

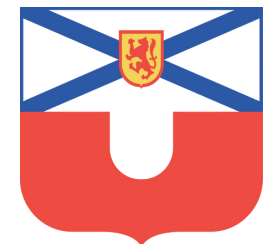
TOXIC PUZZLE

CURRICULUM RESOURCE

PRESENTED BY



SPONSORED BY



Nova Scotia
Teachers Union

CURRICULUM BY

Mrs. Krista LeBlanc

IB Biology HL
Biology 11/12
Food Science 12

TOXIC PUZZLE

A DOCUMENTARY BY BO LANDIN | NARRATED BY HARRISON FORD
2017 | UNITED STATES | 82 MINUTES | [TRAILER \(https://www.toxicpuzzle.com\)](https://www.toxicpuzzle.com)

TEACHER'S GUIDE

This curriculum resource will guide teachers and students to enrich their viewing experience of the 2017 documentary *Toxic Puzzle: The Hunt for the Hidden Killer*. This resource is designed to help teachers frame discussions with their class, with viewing activities for the film as well as an assignment relating to the themes of the film that can be completed after viewing.

ABOUT THE FILM

Dying from diseases like ALS and Alzheimer's is a tormenting process. The illnesses are on the increase and scientists believe an environmental toxins can trigger the disease in a gene/environment interaction. *Toxic Puzzle* is a medical and environmental detective story where documentary filmmaker Bo Landin follows ethnobotanist Dr. Paul Alan Cox and his scientific team around the world in a hunt for the hidden killer. The pieces come together in a toxic puzzle where cyanobacteria in our waters become the culprit.

Are these organisms, fed by human pollution and climate change, staging nature's revenge by claiming human lives?

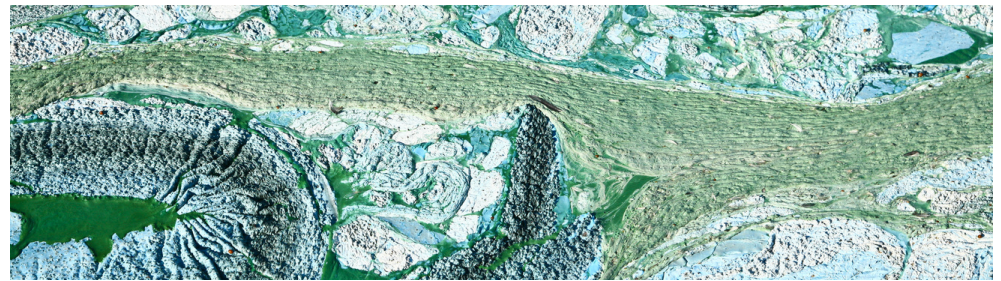
In the film, which has been four year in the making, filmmaker Bo Landin was granted unique access to follow Paul Cox and over 50 collaborating scientists from around the world. On their quest to learn more about toxic substances produced by cyanobacteria, they make an extraordinary discovery of a link between cyanobacteria and ALS (Lou Gehrig's disease), Alzheimer's and Parkinson's illnesses. Is it possible that this link may also provide clues to a cure?

Source: <https://www.toxicpuzzle.com/about>

ABOUT THE FILMMAKER

Bo Landin is the award winning founding director of Scandinare Film. He holds a B.Sc. in biological sciences and has 40 years of experience as a science, natural history and environmental writer and producer for magazines, books, radio and television.

Source: <https://www.toxicpuzzle.com/crew>





LEARNING OUTCOMES

SCIENCE 10 STUDENTS WILL BE EXPECTED TO...

OUTCOME #	OUTCOME STATEMENT
331-1, 214-3	<ul style="list-style-type: none"> Use scientific theory, identify questions about, illustrate, and explain heat energy transfers that occur in the water cycle
331-3	<ul style="list-style-type: none"> Describe how the atmosphere and hydrosphere act as heat sinks in the water cycle
318-2, 318-5	<ul style="list-style-type: none"> Distinguish between biotic and abiotic factors, determining the impact on the consumers at all trophic levels due to bioaccumulation, variability, and diversity
214-1, 318-6	<ul style="list-style-type: none"> Describe how the classification involved in the biodiversity of an ecosystem is responsible for its sustainability
212-4, 214-3, 331-6	<ul style="list-style-type: none"> Predict and analyze the impact of external factors on the sustainability of an ecosystem, using a variety of formats
213-7, 215-1, 318-4	<ul style="list-style-type: none"> Diagnose and report the ecosystem's response to short-term stress and long-term change

OCEANS 11 STUDENTS WILL BE EXPECTED TO...

UNIT	OUTCOME STATEMENT
Marine Biome	Life in the Oceans: <ul style="list-style-type: none"> Explain the marine biome and describe the biodiversity of ocean life and determine interconnections that exist within the marine biome (MBIO-1)

FOOD SCIENCE 12 STUDENTS WILL BE EXPECTED TO...

UNIT	OUTCOME STATEMENT
Food Constituents	Water and Other Constituents in Food: <ul style="list-style-type: none"> 1.6 Summarize the functions of water in food preparation and food development
Preservation Factors	Food Microbiology and Food Safety: Food Safety Microbiology: <ul style="list-style-type: none"> 2.5 Explain how viruses, bacteria, moulds, and parasites can cause disease

BIOLOGY 12 STUDENTS WILL BE EXPECTED TO...

UNIT	OUTCOME STATEMENT
Maintaining Dynamic Equilibrium II	Nervous System: Neurons and Structure: <ul style="list-style-type: none"> Evaluate the impact of viral, bacterial, genetic, and environmental diseases on an organism's homeostasis (317-4) Design an experiment to investigate and collect data on aspects of the nervous system and identify specific variables involved (212-6) Analyze how and why technologies and drugs developed and improved over time can affect homeostasis (115-5, 317-7)
	Endocrine System: Maintaining Homeostasis: <ul style="list-style-type: none"> Identify and describe the structure and function of important biochemical compounds, including protein and steroid hormones (314-3) Analyze contributions, including Canadian, to science and technology and how these have improved over time (117-11, 115-5)
Genetic Continuity	Implications: <ul style="list-style-type: none"> Students will be expected to explain the circumstances that lead to genetic diseases (315-8)

INTRODUCTION

The film *Toxic Puzzle* investigates the role the environment plays on the development of illnesses like ALS, Alzheimer’s and Parkinson’s disease. We will follow Dr. Paul Cox around the globe as he works as a medical detective to uncover if there are links between these fatal diseases and the environment we live in. As you watch the film, please complete the following questions. We will synthesize our discoveries as a class after.

INITIAL THOUGHTS: Prior to watching the film, take a moment to use your textbook, notes, the internet to research a little bit about key topics.

1) What is ALS (Lou Gehrig’s) disease? List how it affects the brain/neurons and the symptoms.

2) What is cyanobacteria? Include a little sketch to accompany your initial notes.

3) What is an algal bloom?

VIEWING QUESTIONS: As you watch the film, please complete the questions below. We will need these pieces of the puzzle for post-viewing activities.

1) In previous science classes (Science 7-10, Biology 11 and Oceans 11) we learn a lot about cyanobacteria. Throughout the film, *Toxic Puzzle*, you will hear lots about cyanobacteria that you may not have known about. Use the space below to write new information you learn about this microscopic photosynthetic bacteria.

2) What is the suggested relationship between increasing sea temperatures and cyanobacteria blooms?

3) Dr. Paul Cox, the film’s main narrator has a passion for people, and medicine. He describes himself as an ethnobotanist and studies ethnomedicine.


4) How can conversations with elders around the world lead to discoveries in modern medicine? Use an example specifically mentioned in the film to strengthen your answer.

What is an ethnobotanist?

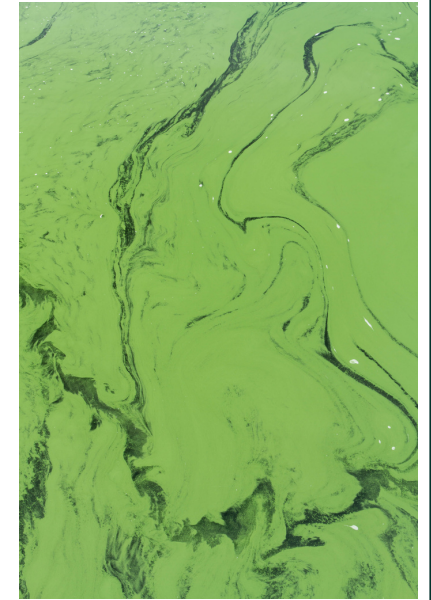
What is ethnomedicine?

5) What is BMAA? How does it affect the brain?

6) Gulf War Syndrome has puzzled scientists in North America for more than 2 decades. What interesting information does Dr. Cox discover in Kuwait?

<p>7) There is an old saying that “you are what you eat” -- should the saying be modified to say “you are what you eat and breathe”? What evidence is presented in the film to change your thinking?</p>	<p>8) In the early 16th century, Robert Hooke noted that the river Thames changed colour based on the season. He became fascinated with little “animalcules” in the water as he used the microscope to discover and draw the hidden kingdom. What comparisons can draw between Dr. Paul Cox and Robert Hooke? Suppose they were to have supper together to discuss their findings, what excitements would they share?</p>	
<p>9) Algae blooms are not a problem just in Canada and the United States. The film takes us around the world to various other locations experiencing high levels of cyanobacteria blooms. What relationship do scientists see between algae blooms and coastal communities of people in the following areas:</p> <p>a) Sweden</p>	<p>10) How do algal blooms of cyanobacteria affect apex predators like dolphins?</p>	<p>11) Do you think that filter feeding organisms found in the supermarket, like mussels and oysters should come with a food poisoning advisory? Justify your answer.</p> 
<p>b) France</p> <p>c) Qatar</p> <p>d) Guam</p> <p>e) Japan</p> <p>f) Australia</p>	<p>12) An incredible discovery is made in the film that links a Japanese diet that is rich in L-serine, an amino acid, with increased brain function and less risk of developing ALS with age. Would you willingly change your diet, if you knew that it would prevent degenerative brain diseases? Explain.</p> <p>You may want to visit this helpful website after the film: https://www.alzdiscovery.org/cognitive-vitality/ratings/l-serine</p>	<p>13) The film highlights the incredible teamwork that can happen when scientists from around the world work together. What incredible finding does Dr. Paul Cox and his worldwide team conclude at the end of the film?</p>

14) In the film, we see scientists wearing protective masks around algal blooms of cyanobacteria. Do you think that these protective measures should be promoted around Lake Banook & Lake MicMac, a local area in Dartmouth that frequently experiences blooms?



Read recent public swimming advisory: <https://www.halifax.ca/about-halifax/energy-environment/harmful-algae-blooms>

15) Drink Up! Many people around the world consume “green juice” that contains Spirulina or they ingest blue-green algae powder to boost health and well-being. Do you believe that people are unknowingly consuming potentially harmful substances?

What important discovery did Canadian researchers make about Spirulina juice? Now that you are aware of this discovery, would you change your consumption pattern of this green juice?





POST-VIEWING ASSIGNMENT

Group Names: _____

INTRODUCTION

Now that you have viewed the film *Toxic Puzzle*, you likely are feeling informed and want to tell everyone about the major findings from the film! Great news! You have an upcoming lunch with the mayor of your town. An insider tells you that you will be seated right beside them. You know that your coastal community and elders are depending on you.

Working in a small group, develop a focused message that you would like to deliver at this luncheon about the major take-aways from the film. You will have one class to brainstorm and complete the page below, then you will have one class to make a digital audio recording of your conversation from the luncheon that will make your community very proud. Now that you have seen the film, you must decide the main topic your group is interested in raising awareness for. To do this, you will need to examine the major themes of the movie a little closer.

1 - WHY? Within a small group, start by drafting some of the <i>why</i> questions on the topic, such as: <ul style="list-style-type: none"> • Why does human health depend on environmental health? • Why should we care about BMAA testing in our food and air? 	2 - WHAT IF? All of our actions today travel downstream to affect our future. Consider the impossible! <ul style="list-style-type: none"> • What if we were able to decrease the temperature of the ocean? What would be the ripple into our brains? • What if we had the resources to test all food prior to consumption for BMAA? • What if we changed our irrigation practices so that only filtered water was used to water wheat? • What if we marketed diet change in lieu of medications for helping us age well? 	3 - HOW? Now consider where we can start to prevent neurodegenerative diseases like ALS, Alzheimer's and Parkinson's disease. <ul style="list-style-type: none"> • How can an understanding of toxins from cyanobacteria help with the prevention of ALS? • How can we use L-serine to treat brain disorders?
1)	1)	1)
2)	2)	2)
3)	3)	3)
4)	4)	4)
5)	5)	5)

REFLECT & WRITE

With your group, reflect on the questions you wrote on the previous page. What common themes do you see on the page? What would you like to tell the mayor of your town about the health and wellness of your coastal community?

Use the space below to write your persuasive essay that you will memorize for your lunch meeting. Have a peer edit your work, and then using a laptop and headphones, or a phone record your lunch with the mayor. You may opt to record a conversation between two people or you may opt for a monologue. Be creative, and have fun! Your community is going to be so proud of your efforts!



POSTER CAMPAIGN

Your luncheon is such a success that the mayor hires you on with the city to help develop an ad campaign for promoting wellness during algal blooms in the local lake. Formerly, the lake would only close sections of the beach for swimming, stating to the public that ingesting the bloom could cause upset stomach or diarrhea, now the mayor is aware that they were incorrect with their public advisories.

Please draft new signage for the beach, should it be closed in the summer due to algal blooms of cyanobacteria. Remember on your signage that our most vulnerable community members may be unable to read or may not speak English. Be inclusive with the images and languages that you use to promote public safety.