

# CANADIAN BIOLOGY OLYMPIAD 2020

The 2020 Canadian Biology Olympiad/Les Olympiades Canadiennes de Biologie (CBO/OCB) is a nation-wide organization involved in the selection of four secondary school students talented in the field of biological sciences to represent Canada at the International Biology Olympiad. Students are selected on the basis of a two round competition process (see below). The top four performing students in the CBO/OCB competition are invited to represent Canada at the 31<sup>th</sup> annual International Biology Olympiad (IBO) to be held in Nagasaki, Japan in July 2020.

## A) Who can participate in the CBO/OCB competition?

- Competitors must be residents of Canada and Canadian Citizens or Landed Immigrants.
- Competitors are students of a regular secondary school for general education in Canada. In Quebec, first year CGEP students are also eligible to participate.
- Competitors have not obtained a diploma allowing them to study at a university or equivalent institution, before the 1<sup>st</sup> of January 2020.
- Competitors have not yet started study at a university or equivalent institution as regular or full-time students.
- Competitors must be under the age of 20 as of July 1<sup>st</sup>, 2020.
- Competitors have not already participated in the IBO (can only participate once).

## B) Selection of the national team and participation in the IBO

In addition to the rules stated above:

- In accordance to the IBO rules, competitors cannot train for more than one week or do their portfolios in an Olympiad school or specialized school or study group of less than 50 students.
- Competitors cannot compete in another International Olympiad in the same year they are participating in the IBO.
- No school can have more than 2 members on the CBO team.
- At least 2 provinces should be represented.

## C) The National Competition

The CBO/OCB competition is a two-round contest. Round one is the submission of a Skills Portfolio to test your lab skills (see details below). The second round is the University of Toronto National Biology Competition to test your theoretical skills. In order to participate in the CBO/OCB competition, schools must be registered with the CBO/OCB as well as with University of Toronto Competition:

### Registration with the CBO/OCB:

Schools with students competing need to complete the online registration form and submit the registration fee of \$50. The registration form and payment information can be found [https://docs.google.com/forms/d/e/1FAIpQLSelp1sxEXNTE5ANt9hAi89na8FQnYVeiQKIpVHij3JzvwVcvg/viewform?usp=sf\\_link](https://docs.google.com/forms/d/e/1FAIpQLSelp1sxEXNTE5ANt9hAi89na8FQnYVeiQKIpVHij3JzvwVcvg/viewform?usp=sf_link)

School registration and payment should be submitted no later than **April 1, 2020**.

Deadline for the submission of the portfolio (see information below) is **5 pm on April 21, 2020**.

#### Registration with the University of Toronto Competition:

School need to set up an account on the University of Toronto Competition website (<http://www.biocomp.utoronto.ca/about>) and need to register in order for students to compete. The deadline for registration is **March 6, 2020**. The exam will take place on **April 30, 2020**.

#### **D) Selection of the team**

Final placing and selection of the four students that will compete at the IBO is based equally on the results from the Skills Portfolio and the University of Toronto competition. Team selection is made by the CBO Jury consisting of Biology Professors and Teachers. All decisions from the Jury are final.

The four selected students will be required to attend the CBO National Training Camp taking place a week before the international competition. The camp provides a unique experience for students to work alongside professionals in a variety of biology fields and develop laboratory skills through intensive hands-on activities. Please note that the camp is also open to other young biology enthusiasts who will train alongside the four selected students (check the National Training Camp tab on the web site for more information).

#### Cost:

The cost for participating at the National Skills Training Camp and the IBO is of \$4,500. We realize that the cost is quite high. And we hope to be able to refund a portion of the cost if grants become available

#### Important dates (summary):

- Registration of the school at the Toronto Biology Competition: March 6, 2020
- Registration of the school to the CBO/OCB: April 1, 2020
- The laboratory portfolio is due by: April 21, 2020, 5 pm
- The University of Toronto Biology Competition exam is on: April 30<sup>th</sup>, 2020
- The National Skills Training Camp will be held tentatively from: June 27 to July 1, 2020  
(details will be posted on the website).
- The IBO will be held in Nagasaki, Japan from: July 3 to 11, 2020

# **LABORATORY SKILLS PORTFOLIO: CBO2020**

To be considered in the Canadian Biology Olympiad and National Team Selection, you must submit this Laboratory Skills Portfolio on or before **Tuesday, April 21, 2020, 5 pm** in digital format. You may perform tests/labs as often as you wish (to work on technique and mastery), but only one lab sample is to be submitted for each category. Please remember, at the International Biology Olympiad you will be expected to complete a multitude of lab exercises independently under pressure and time constraints, so it is in your best interests to work on laboratory skills and be proficient in these. Note, the labs here are not necessarily the same labs you will encounter at the International Biology Olympiad—the IBO labs remain unknown until the competition begins.

The skills portfolio is designed to select candidates best suited to compete at the International Biology Olympiad. The IBO is more than just a knowledge competition; competitors must possess lab skills and the ability to work under pressure. By creating this portfolio students are expected to demonstrate exemplary laboratory skills, design and analysis, and the ability to complete tasks within set parameters.

All work presented must be your own and performed at your school. Ensure you do not work too closely with another student. Similarities between students' submission may be considered as plagiarisms and may result in disqualification. Also, teachers/supervisors have to be careful not to coach or help their students with the portfolios. Please refer to the file Guidelines for Teachers (<https://www.canadianbiologyolympiad.ca/Guidelines%20for%20Teacher2019.pdf>) for more information. Proof of coaching from the teacher/supervisor may lead to the disqualification of the student. If a student cannot perform the portfolios at their school due to lack of specific equipment for example, **they should seek approval with the CBO** before commencing the work at the off-school campus. A teacher/supervisor must sign for authenticity and original work—see forms below. NOTE: the supervisor of student work **cannot** be a direct family member. The portfolio is presented in advance so work on skills and development represents the student's true abilities and strengths. Please ensure the completed portfolio is uploaded to the CBO on or before 5 pm on April 21, 2020. Portfolios and links to videos will be submitted by your teachers electronically. Details how to submit the portfolio will be provided to teachers once the school is fully registered. **Late submission will not be accepted—no extensions.**

Note: A French translation of the Skills Portfolio is available upon request but the U of T exam is only available in English.

If you require clarification regarding the portfolio, please do not hesitate to ask. Questions are to be directed to: [admin@canadianbiologyolympiad.ca](mailto:admin@canadianbiologyolympiad.ca)

***Remember: The Lab Skills portfolio must be received on or before  
5 pm on April 21, 2020***

# The Portfolio must contain:

**1. Personal Profile:** Students, who wish to participate in the NBO competition, need to complete the online registration form. This can be done at Personal Profile Link.

([https://docs.google.com/forms/d/e/1FAIpQLSedp27VqrImeSz44ciUGNhO-xsKwpyyeVZe3NxCdUuwRKynaQ/viewform?usp=sf\\_link](https://docs.google.com/forms/d/e/1FAIpQLSedp27VqrImeSz44ciUGNhO-xsKwpyyeVZe3NxCdUuwRKynaQ/viewform?usp=sf_link))

This is NOT part of the evaluation for the Canadian Biology Olympiad, but will describe you as the participant!

**2. Teacher Reference:** each candidate must submit a confidential teacher reference. Teachers are to include the following information in the reference letter:

- a. In terms of Biology knowledge and skills, how would you rate this individual?
- b. In terms of maturity for international travel and ambassador for Canada, can you cite any examples of this student's ability to be a role model at an international venue?
- c. Do you have any concerns about this student, such as social behaviours or other issues? Would you travel with the student on an international expedition? Why or why not?

**3. Completed Activity for EACH category below (36 marks):**

**Category A: Dissection**

**Category B: Plant Biology**

**Category C: Proteomics and Phylogeny**

# Category A - Histology and Dissection Lab (12 Marks)

Category A has two parts (I and II)

NOTE: you are working with NON-preserved animal specimens, you must keep your workspace clean at all times, and you must also ensure proper clean up procedures ensuring no spread of bacterial contamination.

## Part I: Chicken Wing Dissection

Your task is a single dissection of a chicken wing, accomplishing the following skills in the dissection (filmed and uploaded to YouTube, a link needs to be provided- see below).

- a. Remove a single continuous segment of the nerve that is found between the tricep and the bicep muscles (the dissected segment is to be at least 6cm in length). Once removed, place the nerve on a piece of paper showing the dissected tissue.
- b. Clean Removal of the Radius, demonstrating a clean bone. Place the Radius on a piece of paper, and ensure you label proximal and distal ends in your video.
- c. Clean removal and demonstration of the bicep muscle. Place the bicep muscle on a piece of paper with the insertion points identified and labeled.
- d. Once the dissection has completed, take a photograph of all 3 removed items next to the dissected wing (include the labels in the photograph). This does NOT have to be done during video clip, but should be done immediately after the dissection is completed.

NOTE: the dissection is to be done as ONE continuous dissection on a single chicken wing. You can practice as much as you would like, but the actual submission, you are to use ONE chicken wing and completed while being filmed in its entirety, from start to finish. The dissection should be completed in 12 minutes, you will be asked to document the time it takes to complete your dissection, this is the expected time to complete the activity--remember at the IBO things are timed and expected to be completed.

<b>What must be submitted for Lab A-Part I Folder:</b>
(note: all documents are to be typed, with 12 pt font-size and 1-inch margins)
1. Dissection Lab Cover sheet (with appropriate details), submitted as a PDF document (Mentor/teacher signature is required)
2. A LINK to your video (to be submitted as a YouTube video--uploaded as private, but link allows the evaluators to view it). Video is to be unedited, and recorded nonstop from start to finish, and include all parts of the dissection. You can submit a pdf or word document with the link inserted.
3. One photo (.jpeg or .pdf) including the Nerve Fiber, Cleaned Radius, and Bicep muscle (from the actual chicken wing dissection that was recorded--next to your dissected wing), including proper labels. (this must be the wing you dissected in your video).

**Lab A – Part I: Dissection Cover sheet (completed and saved as pdf)**

Participant Name:

Date of Dissection:

Total Length of Time to complete dissection:

Time Segment, on the video, of the clean **removal of the Radius**  
(example: Start time is 4:08, end time is 7:43)

Start Time:

End time:

Name of Videographer (if tripod, or phone perched, just say self video)

Mentor Teacher Agreement:

(must be signed by a supervising official—someone to verify that the work is the participant's)

I, \_\_\_\_\_, the supervising teacher, confirm that the work presented/demonstrated with this cover sheet is \_\_\_\_\_ (name of student) personal's work. The video submitted represents this person's own work, and was completed in ONE undertaking, and the time it took the student to complete the dissection was \_\_\_ min \_\_\_ sec.

I also certify with my signature that this student completed the requirements as outlined in the objectives of the portfolio assignment.

\_\_\_\_\_ Signature of Teacher

\_\_\_\_\_ Position

\_\_\_\_\_ Date

\_\_\_\_\_ Contact Information<sup>[1]</sup><sub>SEP</sub> (phone or email)

## **Part II: Chicken Tissue Histology:**

Using samples from a chicken wing, you are to produce 4 different wet mount slides to observe under the microscope. You are to generate your own sectioning technique, and NOT use a commercially available microtome to section samples. You may stain the tissue if preferred, but stains must be approved at your school/site of preparation. There may have to be consultation with your mentor/teacher as to what stains are available.

Once prepared, you are to submit ONE labelled digital photograph for each of the following tissues. You are to use a light microscope to obtain your photographs, and the labels on each photograph should include any identifiable features/structures to help identify the tissue as what is being shown from the slide. The following tissues to demonstrate are:

- A. Connective tissue (at 400x magnification)
- B. Cross section slide of a nerve tissue (100x magnification)
- C. Blood vessel cross section (100x magnification)
- D. Muscle tissue (400x magnification)

### **What must be submitted for Lab A-Part II Folder:**

**(note: all documents are to be typed, with 12 pt font-size and 1-inch margins)**

1. Chicken Histology Lab Coversheet
2. Procedural Summary Page: A maximum one-page explanation of how you were able to section the tissues for slide preparation. Include your technique for creating thin sections without using a commercial microtome, and how you were able to do your sections. Two additional photos are acceptable to show your technique (and can be in addition to the one-page explanation).
3. 4 Labelled Photos: One for each tissues A through D. These are to be YOUR sections and photos taken after YOU have focused the tissue under a light microscope. Labels added to show identifiable features to help identify the specific tissue being demonstrated.

**NOTE:** you must hand section the tissues; the use of a mechanical microtome is not permitted--these are fresh wet mounts and stained with dyes available at your school. These are not to be professionally made slides.

**Lab A – Part II: Chicken Tissue Histology Coversheet (completed and saved as pdf)**

Participant Name:

Date of Sectioning and Staining:

Name of Photographer (if different than yourself)

Mentor Teacher Agreement:

(must be signed by a supervising official—someone to verify that the work is the participant's)

I, \_\_\_\_\_, the supervising teacher, confirm that the work presented/demonstrated with this cover sheet is \_\_\_\_\_ (name of student) personal's work. The photos submitted represents this person's own work, and the slides were prepared by the student, and the microscopy work is the student's own work.

I also certify with my signature that this student completed the requirements as outlined in the objectives of the portfolio assignment.

\_\_\_\_\_ Signature of Teacher

\_\_\_\_\_ Position

\_\_\_\_\_ Date

\_\_\_\_\_ Contact Information<sup>[11]</sup><sub>SEP</sub> (phone or email)



## **Category B: Plant evolutionary biology and embryology Lab (12 marks)**

Category B has two parts (I and II)

### **Part I: Power Point presentation**

Download the attached PowerPoint presentation template.

**Slide 1:** Write a title for your presentation, your name and the date your presentation was completed

**Slide 2:** Use the timeline template on slide 2 to describe in details the macroscopic and microscopic differences in meiotic division and embryo development of conifers. Starting with pollen and Ovule development then fertilization and finally embryo development (Hint: in conifers the process takes about 15 months). You must indicate when meiosis and mitosis occur.

**Slide 3:** Use the timeline template on slide 3 to describe in details flower development of Amaryllis. Indicate when the ovules are produced in flowers and meiotic divisions occur in the Anther. Describe the fertilization event and embryo development.

You are welcome to incorporate images from your cone and Amaryllis ovule slides (prepared in Part II) into your PowerPoint.

**Slide 4:** Summarize the differences in the male and female gametes development between pine and Amaryllis.

**Slide 5:** Summary of the standard method used to extract the developing plant embryonic tissue for examination.

### **Part II: Slide preparation**

- A. Collect a Pine cones from the environment. Slide preparation- Dissect and stain scale/ ovule complex of an immature cone and a mature Pine cone.
- B. Grow an Amaryllis plant from a bulb. Slide preparation- Dissect and stain developing ovary.
- C. Create a photo essay from your slides featuring your own specimen and comparing the Pine and Amaryllis developing ovaries. Make sure you include captions to each image and label all cellular structures found in the images. Write a 100-300 words essay comparing your two slides.
- D. Prepare a five-minute video (maximum) demonstrating your slide preparation technique with audio describing what you are doing. Video is to be unedited, and recorded nonstop from start to finish. The video is to be uploaded on a private YouTube site and you are required to submit a pdf or word document with the link inserted.

Skills to demonstrate:

- Your understanding in the embryo development process in vascular plants
- Your ability to communicate biological processes to an audience
- Proper sectioning and staining techniques
- Proper display of photo microscopy.

**What must be submitted for Lab B Folder:**

**(note: all documents are to be typed, with 12 pt font-size and 1-inch margins)**

1. Plant evolutionary biology and embryology Lab Coversheet

2. For Part 1:

Fill in the PowerPoint (template provided) with your answers and submit as a PDF file.  
All text must be original. No paraphrasing and no plagiarism with fellow students.

3. For part 2:

- Written essay comparing the slides and photos essay with caption. All photographs in your photo essay must be original.
- In your video, you must have audio explaining your conifer and angiosperm embryo sectioning and staining. Video must be posted on YouTube. Please include the link with your submission.

**Lab B – Plant evolutionary biology and embryology Lab (completed and saved as pdf)**

Participant Name:

Date of Slide preparation:

Total Length of Time to complete slides:

Name of Videographer (if tripod, or phone perched, just say self video)

Mentor Teacher Agreement:

(must be signed by a supervising official—someone to verify that the work is the participant's)

I, \_\_\_\_\_, the supervising teacher, confirm that the work presented/demonstrated with this cover sheet is \_\_\_\_\_ (name of student) personal's work. The video submitted represents this person's own work, and was completed in ONE undertaking, and the time it took the student to complete the dissection was \_\_\_ min \_\_\_ sec.

I also certify with my signature that this student completed the requirements as outlined in the objectives of the portfolio assignment.

\_\_\_\_\_ Signature of Teacher

\_\_\_\_\_ Position

\_\_\_\_\_ Date

\_\_\_\_\_ Contact Information (phone or email)

## Category C - Determine the relatedness of fish species using molecular biology techniques (12 Marks)

This portfolio has two parts; Part I investigates your knowledge of the SDS-PAGE technique and in Part II you need to devise a method to analyze a SDS-PAGE gel of fish muscle proteins (provided to you in the Appendix below) and predict, from these data, the phylogeny of the fishes present on the gel. Then, compare/contrast your phylogenetic tree with a published phylogeny tree obtained from morphological data analysis.

### Part I: Answer the following questions about SDS-PAGE

In this experiment, proteins from several fish muscle were extracted and the proteins in the extracts were separated using a SDS-PAGE gel.

Answer the following questions about SDS-PAGE (All six answers should fit on TWO pages with text double-spaced, 12 pt font-size and margin no smaller than 1 inch):

1. What does SDS-PAGE stand for?
2. What is a SDS-PAGE gel made of?
3. What are SDS\_PAGE used for?
4. How does a SDS-PAGE work?
5. What are the purposes of SDS in sample preparation and in the SDS-PAGE gel??
6. In which conformation are the proteins when they are run on a SDS-PAGE gel?

**References:** Make sure to include references. Peered reviewed references are preferred. References can be on a separate page (they are not included in the page limit).

### Part II: Phylogeny of the fishes using molecular analysis

Using the SDS-PAGE gel (Figure 1, in the Appendix), you are to devise a way to analyze the gel in order to determine the phylogeny of the fishes **according** to their protein muscle band patterns.

4. **Explain** how you will analyze the gel in order to determine the phylogeny of the fishes according to their protein muscle band patterns. Your explanation should fit on ONE page with text double-spaced, 12 pt font-size and margin no smaller than 1 inch). Make sure to include all calculations on a separate page.
5. **Draw** the Phylogenetic tree for the fishes on the gel that fits your analysis of the SDS-PAGE data.
6. **Compare/contrast** your constructed phylogenetic tree with a published phylogenetic tree built based on morphological data. Make sure to include the reference of the published tree. Your explanation should fit on ONE page with text double-spaced, 12 pt font-size and margin no smaller than 1 inch).

## What must be submitted for Lab C Folder:

(note: all documents are to be typed, with 12 pt font-size and 1-inch margins)

1. Lab C: Cover Sheet (PDF of the signed document is acceptable)
2. Part I: Single Document-SDS-PAGE Understanding:
  - Answers of the 6 questions, explaining SDS-PAGE. Max: 2 pages, double-spaced; (references are provided on an additional page)
3. Part II: 3 Separate Documents:
  7. Gel analysis:
    1. Max: 1 page, double-spaced; Calculation must be provided on a separate page
  8. Phylogenetic Tree:
    1. Obtained from the gel data.
  9. Comparing and Contrasting Phylogenetic Trees:
    1. Max: 1 page, double-spaced; Make sure you include reference.

## Lab C: Phylogeny of Fishes using molecular analysis (completed and saved as pdf)

Participant Name:

Mentor Teacher Agreement:

(must be signed by a supervising official—someone to verify that the work is the participant's)

I, \_\_\_\_\_, the supervising teacher, confirm that the work presented/demonstrated with this cover sheet is \_\_\_\_\_ (name of student) personal's work. The answers and analysis submitted represents this person's own work,

I also certify with my signature that this student completed the requirements as outlined in the objectives of the portfolio assignment.

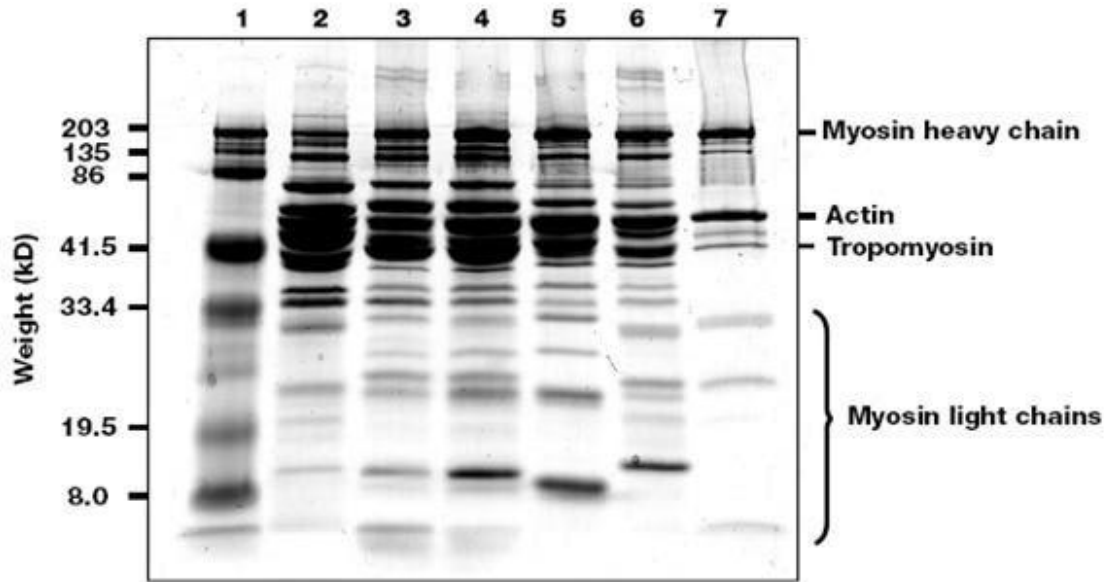
\_\_\_\_\_ Signature of Teacher

\_\_\_\_\_ Position

\_\_\_\_\_ Date

\_\_\_\_\_ Contact Information<sup>[1]</sup><sub>SEP</sub> (phone or email)

## Appendix



Lane: 1. Kaleidoscope standards  
2. Shark  
3. Salmon  
4. Trout  
5. Catfish  
6. Sturgeon  
7. Actin and myosin standard

Figure 1. 15% polyacrylamide Ready Gel electrophoresed at 200 V for 30 minutes, stained with Bio-Safe Coomassie stain and destained in water.