Appendix I. The questionnaire.

PART I
*Please answer the following questions regarding your education and research background and general views about evolution.*

1 – **In which college are you conducting graduate studies/research?**
   
   A – College of Biological Science  
   B – College of Physical and Engineering Sciences  
   C – Ontario Agricultural College  
   D – Ontario Veterinary College

2 – **Which of the following most accurately describes the field in which you are conducting graduate studies/research?** Please choose only ONE option.

   - Crop science or agriculture
   - Biochemistry
   - Cell biology
   - Chemistry
   - Computer science
   - Conservation biology
   - Developmental biology
   - Ecology
   - Engineering
   - Environmental science
   - Evolutionary biology
   - Genetics
   - Genomics
   - Geology or geography
   - Mathematics or statistics
   - Medical sciences
   - Microbiology
   - Molecular biology
   - Nutrition sciences
   - Physics

3 – **When did you last complete a formal undergraduate course in Evolutionary Biology?**

   A – < 2 years ago  
   B – 2-3 years ago  
   C – 3-4 years ago  
   D – 4-5 years ago  
   E – > 5 years ago  
   F - Never
4 – In your opinion, how well do the following people understand evolution? 
(1=Lowest, 5=Highest)

A – You
1 2 3 4 5

B – Fellow graduate students in your field
1 2 3 4 5

C – Members of the general public
1 2 3 4 5

5 – Please rate how relevant you feel that evolution is for the following. 
(1=Lowest, 5=Highest)

A – Your day-to-day research activities.
1 2 3 4 5

B – The broader context in which your research will be interpreted and understood.
1 2 3 4 5

C – The overall goal of science at large to understand the natural world.
1 2 3 4 5

6 – How strongly do you agree with the following statements? 
(1=Lowest, 5=Highest)

A – The meaning of the word “theory” differs considerably in science versus in common language.
1 2 3 4 5

B – In science, what begins as a “theory” may be promoted to being considered a “fact” once there is overwhelming evidence to support it.
1 2 3 4 5

C – In science, “theories” do not become “facts”, but rather theories explain facts.
1 2 3 4 5
7 – Which of the following statements most closely approximates your views on evolution?

A – The relatedness of species by descent from a common ancestor (i.e., that evolution has occurred) is an established scientific fact that is supported by an overwhelming body of evidence.

B – The relatedness of species by descent from a common ancestor is generally accepted as a fact by the scientific community because there is evidence to support it, but I remain only partially convinced.

C – The relatedness of species by descent from a common ancestor remains just a theory that has not been established, although there is some evidence to support it.

D – The notion that species are related by descent from a common ancestor is purely speculative, and there is no convincing evidence to support it.

PART II

In this section, please indicate where along a continuum between two opposing statements your agreement lies by selecting 1, 2, 3, 4, or 5 for each question. For example, choosing 1 = fully agree with the statement in option 1 and disagree with the statement in option 5, choosing 3 = agree/disagree equally with both, and choosing 5 = agree fully with the statement in option 5 and disagree with the statement in option 1.

8 – Cheetahs are the fastest land mammals. They evolved their remarkable speed...  
... because in each generation, it was necessary for cheetahs to run slightly faster in order to catch prey, and as such each generation was born with slightly improved running abilities.  
1 2 3 4 5  
... because in each generation, individuals that happened to be faster runners due to chance mutations caught more prey and left more offspring than slower runners.

9 – A recent news story noted that, “Because bird flu viruses are constantly changing, health officials warn that they could adapt over time to infect and spread among humans.” These viruses are constantly changing...  
... because the replication of bird flu virus genetic material is particularly prone to error.  
1 2 3 4 5  
... because even the most successful bird flu viruses have not yet discovered a way to gain access to the large population of human hosts.
10 – It is sometimes said that “the first bird hatched from a reptile egg”. This statement...

… is correct, because the first animal with the defining features of birds (feathers, no teeth, etc.) would have been the offspring of a reptile lacking these features. ... must be interpreted somewhat figuratively, in that it would be very difficult to determine which animal qualified as the first bird but whose parents did not.

11 – Male fiddler crabs have one small claw and one very large claw, the latter of which is used in combat with other males and to attract females. The size of the large claw in these crabs...

... may become so large as to make the males unable to survive long enough to mate by interfering with their ability to walk and eat. ... may become slightly larger on average if males with the largest claws acquire the most mates, but there is a limit to how large it will become.

12 – Imagine that life exists on other planets outside our solar system. On any given planet...

… it is very likely to include complex, highly intelligent species. ... it is very likely to consist only of very simple species.

13 – A recent media report stated the following: “The scientists believe the toads evolved longer legs to conquer new territory to get to better food supplies.” Most likely, the toads that conquered the new territory were the ones...

... that were able to adapt to the newly invaded environment by evolving longer legs. ... that were able to invade the new territory because they happened to have longer legs.
14 – A media story is quoted as saying: “Scientists think that in an environment of limited resources, smaller body size becomes an advantage, and so captive populations shrink in body size over long periods of time.” Under such circumstances, one would expect that in any given generation...

... most individuals will be about the same size as their parents. 1 2 3 4 5 ...

most individuals will be slightly smaller than their parents.

15 – Resistance to antibiotics evolves because, when treated with antibiotics ...

... the most successful bacteria become resistant. 1 2 3 4 5 ...

the most resistant bacteria become successful.

16 – According to a news story about a recent fossil discovery, “evidence suggests that the first limbed animals tried all kinds of walking strategies.” What this probably means is that...

... an early population of limbed animals contained individuals that varied widely from one another in the structure of their walking appendages, but only some turned out to be successful. 1 2 3 4 5 ...

most individuals within a given species were very similar to one another in their walking appendages, but there were many differences in walking styles among related species.

17 – If a meteor had not impacted the Earth 65 million years ago and wiped out the dinosaurs...

... it is very likely that mammals nevertheless would soon have taken over because they are superior to reptiles. 1 2 3 4 5 ...

it is probable that mammals would not have become the dominant group of terrestrial vertebrates.
PART III

In this section, please indicate on the scale from 1 to 5 how strongly you agree with each statement. In all cases, 1 = strongly disagree and 5 = strongly agree.

18 – Biological evolution can be summarized succinctly and accurately as “a process of continuous change from a lower, simpler, or primitive condition to a higher, more complex, or more advanced state”.
1 2 3 4 5

19 – The large, flattened tails of beavers evolved when a mutant beaver born with a large, flat tail survived and reproduced successfully whereas the others with small, narrow tails died out.
1 2 3 4 5

20 – Exposure to pesticides typically kills off all the insects in a population except a small minority that are able to develop a means of becoming resistant.
1 2 3 4 5

21 – Saber-toothed cats may have become extinct because their fangs became too large to allow them to eat their food effectively.
1 2 3 4 5

22 – Natural selection is an evolutionary force that chooses the most fit individuals in each generation and over time results in optimal adaptive solutions to challenges posed by the environment.
1 2 3 4 5

23 – Because they are no longer beneficial, we can expect more and more humans to be born without wisdom teeth in the future.
1 2 3 4 5

24 – The carnivorous plant known as the Venus flytrap uses modified leaves to capture insect prey. These leaves include specialized features such as a folded structure, interlocking “teeth” along the edges, hair-like triggers, and mechanisms to snap shut. In order for the earliest version of this trap to have been functional, all of these features must have arisen at the same time in an ancestral flytrap plant.
1 2 3 4 5

25 – Male kangaroos engage in vigorous fights in order to ensure that only the strongest will mate, thereby improving the overall fitness of their species.
1 2 3 4 5

26 – Redwood trees are the tallest and generally most massive trees in the Americas. One plausible explanation for their remarkable size is that they needed to become taller than other trees in order to have access to the most sunlight.
1 2 3 4 5
27 – Neanderthals (*Homo neanderthalensis*) were a separate species of hominid that co-existed with anatomically modern humans (*Homo sapiens*) but went extinct roughly 25,000 years ago. In this sense, Neanderthals represented a less successful side-branch off the main line of human evolution.

28 – Even if a gene has detrimental effects on survival later in life, it may still become common if it improves reproductive output early in life.

29 – In light of an increasing number of emerging diseases, it may be a wise strategy to begin exposing children in each generation to low-level (i.e., non-fatal) infectious agents so that many generations from now babies will be born with much stronger immune systems.

30 – Compared to other animals, the human brain is very large in proportion to body size. In fact, it can be difficult for human mothers to give birth to babies with such large heads. Assuming that medical interventions could not solve the problem, further increases in infant head sizes represent a legitimate threat to the survival of the human species by making birth impossible.
PART IV

Please answer the following questions in the space provided.

31 – The fish known as the Mexican tetra (*Astyanax mexicanum*) occurs in two forms: a surface-dwelling form that has fully functional eyes and a cave-dwelling form that lives in the dark and lacks eyes. Assuming that the blind, cave-dwelling form is descended from the sighted, surface-dwelling form, please outline in the space provided how you think an evolutionary biologist would explain its loss of eyes.

32 – Bats are the only mammals capable of powered flight, and are descended from non-flying ancestors that were probably superficially similar to modern mice. In the space provided, please outline how you think an evolutionary biologist would explain the evolution of flying bats from flightless, mouse-like ancestors.
Appendix 2. Index formulae.

**Darwin Index**
100 x \(\frac{(Q8+(6-Q9)+Q10+Q11+Q12+(6-Q13)+Q14+Q15+(6-Q16)+(6-Q17)+Q18)}{55}\)

**Intuitive Index**
100 x \(\frac{((6-Q8)+Q9+(6-Q13)+(6-Q15)+Q20+Q23+Q26+Q29)}{40}\)

**Orthogenesis Index**
100 x \(\frac{((6-Q11)+Q14+Q21+Q30)}{20}\)

**Saltationism Index**
100 x \(\frac{((6-Q10)+(6-Q16)+Q19+Q24)}{20}\)

**Progressionism Index**
100 x \(\frac{((6-Q12)+(6-Q17)+Q18+Q27)}{20}\)

**Theory Index**
100 x \(\frac{(Q6A+(6-Q6B)+Q6C)}{15}\)