precaution by wearing protective clothing, working on a clean and dry work surface, keeping long hair or loose clothing tied back and wearing safety glasses. You should always have adult supervision when electrical safety is a concern.

**Structural and Mechanical Safety**
If you are building something with dangerous moving parts or it is of a size or mass that could potentially hurt someone, take every precaution to make sure you or other people are interacting with your design safely. You should always have adult supervision when structural safety is a concern.

**Biohazards**
If you are working with biohazards, such as bacteria, tissue samples, blood, blood products, animal waste, etc., you must work in an appropriate environment (e.g. lab, fume hood) and with appropriate tools (e.g. clean glassware that won't react with biohazards). Take further precaution by wearing protective clothing, working on a clean work surface, keeping long hair or loose clothing tied back, and wearing safety glasses. Keep your local Poison Control number handy and make sure you know what to do should you accidentally inhale or ingest a biohazard. You should always have adult supervision when biohazards are a concern. This kind of project may also require an Ethics Review Request

## SAFETY QUESTIONS

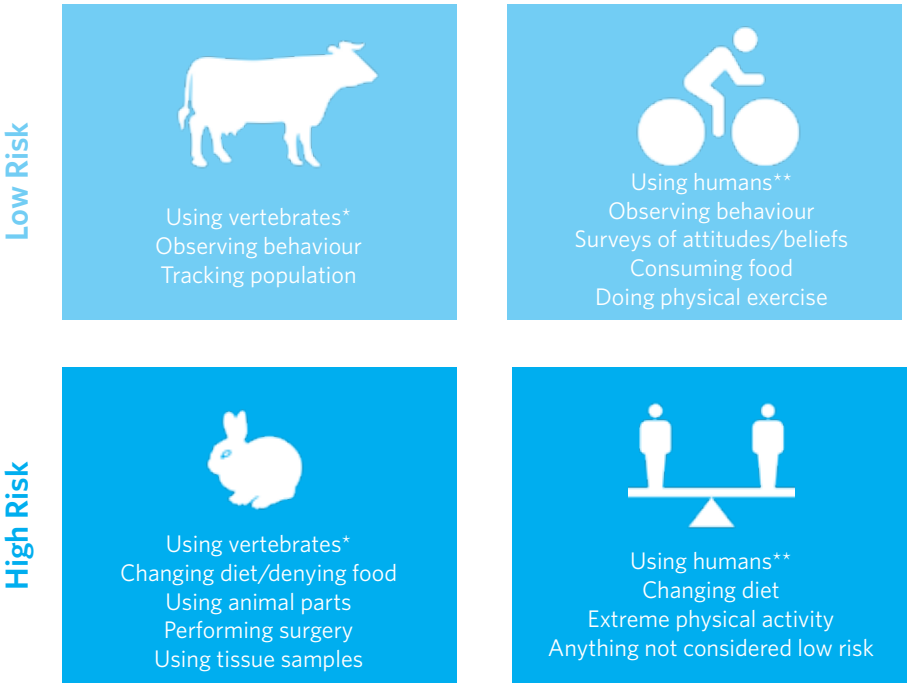
- Have I been trained how to do this?
- Do I have permission?
- Do I have supervision?
- Do I have the necessary safety materials and clothing?
- Is there a safer way to do this?
- Am I putting myself or others in unnecessary danger? (Include animals and the environment in your consideration)

# ETHICS

Science is awesome but it needs to be ethical science! Ethics are about considering the right and wrong conduct in a variety of situations and in a science fair project it is especially important that proper ethical procedures are followed at all times.

You will be asked if you will be using humans or animals in your project when you register. Using humans or animals (both vertebrate and invertebrate) in an experiment requires submitting an Ethics Review Request, and if you're using humans you'll also need to complete the Informed Consent Letter and Permission Form. The forms you will need to fill out can be downloaded from either your profile on register.4-h-canada.ca or from 4-h-canada.ca/sciencefair. These projects will be assessed by the Ethics Review Committee to ensure they don't violate ethical science procedure.

To give you an idea of what categories different projects fall into, look at the diagram to the side. Please note that all project topics aren't covered – this is meant to just give you an idea. If you are thinking of using an animal or human in your project, you must fill out an Ethics Review Request.




*The use of plants, fungi, and protozoa does not require a review by the Ethics Committee.
** You will need to get consent when using humans in your project.

Note: If you want to see what types of projects have been accepted or denied in the past, look here: http://youthscience.ca/node/67 and http://youthscience.ca/node/94.

# PLAGIARISM

**The Importance of Referencing**
When doing research for your project, creating your PowerPoint display or writing your report, it is important to reference all of the information that you use in your bibliography. Whether the work has inspired your project or you've quoted text or data directly, you must give credit to the original authors. Science works by building upon previous experiments, innovations or studies but it is also necessaryto give credit.

**Other Bibliography Requirements**
4-H Canada encourages members to be truthful and acknowledge the information and resources they use in their projects. If you didn't write it or think of it yourself, you should be referencing the source. This includes any significant work done by a mentor.

**Cite with Your Sources with APA**
When you are referencing other people's work use the APA citation format. Visit this link for a chart on how to reference using APA style: http://brescia.uwo.ca/library/wp-content/uploads/sites/12/delightful-downloads/2018/01/APA-Jan-2018.pdf

If you use information that you found in an article, you would cite it in your PowerPoint or report like this: **One important factor is the, "groundwater in the area is decreasing by 5% a year" (Brown, 2015).**

And then in your bibliography, you would cite like this: Brown, Joe. Groundwater depletion in Ontario. Journal of Watersheds and Groundwater. Published January, 2015.

**What counts as plagiarism?**
- Using information from your research but not saying where you got the information.
- Copying another person's science fair project.
- Presenting the work of other people as your own.
- Fabricating or falsifying data.

September 1

Registration & Preparation September 1, 2020 to January 24, 2021

1

January 24

Submit your project by January 24, 2021

2

4-H Canda Science Fair: First Round Online Judging January 25 to February 1, 2021

3

Second Round of Judging

4-H Canada Science Fair: Second Round Virtual Presentations & Judging March 1 to 7, 2021

4

Explore Science & Technology at the virtual 4-H Canada Science Fair March 1 to 7, 2021

5

May 17 to 21

Winners of the 4-H Canada Science Fair move on to the virtual Canada-Wide Science Fair, a separate entity

CWSF

6

## SPARKING SCIENCE; CULTIVATING CURIOSITY

### 4-H CANADA SCIENCE FAIR: FIRST ROUND

Between Sept. 1, 2020 and Jan. 11, 2021 register and submit a project online to be judged between Jan. 12 and 29, 2021.

### 4-H CANADA SCIENCE FAIR: SECOND ROUND

Finalists of the 4-H Canada Science Fair: First Round move on to the Second Round of virtual judging from March 1 and 7, 2021.

### CANADA-WIDE SCIENCE FAIR

Winners of the 4-H Canada Science Fair move on to the virtual Canada-Wide Science Fair, a separate science competition entity, between May 17 to 21, 2021.

# Glossary

**Analyze:** To look at results and data and notice patterns or draw conclusions.

**Conclusion:** To reach a judgement or decision based on the analysis of your project results. Conclusions either support or oppose your hypothesis.

**Control Variable:** Variables you keep the same throughout an experiment.

**Data:** Information that can be shown in the form of numbers, facts or statistics.

**Dependent Variable:** The variable you measure in an experiment.

**Experiment:** An experiment involves testing a hypothesis through a specific method. An experiment has one variable that is changed and the rest stay the same. The best experiments are original and are carefully planned out so that the results are as accurate as possible.

**Hypothesis:** A suggested explanation or "educated guess" that is used as a starting point for further investigation.
"If [I do this] _____, then [this] _____ will happen."

**Independent Variable:** The variable you change in an experiment.

**Innovation:** An innovation involves creating and testing a new product, theory, technique, technology or scientific method.

**Objective:** The goal or purpose of your project. An objective is what you aim to achieve or address.

**Observation:** Observations are what you see, hear, smell or experience during your experiment. It could also be the measurements you take or the data you record.

**Prototype:** The first model of a design is a prototype. Changes can be made to improve this design.

**Study:** A study involves researching and analyzing data or facts that are accepted in science. This could involve looking at a variety of scientific studies, for example, about the best way to shear sheep. Looking at all of the information together and comparing it, may allow you to draw new conclusion or recommend one study over the others.

**Variable:** A variable is an element within an experiment that can change.

# RESOURCES

**4-H Canada Science Fair Main Page**
4-h-canada.ca/sciencefair

**4-H Canada Science Fair Tools**
www.4-h-canada.ca/science-fair-project-members

- Logbook Guide
- Invitation to Mentor
- Mentor-Member Code of Conduct
- Ethics Review Request Form
- Informed Consent Letter of Information
- Informed Consent Permission Form
- Judging Rubric

**4-H Canada Science Fair Registration**
register.4-h-canada.ca

**Science Fair Project Ideas and Resources**
https://www.googlesciencefair.com/#!?modal_active=none
www.juliantrubin.com/fairencyclopedia.html
www.cwsf.youthscience.ca
https://cwsf.youthscience.ca/judging-%E2%80%93-project-types
www.sciencebuddies.org/science-fair-projects/recommender_register.php
https://www.sciencebuddies.org/science-fair-projects/ask-an-expert-intro

**Ethics Assessments for Science Fair Projects**
www.youthscience.ca/node/67 and http://youthscience.ca/node/94

**Referencing in APA**
http://brescia.uwo.ca/library/wp-content/uploads/sites/12/delightful-downloads/2018/01/APA-Jan-2018.pdf

**Scientific Method Flowchart**
https://www.sciencebuddies.org/science-fair-projects/science-fair/steps-of-the-scientific-method

**Chemical Safety**
www.ccohs.ca/oshanswers/legisl/msdss.html

**How to Create a PowerPoint Presentation**
https://www.youtube.com/watch?v=XF34-Wu6qWU

**How to Create and Save a PDF**
https://www.youtube.com/watch?v=OzmjkLOYtDE

# FREQUENTLY ASKED QUESTIONS

**Q. Who is eligible?**
A. 4-H members in good standing, who are in grade 7 - 12 or studying in CÉGEP are welcome to participate.

**Q. Can I have a partner?**
A. Definitely! You may work individually or in pairs. Groups may not have more than two people per project.

**Q. Can I compete in both my school science fair and the 4-H Canada Science Fair: First Round Round?**
A. You are welcome to participate in both your school's science fair and the 4-H Canada Science Fair: First Round. Visit 4-h-canada.ca/sciencefair for resources you can share with your teacher.

**Q. Can I compete in my school's regional science fair and the 4-H Canada Science Fair: Second Round?**
A. At the regional level you can either compete in the 4-H Canada Science Fair: Second Round or your school's regional fair – you can't do both!

**Q. What can my science fair project be about?**
A. Anything! Well, almost. Read the 4-H Canada Science Fair guidebook for inspiration, to identify topics to avoid and to understand the rules around projects involving humans or animals.

**Q. Does the 4-H Canada Science Fair count as my 4-H project?**
A. Your 4-H specialist or the 4-H office in your province can help you determine this. Some provinces count your science fair project as a "self-determined" or "create-a-project" option or as a communications project.

**Q. When do I need to start my project?**
A. The 4-H Canada Science Fair: First Round runs from September 1, 2020 through January 24, 2021. You can submit your project anytime between these two dates. We recommend starting your project as soon as you can so we can support you. Even if you haven't started your project but are thinking of doing one register here: register.4-h-canada.ca.

**Q. Who are the judges and how will I be judged?**
A. All of the judges will have a science background. Each project will be reviewed by three judges for roughly 20 minutes. Judges are provided a 4-H Canada Science Fair rubric and scoring guide available at: 4-h-canada.ca/sciencefair. Judges will assess your PowerPoint project display, your logbook and your report.

**Q. What can I win?**
A. Finalists of the 4-H Canada Science Fair: First Round will win the opportunity to attend the 4-H Canada Science Fair: Second Round, being held online between March 1 and 7, 2021. If you are successful and win at the 4-H Canada Science Fair: Second Round, you will have the opportunity to represent 4-H Canada at the online Canada-Wide Science Fair where there is nearly $1,000,000 in scholarships and prizes to be won!

# FREQUENTLY ASKED QUESTIONS

**Q. What is a mentor? Should I have one?**
A. A mentor can be a teacher, guide or advisor who supports you with your science fair project. They can have a science background or they may just be supportive of your passion! Mentors may provide you with workspace (e.g. access to a science lab), connect you with experts, or offer encouragement. It is your responsibility to come up with the project idea, build the project, write the report and create the PowerPoint project display.

**Q. Where can I find a mentor?**
A. There are many places you can find a mentor. Ask someone you think would be able to support your project like your science teacher, your 4-H club leader, a parent or even contact someone who works at a local university or company. Find more mentor resources at 4-h-canada.ca/sciencefair.

**Q. Could I be a mentor?**
A. If you are interested in supporting a 4-H member in their project, visit 4-h-canada.ca/sciencefair for important documents such as the "Letter for Mentors" and the "Code of Conduct" to review and submit.

**Q. What does participating in the 4-H Canada Science Fair cost?**
A. There is no cost to participate in the 4-H Canada Science Fair: First Round. If you are selected as a finalist for the 4-H Canada Science Fair: Second Round, there is a fee of $100 + baggage fees to help cover the cost of travel and accommodation. If you are successful and win at the 4-H Canada Science Fair: Second Round, 4-H Canada will cover all of the costs for attending the Canada-Wide Science Fair.

**Q. I have now submitted my project for judging. What happens next?**
A. Congratulations on submitting your project! You will have received a confirmation email once you submit your project. The deadline for submissions is January 24, 2021, at 11:59 p.m. ET. Judges from across Canada will judge the projects virtually. Finalists for the next round will be announced in January 2021.

**Q. Can I use humans or animals in my project?**
A. The use of humans or animals in science is strictly regulated to ensure that no humans or animals are treated unethically. Read the 4-H Canada Science Fair guidebook for project inspiration, to identify topics to avoid and to understand the rules around projects involving humans or animals. If you involve humans or animals in your project, you will need to submit an ethics review request for approval before proceeding.

**Q. Can I get help from my parents, club leader or teacher?**
A. While your parents, club leader or teacher can support you, the writing, experimentation, research, and conclusions need to be completed by you.

**Q. How can I make sure my science fair project is safe?**
A. 4-H Canada encourages you to take all safety precautions in your science fair project. If you are using chemicals, materials or tools, make sure that you have read all instructions, have been trained on how to use them safely and have supervision.

Talk to your parents, 4-H leaders or teachers before starting your project. If your project feels unsafe, it probably is, do not continue. Read the 4-H Canada Science Fair guidebook for more information on project safety.

**Q. I have invented something. Can I apply for a patent?**
A. Yes, you can apply for a patent if you have invented something, however, the process is quite long, there is a cost involved, and you will likely need help from your parents/4-H leader/teacher, and possibly a lawyer. Check out this site for more information: www.ic.gc.ca/eic/site/cipointernet-internetopic.nsf/eng/wr01477.html

**Q. I am having problems registering my project. What should I do?**
A. Read this 4-H Canada Science Fair guidebook in full for more details about registration. If you are still experiencing difficulties, contact 4-H Canada's Youth Programs Manager, Lina Saigol at lsaigol@4-h-canada.ca.

## Use Your Resources!

Find other project resources at 4-h-canada.ca/sciencefair:

- Logbook Guide
- Teacher Information
- Invitation to Mentor

## Questions? Contact Us!

Lina Saigol
Youth Programs Manager
lsaigol@4-h-canada.ca
613-899-7459

# ACKNOWLEDGEMENTS


4-H Canada is proud to recognize the support of Agriculture and Agri-Food Canada in supporting all of 4-H Canada's national youth programming. Through this support, programs such as the 4-H Canada Science Fair are able to bring science, technology, engineering and math programming to youth from coast to coast.

4-H Canada recognizes the support of Bayer, a partner of the 4-H Canada Science & Technology leadership development pillar. Their continuous enthusiasm to support 4-H in Canada science programing, including the 4-H Canada Science Fair is a testament to their commitment to help youth explore, experiment and discover.

4-H Canada recognizes the support of the Natural Sciences and Engineering Research Council (NSERC) through an NSERC PromoScience grant. This grant has enabled 4-H Canada to focus on building robust science opportunities for members and to grow our capacity for science, technology, engineering and math programming.

4-H youth who advance to the second round will have the opportunity to compete and display their projects for judges who work in Science & Technology fields while experiencing an academic institution committed to responsibly caring for the environment while finding solutions to meet the demands of a hungry and growing world.

**Resource Development Partner**
4-H Canada recognizes Youth Science Canada, best known for their showcase event, the annual Canada-Wide Science Festival (CWSF), in the development of the 4-H Canada Science Fair.