

1. SOMETHING IN THE FOREST

1. The author makes a distinction between lethal and non-lethal contagion. What is the difference?
2. Describe the behavior of weaverbirds and what makes them interesting.
3. Why were workers burning the fields? What impact does this have on the migration of microbes and the natural biodiversity of an area?
4. What is the importance of the reference to Monet's "women friends"?
5. Find Mt. Elgon on a map and download a picture of this ecological terrain.
6. Go to the American Museum of Natural History's rainforest exhibit site and find photos of the species listed on page 9.
7. How big is Kitum Cave? What are the characteristics of Kitum Cave as a natural habitat?
8. Why is salt so "precious" in the rainforest?
9. How does wood petrify?
10. Why does the author take the time to describe the crystals so precisely?
11. As discussed in this chapter, list three possible sources of infection from the cave.
12. How did the pillar in the cave get scored and marked? How does this realization contribute to the mood of life in the cave?
13. List the symptoms, feelings, and progression of the disease as it struck Monet. Draw a picture of this patient.
14. List all the contacts Monet had, from the onset of symptoms to death. Then list the next three people each of those contacts might have had. How many possible infections do you have in this scenario?
15. Why don't antibiotics work on viruses?
16. How does the ease of plane travel make us more susceptible to infection?
17. What is the relevance of the East Rift Valley in early human history? What famous skeleton(s) were found there?
18. Connective tissue is one of four types of tissue in our bodies. What are the other three?
19. What is a stroke?
20. Get a brain diagram and describe the functions controlled by the brain stem. Why is this seen as the most primitive part of the brain?

2. JUMPER

21. Describe some of the tools the doctor uses on Monet to find out what is wrong. What is the flaw in his procedure?
22. What is the range of normal blood pressure? What do the two numbers represent?
23. Describe the kidneys and liver during the autopsy.
24. How do the results and findings relate to the symptoms of connective tissue damage?
25. Dr. Musoke is concerned that he might have malaria. How do the symptoms of malaria compare to the ones he is experiencing?
26. What did Dr. Musoke do that contributed to the spread of the disease? What would you have done?
27. What is hemophilia and how would the symptoms compare to the ones described in this chapter?
28. How does dialysis work and why would it be appropriate here?

3. DIAGNOSIS

29. In the original home of the virus, what % of the monkeys were infected?
30. What does it mean to “jump species”? What are some more common examples of this?
31. Who was the first victim of Marburg virus and how many people did the 1967 outbreak affect? What was the fatality rate?
32. What everyday shape is the virus particle of Marburg compared to in the book?
33. What are some of the other main shapes of viruses?
34. Is a virus alive or not? How would you define life? What are the characteristics of a virus that make it seem NOT alive? What characteristics does a virus have that make it seem alive?
35. Graph the fatality rate of the three filoviruses named
36. What are the two types of Ebola?
37. Describe the recovery period and problems from Marburg. What are some of the surprising organs attacked?
38. In this chapter, the author lists four possible intermediate hosts. Make the case for or against any two of them.
39. What was being done with the sick monkeys? Why was this dangerous?
40. What is the WHO? What do they do?
41. What is the science of epidemiology? What is the root word structure of this field?
42. Find the latest statistics on the incidence of AIDS in Central and East Africa.
43. How did the mixture of monkey samples and species contribute to the hypothesis about HIV being a hybridized or mixed-origin virus?

4. A WOMAN AND A SOLDIER

44. How much education do you need to become a vet? Why does the Army need vets?
45. Nancy cuts herself in the kitchen. How does this foreshadow the events to come, and what kind of reaction and emotion does it signify on her part?

5. PROJECT EBOLA

46. What do the initials USAMRIID stand for? What other nicknames does the place have?
47. How did the USAMRIID mission change in 1969?
48. What are two examples of the lethal microorganisms being worked on at USAMRIID? What are the fears of these agents?
49. Describe the characteristics of the four levels of BSL.
50. Why does she have to do autopsies very quickly in Ebola cases?
51. What were some of the other agents Nancy had worked on and had vaccinations for? Pick three and get pictures and describe their ecology (living conditions and symptoms).
52. Anthrax is quite deadly. Why is it referred to as “safer” than Ebola?
53. From this chapter, draw a food web of Central Africa as described here, showing the relationships among the organisms listed in this passage.
54. What are the other vectors, or transmission paths, of infections (airborne is one method)?
55. Describe the viral family tree, and some of the cousins to Ebola.
56. Research and describe the protein sequence of Ebola—since the book was written it has been completely sequenced and dissected as a particle.
57. Which system is attacked first? Why is this important?
58. How do HIV and Ebola compare in their transmission?
59. What is the relevance of the practice of cleaning up dead bodies for burial?
60. How does UV light act as a sterilizing agent?
61. Diagram the steps of containment as Gene and Nancy progress through the different levels.
62. What is the value of the pressurized suit?
63. Why are gloves portrayed as the most important part of the defense against Ebola?
64. What is the decon shower for?

6. TOTAL IMMERSION

65. How are the blood samples stored? How do these facilities work? Why is this method of storage important?
66. Compare the symptoms of the dead monkeys with the symptoms in the human victims portrayed so far. Make a list.
67. What were the safety considerations in getting the monkey out of the cage and into the autopsy room?
68. What were the three life forms in the room at that time?
69. What is a parasite and why does the author describe a virus as a parasite?
70. Is Ebola a DNA or RNA virus? Why is this a meaningful way to distinguish viruses?
71. Why do scientists think that RNA may have appeared on the earth before DNA?
72. In this chapter, the author compares the scale of viruses using analogies to cities and buildings. Create another set of analogies using drops of water in a bathtub. How many polio viruses can fit on the period at the end of a sentence?
73. How many particles does it take to cause an Ebola infection?
74. What did the two sick monkeys make scientists think about Ebola? What made them special? How were they used as a control in this experiment? What was the concern about this within the experimental procedure? What was Nancy's conclusion about this?

7. EBOLA RIVER

75. Where is the virus' original spreading point? Who was the "index case"?
76. Graph the population growth in the equatorial regions of the world over the last 30 years.
77. Draw or download a picture of this ecosystem.
78. How did the practices of the hospital in Maridi contribute to the spread of the disease? How can the medical community intensify an outbreak of infectious disease?
79. What is the fatality rate in Ebola Sudan strain (subtype) and how does it compare to the Marburg strain and to the bubonic plague in medieval Europe?
80. What are some of the possible vectors for Ebola Zaire?
81. Take stock! What would happen if Ebola was let loose in a hospital? You would be safe, you're in a hospital. Is this theory correct? Give five reasons why you feel safe or unsafe and one piece of evidence to support your position.
82. What did the nuns at the Yambuku Hospital do to sterilize used syringes? What recommendations would you make to improve this practice?
83. The Sudan virus subsides, and then vanishes. Can you explain why this might be happening? What are two possible reasons the outbreak burned itself out?
84. Define *hot* as it is used in this book.
85. What is Ebola's favorite protein food?
86. What is Ebola's "strategy for success"?

87. What about the picture scares Murphy? What did he do next?
88. What is the characteristic shape they notice? Why did they decide it was a new strain?
89. Johnson says "I'm glad nature is not benign". What do you think he means? Do you agree or disagree and why?
90. What are the implications if Ebola is airborne?
91. What is a species threatening event?
92. "A virus can be useful to a species by thinning it out." Research the concept of herd immunity and how it ultimately can benefit a species chance for survival.
93. What % of Europeans were killed by the plague in the 14th century? What % of Americans were killed by the flu in 1918?
94. What were some of the steps that the villagers had taken to control the spread of the disease on their own?

8. CARDINAL

95. As the courier passed the sample of Peter Cardinal's blood to Gene Johnson at the airport, think about how this would take place after 9/11. What would have been different?
96. How was the sample stored for safety handling? How many levels of physical and biological protection were there?
97. What is the distinction between parasites and predators?
98. Describe the shape of the virus particle called the 'shepherd's crook.'
99. How did Gene Johnson culture the sample of Peter Cardinal's blood serum? Describe the three steps of this experimental protocol.
100. What does the relative lethality rate in animal species tell us about the original host or reservoir species?

9. GOING DEEP

101. Describe the experiment in 1988 that confirmed that Ebola could travel through the air.
102. What did the U.S. Army scientific team members wear in Kitum Cave to protect themselves? What other kinds of equipment did they carry to increase their safety?
103. There were 35 specialists on this trip. What were some of their fields of expertise?
104. What are sentinel animals? Give two examples.
105. What were the methods used to collect samples? Describe how light traps and pitfall traps work.
106. What is an antibody and how does this test confirm the presence or absence of a virus?

10. RESTON

107. How many monkeys are imported into the United States each year? For what purposes does this happen?
108. Which government agency(ies) are responsible for overseeing these facilities? How long are monkeys quarantined before distribution?
109. What are the characteristics of the crab-eating macaque species of monkey? Can you find a picture? Why are they described as competitors of humans in their natural environment?
110. Why can't you do an autopsy of a monkey in front of other monkeys?
111. What does the spleen do? What was the condition of the spleens in these specimens compared to a normal monkey spleen?

11. INTO LEVEL 3

112. What characterizes the safety conditions in a Level 3 facility?
113. How did they culture the virus? There were at least four different samples, what were they?
114. "A freezer can be hot as hell." What does the author mean in this case?

12. EXPOSURE

115. What's the difference between an electron microscope and a light microscope? What size particles can each see?
116. What is Pseudomonas and how does it live? What is its characteristic smell?
117. Why was it a mistake for Geisbert and Jahrling to smell the flask?

13. MEDUSA

118. Describe the six steps of preparing an EM photo.
119. "The incredible thing about living systems is that no matter how small the view, it is just as complicated as ever." What does the author mean by this? Describe some of the complexity at the cellular or molecular level.
120. How did Thomas Geisbert determine that the cells under his microscope were a form of Ebola?
121. What were some of the possible modes of infection?
122. What are inclusion bodies?
123. What are bricks and why are they so dangerous?
124. In retrospect, what was the "pepper" that Tom had seen under the light microscope

14. THE FIRST ANGEL

125. What convinced Geisbert that the substance was Marburg?
126. What is “a certain pucker factor”? What is his concern? What is his first idea that he needs to eliminate? What follow-up tests does CJ have done in order to reconfirm the test results?
127. Neither Peter nor Tom mention the “sniffing incident” to CJ, Why not? Would you have mentioned it? Why or why not?
128. Peter thinks Marburg is not easy to catch. Dan thinks it could be airborne. What evidence do you have to this point? Make a list.

15. THE SECOND ANGEL

129. What did the evidence from monkey 053’s cells show?
130. What were the safety precautions Dalgard had already implemented and then what were the new ones he had to implement?
131. How could Jahrling test to see if the monkey virus reacted in humans? What did it mean if the cells were glowing?
132. Explain the results of the culture. What was the reaction?

16. CHAIN OF COMMAND

133. How would you answer Gen. Russell’s questions about evidence for the virus being airborne? Summarize Col. Nancy Jaax’s arguments. Did she miss anything?
134. What is a thread virus?
135. Why hadn’t they published the pictures? Why did the General want it published? How does publishing advance science?
136. Why is it important to know how the viruses spread?
137. What are three ways to eliminate a virus? Which are or are not applicable at this point?
138. What is a species jumper?

17. GARBAGE BAGS

139. Why was Dalgard so afraid of Peters and of letting outsiders into the monkey house?
140. What is “extreme amplification”?
141. They examine the dirty needle hypothesis. Name two other infectious diseases spread through dirty needles?
142. The comparison to AIDS is made here. Compare the deaths so far with the 100 million predicted in this 1993 book. “And all it did was suppress the immune system.” How does the HIV virus do this?
143. Why did they have to move fast with these specimens? Why couldn’t they wait?

18. SPACE WALK

144. Describe the steps to take prior to going into a Level 4 zone.
145. How does the author characterize the states of order and disorder in life and death terms? Why are viruses an exception to this rule?
146. Why could she not confirm the presence of Ebola in these specimens? List the evidence from the internal organs.
147. Why are all the beakers and tubes made out of plastic?

19. MISSION

148. Why is Kitum Cave so important to the story? How was the monkey house like Kitum Cave?

20. RECONNAISSANCE

149. Why do you think Bill Volt wasn't concerned about being in the monkey house? Do you think his opinion changed when Gene Johnson and Sergeant Klages were afraid to touch things in his office?
150. Why weren't they wearing respirators or suits in room H?
151. What else did she notice about the monkeys that scared her?
152. What would you do if you were involved in the Reston operation and you saw one of the monkeys escape its cage?

21. INSERTION

153. Why didn't the army officials just let the virus kill off all the monkeys?
154. Why would they use a bubble stretcher instead of a regular stretcher?
155. What size would pores in a virus filter have to be?
156. What is the main rule of the airlock that allows it to work?
157. Why did she carry extra tape on her uniform?
158. Why would they be panicked when they found Dan Dalgard with only a respirator? Is the Army overreacting or are the civilians under-reacting?
159. What are the similarities/differences between Kitum Cave and the Reston Monkey House as habitats for living organisms?
160. How are cold and flu viruses transmitted?
161. What are the symptoms of monkeys that contract the virus and die? Did they compare to the Ebola victims? Describe.
162. How did they euthanize the monkeys?
163. How did Nancy package the carcasses?

164. How does bleach kill microbes?
165. What is a blood clot and how does it cause organ damage?

22. A MAN DOWN

166. Should Dan have evacuated the facility last week when he first found out about the outbreak?
167. Describe all the human contacts you have had since you got up this morning. In case of a dangerous exposure, how would you begin the process of contacting them and maybe quarantining them?
168. If it's hot inside and cold outside, what happens if you open a window? What are the dangerous consequences associated with this possibility?

23. TANGOS

169. What are some problems you would experience in wearing a space suit?
170. Why not maintain a 24-hour operation if it's so dangerous?
171. Why is the buddy system useful, why did they use it in the monkey house?
172. What was the condition of the monkey house? What human setting could you compare this to?
173. What were 4 symptoms Jerry saw as he moved around?
174. Why does the coughing and sneezing worry Jerry? What comparison does the author make in this case and why?
175. Why is it not safe to hand an opened syringe to another person?
176. Describe the feedback loop and how adrenaline creates that familiar energy rush.
177. What is ketamine?
178. Why is bleach poured down the drain after blood?

24. INSIDE

179. What are some suggestions to help prevent accidents such as the one that happened to Rhonda Williams?
180. How does a pressure suit work to keep viruses away from your body? How did this protect Rhonda?
181. During the cleanup what did they find lying around? What do you think was the source of these items?

25. A BAD DAY

182. What is the rapid Elisa test? (do the HHMI Virtual Immunology lab which is available on the Howard Hughes Medical Institute site, <http://www.hhmi.org>)
183. What is T-61?
184. "This environment favors the monkey over us." List evidence to support or refute this statement.
185. Compare the technique of a good injection with a bad one. How could they tell by the effects?

26. DECON

186. Why is it better to dispose of the monkeys the way they did instead of just burying them? What improvements would you suggest?
187. What was the sentinel species used to see if the place was really clean? Research this species to find out why it is so hard to kill off. What are some other hard-to-kill microbes?
188. What is the chemical formula for formaldehyde gas and what makes it toxic?
189. "You can never know when life is exterminated." Research the domain of extremophiles, organisms that live in very harsh conditions. We know now that these are more common than previously thought. What are the implications of a toxic extremophile that is infected with a lethal virus?

27. THE MOST DANGEROUS STRAIN

190. How and where does a virus hide?
191. How did Ebola travel throughout the building?
192. Compare the reaction in the face of the second infection compared to the first. Compare the symptoms of the monkeys.
193. What was the case fatality rate in the second outbreak?
194. Although this new strain turned out not to be lethal to humans, what was scary about it?
195. How did the symptoms of Ebola Reston compare to Zaire? What was the likely method of transmission? In 3 of the 4 cases?
196. Find or prepare a graph of deaths from the black plague. What was the vector, or mode of transmission, in that case?
197. "Imagine a virus with the infectiousness of the flu and the mortality rate of the black plague." What could we do to protect ourselves against this?
198. What did the infected lung look like? What are the implications for infection of a virus that moves from the lung to the testicles?
199. What causes Jaax to comment about the high level of sophistication of the virus? What would be the "most dangerous strain" of Ebola?

200. What steps did the CDC take to prevent another outbreak?
201. How is Ebola Reston classified today? Do we generally prove danger or safety? When in doubt, which do we assume?
202. What is the likely index case for Reston? What are some other possibilities for the link between the African and Asian strains? Why can we rule out convergence in this case?

28. HIGHWAY

203. The Rift Valley is seen as the original home of the human species, and is one of the richest archaeological sites on earth. What about the geography of the Valley makes it so special?
204. Where is Mount Elgon located?
205. Describe the road to Mount Elgon. What is the significance of this road?
206. Why is the Kinshasa Highway referred to as the AIDS Highway?
207. Find out what was the original index case for AIDS in Africa and in the United States (for a hint on the US case, go to the June 1981 edition of the Journal of the American Medical Association (JAMA)).
208. How did development of the trans-Africa highway lead to the spread of the disease(s)?
209. What is the relevance of the presence of tse tse flies when the author visited?
210. What is the rate of AIDS infection in that area? How many people in your county are infected with HIV? How many new cases were there last year (you can get this information from the county public health department)?

29. CAMP

211. What are some examples of roadside food available in your area?
212. What are some of the animals that live in or around Kitum Cave?
213. Describe or diagram three possible reservoirs for the virus and their pathways to humans.
214. Compare the ecosystem of a lowland rainforest with the montaine rainforest described here. What are some key differences?
215. What did Robin notice as missing from this natural landscape? How do you explain this anomaly?
216. By what percent had poachers reduced the elephant population? What would you do in this situation?
217. What do the elephants seek in Kitum Cave?
218. What makes Kitum Cave “a nice place for a virus to jump species”?
219. Elephant expert Dr. Ian Redman has a theory that elephants carved Kitum Cave. Describe how he came to this conclusion. Why did Peter Jahrling want a sample of Dr. Redman’s blood?
220. Describe the conditions inside the cave. Why is this an unusual climate for a cave? Why is it described as a good place for a virus to be preserved? Why would sunlight kill viruses?

221. Describe Tom Geisbert's experiment about dormancy of Marburg. What were the results? How does this compare to a) HIV and b) anthrax?
222. Why are spiders continued to be suspect in the hunt for the original host of Ebola? What about the sharp-rock hypothesis? In the end, list as many possible hosts as you can remember from all the scientists in the book.
223. Summarize what the author has to say about AIDS and HIV's path to the outside world as a consequence of habitat destruction. Explain and justify your agreement or disagreement with this statement.
224. Define the latitude gradient hypothesis as explained by E.O. Wilson and how it relates to this issue of species location.
225. How does the author describe the impact of humans on the natural landscape. Is he being fair? Explain your answer and give examples.
226. How are vaccines cultured?
227. What is the impact of the fast mutation rate of HIV and other "hypermutants"?
228. How does HIV survive in spite of the destruction of its native habitat?
229. What was found among some ripening elderberries? Why does the author characterize the vine as like a virus? How is it like and unlike a virus? Make a list.
230. What is the image or ending message the author leaves us?

INTERNET LINKS

- a. www.mcn.net/~jimloy/hotzone.html
- b. www.zmag.org/zmag/articles/jan94eckhardt.html
- c. www.best.com/~caitlinb/ebola.html
- d. www.erskine.edu/news/lethalvirus.html
- e. <http://desires.com/1.2/words/docs/zone.html>
- f. www.bocklaps.wise.edu/eov-ebola.html