Blackwell's Labyrinth

Round 1:

Delegate Cap(2 delegates)

Research Proposal – Before the Outbreak

Overview and Significance

Round 1 represents the initial basis, both scientific and ethical, for the rest of the medical module. As medical researchers, delegates will represent five different countries, in an environment before the outbreak occurred: the research decisions made at this stage will strongly influence how humanity responds globally to the impending health crisis. Delegates will develop their own original medical research proposals that relate to the venom of Laophis crotaloides and its interaction with oleander-derived bioactive compounds. In their proposal, delegates will discuss formulating a biologically sound hypothesis and scientific goal on how these substances may potentially support and enhance the immune response, antiviral resistance, and/or relieve disease symptoms, while taking into account the possible hazards of using potentially toxic and unstable biological materials. This round presents an opportunity to explore crisis science rather than responding to a crisis. Delegates must design a logical and conceptual methodology appropriate for controlled laboratory work, meanwhile on the other hand identifying risks, ethical considerations, and environmental consequences. This round allows delegates to demonstrate their skills in designing research proposals without ever conducting experiments. Providing delegates with recognition of the value of developing an ethical and foresighted perspective toward global medical responsibility.

Step-by-Step Progression

1. At the start of the round, participants will be briefed on the task and the scientific context of *Laophis crotaloides*, based on the content previously covered in the study guides.
2. Participants will assume roles of medical researchers and begin developing an original research proposal using their prior preparation and subject knowledge.
3. The research proposal must be written in a structured format, including an introduction, a clearly stated hypothesis, defined scientific objectives, a conceptual

outline of the proposed methodology, potential applications for human benefit, and a comprehensive assessment of risks and ethical considerations.

4. Participants will be given approximately two hours to complete the written research proposal during the session.
5. The use of internet sources, electronic devices, or external reference materials will not be permitted. All work must be completed based solely on prior knowledge and the provided briefing.
6. At the end of the time period, each team must submit its research proposals. The proposals will be based on the quality of the submissions, with emphasis on scientific reasoning, originality, feasibility, clarity of presentation, and ethical responsibility.

Proposal Format

a) Hypothesis and Scientific Goal

- A clear hypothesis grounded in known or expected properties of Laophis crotaloides venom
- A defined scientific aim that explains the purpose of the proposed research
- Justification for the hypothesis using biological principles, toxin behaviour, or immunological reasoning

b) Methodology (Conceptual Scientific Approach)

- A stepwise plan describing how the venom would be extracted, stabilised, observed, and analysed
- Use of conceptual biological reasoning, such as controlled conditions, monitoring, and gradual variable adjustment
- Consideration of safe handling, contamination prevention, and sample stability
- No requirement for advanced laboratory instrumentation; emphasis is on logic and feasibility.

c) Potential Applications for Human Benefit

- Explanation of how venom-derived compounds may contribute to immunity, antiviral resistance, or treatment development
- Connection to realistic medical applications based on biological mechanisms
- Description of wider global significance

d) Risk Assessment and Ethical Considerations

- Identification of toxicity risks, instability concerns, and possible misuse of venom
- Consideration of ethical dilemmas, including the extinct status of Laophis crotaloides, wildlife impact, and research responsibility
- Evaluation of environmental, scientific, and procedural risks

- Clear strategies for prevention, monitoring, and failure management.

Qualities and Skills Evaluated

The judges will not provide a marking breakdown, but delegates must understand the criteria used to assess proposals:

- Technical accuracy in biological and toxicological concepts
- Logical flow in scientific methodology
- Responsible and realistic conceptual planning
- Awareness of ecological, ethical, and species-related considerations
- Clarity, structure, and coherence in writing
- Justified reasoning behind scientific decisions
- Creativity balanced with feasibility
- Strong performance depends on clear reasoning rather than advanced laboratory expertise.

Delegate responsibilities

- Arrive prepared with all prior background knowledge
- Bring no electronic devices, personal notes, textbooks, or external materials
- Be mentally prepared for a time-restricted scientific writing task

Elimination Structure

Round 1 includes a significant elimination phase:

- 50 percent are eliminated based on proposal quality
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This makes Round 1 one of the most academically demanding stages of the module.

Study Resources

Category	Resources
Topics to Study	Venom Biochemistry and Its Therapeutic Effects Academic Research Proposal Formats and Basic (Undergraduate) How to design simple, logical, and accurate science experiments
Essential Reading	https://www.sciencedirect.com/topics/medicine-and-dentistry/snake-venom https://pmc.ncbi.nlm.nih.gov/articles/PMC6832721/ https://pubmed.ncbi.nlm.nih.gov/33385156/ https://www.uh.edu/~lsong5/documents/A%20sample%20proposal%20with%20comment.pdf https://www.scirp.org/journal/paperinformation?paperid=68101

	https://www.yorksj.ac.uk/media/content-assets/research/documents/Proposal-Example-2.doc https://www.matrix.edu.au/how-to-write-a-scientific-report/
Inspiration Gallery	https://www.youtube.com/watch?v=GX3DSGz8gMg https://www.youtube.com/watch?v=0Wz-Wd07U6c https://youtu.be/aUR4blxBWxY?si=ZGYU3ZHlmX88PGAF https://youtu.be/166FXhGd9T4?si=L3JvowAfJf1u4OQM

ROUND 2: Brain Model – During Breakout

Delegate Cap(3 delegates)

Detailed Overview

In this round of the Medical Module, participants will construct a three-dimensional model of the brain to demonstrate their understanding of neuroanatomy and disease pathology. The objective of the round is to accurately identify and label brain regions affected by the given virus and to explain how disruptions in these neural structures lead to abnormal behaviour observed in infected animals. Participants are expected to use the model to clearly illustrate affected areas and link structural or functional damage to specific neurological symptoms. Evaluation will be based on accuracy in identifying neural structures, the scientific clarity of explanations provided for observed behavioural changes, and the creativity and overall quality of the model's presentation. Expected outcomes include demonstrating a strong understanding of brain anatomy, the neurological basis of behaviour, and the ability to communicate complex medical concepts through visual and structural representation.

Step-by-Step Progression

1. At the beginning of the round, participants will be informed of the animal brain they are required to model. The selected animal will be one of the four options covered below.

2. Participants will begin by constructing the internal structure of the brain using a newspaper core to establish the basic shape and proportions.

3. The newspaper core will then be covered with air-dry clay, which participants will use to form detailed anatomical features of the brain, ensuring accurate representation of major structures.

4. As the model is developed, participants will clearly label all relevant brain regions, with particular emphasis on areas affected by the virus. Participants must use their own coloured pencils and markers for labelling and visual differentiation.

5. Alongside the physical model, participants will create a trifold display. This trifold must explain which parts of the brain are impacted by the virus assigned to them and describe how disruptions in these regions lead to abnormal behaviour in infected animals.

6. Participants will be given a total of two and a half hours to complete the brain model, trifold display, and final labelling.

7. Upon completion, participants will present their model and trifold to the evaluators, explaining the affected brain regions and the neurological basis of the symptoms.

8. Evaluation will be based on anatomical accuracy, clarity and scientific correctness of explanations, creativity, effective use of materials, and overall presentation quality.

Resources:

1. Chart papers for trifold stand
2. Nontoxic Glue
3. Participants will be asked to bring their own coloured pencils and markers
4. Toothpicks for label pointers
5. Scissors
6. Tape
7. Modelling clay for brain model
8. Newspaper to form the core of the brain mode
9. Masking Tape to cover the and hold together the newspaper core

The Preparation and Study Resource Hub

1. <u>Pigeon</u>

   The brain of birds is highly developed and is the second largest after mammals. It is short, broad, rounded, and whitish in shape and is divided into the forebrain, midbrain, and hindbrain.

   The forebrain includes the cerebral hemispheres, which are large, smooth, and pear-shaped, separated by a deep groove. These hemispheres control intelligence, learning, behavior, and voluntary

actions. The olfactory bulbs are very small, showing a weak sense of smell. The corpus striatum, a large visible part, helps in movement control. The pituitary gland, seen hanging below the brain, controls growth, hormones, and metabolism and can also be affected by viral diseases.

The midbrain has two large optic lobes, clearly visible on the sides. These control vision and are well developed because birds have sharp eyesight. Viral infections can disturb vision by affecting this region.

The hindbrain mainly includes the cerebellum, which is large and folded. It controls balance, posture, and muscle coordination, especially important for flight. Damage or viral infection here can cause loss of balance. Behind it lies the medulla oblongata, which connects the brain to the spinal cord and controls breathing and heartbeat.

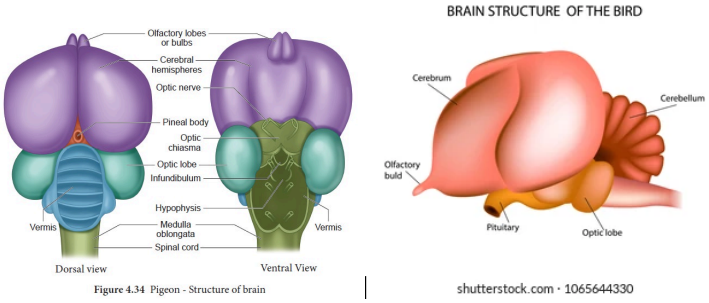


Figure 4.34 Pigeon - Structure of brain

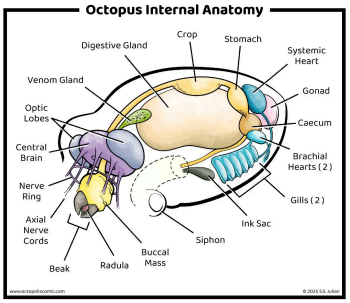
2. <u>Octopus</u>

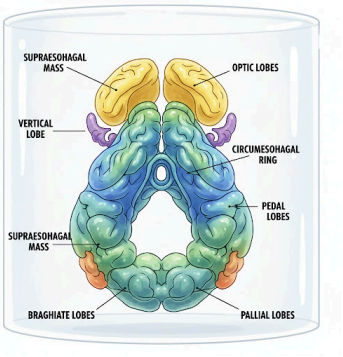
The brain of the octopus is highly developed among invertebrates and is large in proportion to its body size. It is compact, ring-shaped, and surrounds the oesophagus. The octopus brain is mainly divided into lobes, which can be clearly shown in a clay model.

The main brain mass lies around the esophagus and controls intelligence, learning, decision-making, and behavior. This region helps the octopus solve problems and adapt to its surroundings. These lobes are responsible for the octopus's high intelligence and problem-solving ability.
On either side of the brain are the large optic lobes, which are very large and well developed and control vision. Since octopuses rely heavily on eyesight for camouflage and help the octopus detect prey and predators.

Damage or infection in this region can cause poor movement and loss of coordination. A prominent structure called the vertical lobe is

involved in learning and memory. Extending from the brain are thick nerve centers connected to the arms, which control movement, gripping, and coordination. Together, these brain structures help the octopus survive, learn, and interact with its environment.





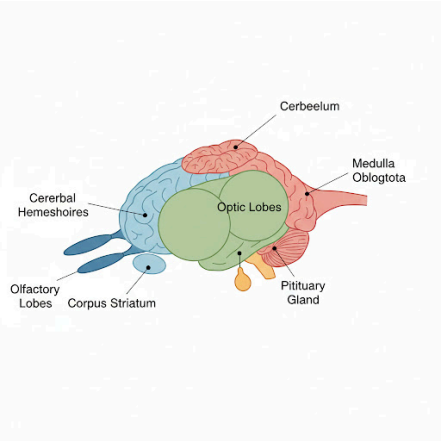
3. <u>Frog</u>

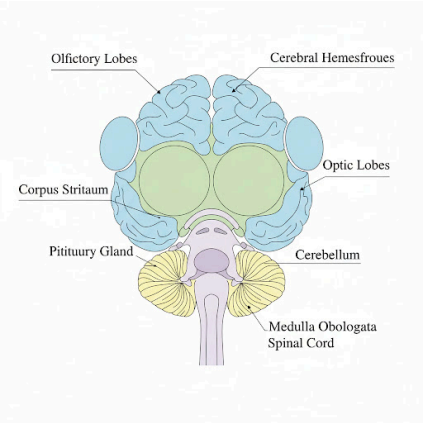
The brain of a frog is relatively small but well organized and is divided into three main parts: the forebrain, midbrain, and hindbrain.

The forebrain includes the cerebral hemispheres, which are small and smooth. These hemispheres control voluntary actions, learning, and behavior. The olfactory lobes, located at the front, are well developed in frogs and help them detect smells in their environment. The corpus striatum is another important structure in the forebrain that coordinates movement.

The midbrain contains the optic lobes, which are large and control vision. Frogs rely heavily on sight to catch prey, so these lobes are well developed. The pituitary glan, located below the brain, regulates hormones, growth, and metabolism.

The hindbrain consists mainly of the cerebellum, which is small but controls balance and coordination, helping frogs move and jump accurately. Behind it is the medulla oblongata, which connects the brain to the spinal cord and regulates essential functions such as breathing and heartbeat.





4. Deer

The brain of a deer is relatively large among mammals and is divided into three main parts: the forebrain, midbrain, and hindbrain.

The forebrain includes the cerebral hemispheres, which are well developed and smooth. These hemispheres control intelligence, learning, memory, behavior, and voluntary actions. The olfactory bulbs are prominent, reflecting the deer's keen sense of smell, which is important for detecting predators and finding food. The corpus striatum, a large visible structure, helps in coordinating body movements. The pituitary gland, located beneath the brain, regulates growth, hormones, and metabolism.

The midbrain contains the optic lobes, which process visual information. Deer have sharp eyesight, and these lobes help them detect movement and navigate their environment.

The hindbrain includes the cerebellum, which is large and folded, controlling balance, posture, and coordination; critical for running and jumping. The medulla oblongata, located below the cerebellum, connects the brain to the spinal cord and regulates vital functions such as heartbeat and breathing.

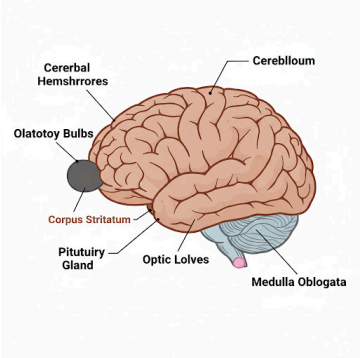
PATHOGENS AND VIRUSES AND THEIR AFFECT

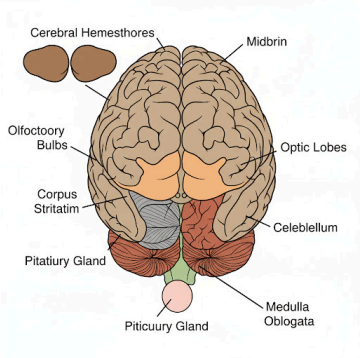
Pathogen Name	Target Area of Brain / Nervous System	Effect on Activity of Animal	Animal(s) Affected

Rabies virus	Brainstem and limbic system	Neuronal dysfunction; aggression, disorientation, abnormal attacks	Deer
Parelaphostrongylus tenuis (brainworm)	Meninges and spinal cord	Inflammatory damage; incoordination, stumbling	Deer
Prions (Chronic Wasting Disease)	Cerebrum, basal ganglia	Spongiform degeneration; disorientation, abnormal grazing	Deer
Borrelia burgdorferi (Lyme disease)	CNS	Demyelination; weakness, lethargy, altered motor coordination	Deer
Angiostrongylus cantonensis	Brain and spinal cord	Larval migration causes inflammation; paralysis, disorientation	Deer
Western equine herpesvirus	Brainstem and cerebellum	Neuronal necrosis; motor dysfunction, abnormal movement	Deer
Chytrid fungus (*Batrachochytrium dendrobatidis*)	Peripheral nerves affecting motor control	Neural disruption; lethargy, loss of righting reflex	Frog
Ranavirus	Brainstem, cerebrum	Viral necrosis; reduced mobility, erratic swimming	Frog
Aeromonas hydrophila (bacterial)	CNS, spinal cord	Inflammation, neural damage; lethargy, loss of coordination	Frog
Batrachochytrium salamandrivorans	Peripheral nerves	Disrupted neural signaling; paralysis, abnormal locomotion	Frog

Trematode (*Ribeiroia ondatrae*)	CNS	Neural damage; impaired swimming and righting reflex	Frog
Iridovirus	Brain and spinal cord	Neuronal necrosis; lethargy, abnormal escape responses	Frog
West Nile virus (WNV)	Forebrain, midbrain, cerebellum	Viral encephalitis; ataxia, tremors, impaired coordination	Pigeon
Borna disease virus	Limbic system, hippocampus	Neuronal degeneration; agitation, hyperactivity, abnormal social behavior	Pigeon
Eastern equine encephalitis virus (EEE)	Cerebrum, brainstem	Neuronal necrosis; weakness, paralysis, abnormal aggression	Pigeon
Western equine encephalitis virus (WEE)	Cerebrum, cerebellum	Neuronal damage; movement disorders, impaired coordination	Pigeon
St. Louis encephalitis virus (SLEV)	Cerebrum, midbrain	Neuronal inflammation; lethargy, tremors, abnormal hunting/escape	Pigeon
Usutu virus (USUV)	Cerebellum, forebrain	Neuronal damage; impaired movement, abnormal flocking	Pigeon
Ostreid herpesvirus (OsHV-1)	Neural ganglia	Neuronal necrosis; disoriented arm movement, impaired coordination	Octopus
Aggregata (protozoan parasite)	Peripheral ganglia of arms	Damages arm neurons; reduced grip, slow response	Octopus

Vibrio lentus (bacterial)	Neural tissues	Necrosis, systemic inflammation; lethargy, abnormal movement	Octopus
Paralytic shellfish toxin (PSP, saxitoxin)	Peripheral and central neurons	Blocks sodium channels; impaired arm movement, disorientation	Octopus
Ophiocordyceps-like fungus	Neural ganglia	Tissue destruction; abnormal movement, erratic arm coordination	Octopus
Naegleria fowleri	Cerebrum and olfactory bulb	Amoebic necrosis; disorientation, abnormal behavior	Deer, Pigeon
Toxoplasma gondii	Amygdala, limbic system	Tissue cysts; reduced fear, risk-taking behavior	Deer, Pigeon
Herpesviruses (avian/mammal)	Forebrain, midbrain	Neuronal necrosis and inflammation; seizures, loss of coordination	Deer, Pigeon





https://www.notesonzoology.com/phylum-chordata/pigeon-phylum-chordata/nervous-system-of-pigeon-with-diagram-vertebrates-chordata-zoology/7983

https://www.sfb874.ruhr-uni-bochum.de/en/rub-scientists-investigate-anatomy-of-the-pigeon-brain/

https://octonation.com/octopus-brain/

https://scienceinsights.org/the-anatomy-of-the-octopus-brain-and-its-intelligence/?

notesonzoology.com/frog/nervous-system-of-frog-with-diagram-vertebrates-chordata-zoology/8161

https://gna.it.com/frog-brain-structure?utm

https://www.simplypsychology.org/forebrain-midbrain-hindbrain.html

Round 3: Global Medical Debate

Delegate Cap(3 delegates)

1. Round Objective and Academic Focus

Round 3 is designed as a high level analytical and argumentative exercise that simulates decision making in an international medical and legal setting. Delegations will participate in a structured debate framed as a mock trial in an international court, where they must defend or oppose a policy, scientific intervention, or ethical decision related to a disease outbreak.

This round evaluates a delegation's ability to:

5. Apply medical and biological knowledge to real-world outbreak scenarios
6. Incorporate ethical and legal reasoning into public health decision-making
7. Use forensic and scientific evidence accurately and appropriately
8. Communicate persuasively under time constraints
9. Work collaboratively as a unified delegation

The debate emphasizes quality of reasoning over quantity of information, and judges will prioritize clarity, factual accuracy, and logical consistency.

2. Assigned Stances

At the end of round 2, each team will be:

7. Given a specific stance card indicating whether they must argue in favour of or against a particular policy or scientific approach

Examples of debate themes may include:

- Mandatory quarantine or lockdown enforcement

- Emergency approval of untested or experimental treatments
- Allocation of limited medical resources
- Government accountability for outbreak mismanagement
- Ethical responsibility toward vulnerable populations

Teams must argue strictly according to their assigned stance, regardless of personal opinions.

3. Debate Structure and Speech Organization

Each delegation must prepare a structured and coherent argument. The following format is strongly recommended:

a) Introduction

- Clearly state the delegation's assigned stance
- Briefly describe the outbreak or policy under discussion
- Define any key medical or ethical terms that will be used

b) Core Arguments

- Present 2–4 main arguments, each supported by:
    - Medical or biological knowledge (e.g., transmission, treatment efficacy, epidemiology)
    - Ethical frameworks (e.g., autonomy, beneficence, justice)
    - Legal or policy considerations where relevant

Arguments should be logically ordered and clearly signposted.

c) Use of Evidence

Delegations are expected to support claims with:

- Medical studies or documented public health guidelines
- Forensic reports or hypothetical investigation findings
- Historical or contemporary global health examples

Evidence must be relevant and clearly explained rather than simply mentioned.

d) Anticipated Rebuttals

- Identify potential counterarguments from opposing delegations
- Prepare concise, evidence-based responses
- Avoid emotional or dismissive language

e) Conclusion

- Summarize the delegation's main points
- Restate the stance clearly
- Propose a justified outcome (e.g., policy approval, reform, accountability, or dismissal)

4. Debate Timeline and Flow

- Initial preparation time is provided after stance assignment
- Each delegation delivers an opening argument (approximately two minutes)
- Rebuttal and response phases follow
- The full session will run for approximately three hours, allowing all ten delegations to present and engage

Delegations must manage time carefully. Overrunning or underdeveloped arguments will be penalized.

5. Use of Medical, Scientific, and Ethical Evidence

Delegations are expected to demonstrate knowledge appropriate to high intellectual standards, including:

- Disease transmission and containment strategies
- Diagnostic and treatment principles
- Ethical dilemmas in emergency medicine
- Public health policy impacts

Recommended Research Resources for Delegates

Public Health Ethics and Case Studies

- NCBI Bookshelf: Public Health Ethics case studies
  https://www.ncbi.nlm.nih.gov/books/NBK435778/
- BMC Medical Ethics Journal (open-access articles)
  https://bmcmedethics.biomedcentral.com

Medical Research and Evidence

- PubMed (simplified abstracts for secondary-level students)
  https://pubmed.ncbi.nlm.nih.gov

- ScienceDirect provides full-text access to peer-reviewed scientific, technical, and medical (STM) journals and e-books
  https://www.sciencedirect.com/

Famous Medicine Debates/Talks:

- Title: A Quality Debate: Should People Have Full and Real-Time Access to Their Electronic Medical Record?
  https://www.youtube.com/watch?v=23-IW9DR28A
- Title: Debating the Legacy of the COVID-19 Pandemic ft Doctor Mike, Tom Frieden, Jerome Adams and Dara Kass
  https://www.youtube.com/watch?v=JHamm-iK008
- A great Jubilee debate, which demonstrates medical ethics and shows how to calmly approach your opposition, while stating your arguments.
  Title: Doctor Mike vs 20 Anti-Vaxxers | Surrounded
  https://www.youtube.com/watch?v=o69BiOqY1Ec

Delegations are encouraged to cite sources verbally (e.g., “According to WHO guidelines…”) during debate.