

1. *For Teachers: When you use Dual method, please have the students do the shadowing after you. Then have them read by them self. And correct their pronunciation, through all of this material.*

2. イートックのレッスン以外で使用禁止。 **Ban to use this without eTOC** 
 3.  Part2 Lesson3.G1-3A-2019.1chobundokai **スマホの方は横にしてご覧下さい**

4. *Reductionism versus Systems Thinking*

5. Modern science has made great progress through the adoption of reductionism,
 6. an approach that breaks down a complex structure or process into its
 7. fundamental elements. This method of examining components individually
 8. reveals how each one contributes to the overall system. In genetics, for
 9. example, isolating and analyzing individual DNA molecules has enhanced
 10. scientists' understanding of inheritance and even enabled them to identify
 11. specific genes that are associated with particular traits. Further, by separating
 12. constituent elements from the complex environments in which they exist, as in
 13. the case of testing drugs on tissue samples instead of injecting them into the
 14. human body, reductionism allows scientists to eliminate the influence of
 15. uncontrolled elements of potential contamination sources that can complicate
 16. the process of determining cause and effect.

17. **Further Questions & Sample Answers** *For Teachers: Please use the direct method like CALLAN for this part.
 1. Ask student to answer the question on their own at first. 2. Then read the "sample answer". 3. Tell student to close their
 eyes. 4. Let them repeat after you again. Because student can't see the answer. 5. Have the student try to memorize the
 answer. 6. Once they have memorized the answer, ask the question one last time.*

18. **1) What is reductionism?**

19. *1) It is an approach that breaks down complex structure of processes into its
 20. fundamental elements.*

21. **2) What is the benefit of testing drugs on tissue samples instead of injecting them into the human body?**

23. *2) It allows scientist to eliminate the influence of uncontrolled elements of
 24. potential contamination.*

25. Reductionism has become so dominant in the field of genetics that many
 26. researchers have come to emphasize genes as the fundamental unit of human
 27. "system." Some reductionists even argue that human beings are merely
 28. vehicles in which genes reside, manipulating our behavior and regulating every
 29. aspect of our existence. On the other hand, biologist Denis Noble of the
 30. University of Oxford argues that "privileging any one level in biological systems
 31. cannot be justified." Biological systems can be approached from molecular,
 32. cellular, and various other perspectives. The interplay between various
 33. components and levels is not always apparent, yet it can significantly affect the
 34. overall functioning of the system, as in the case of human consciousness arising
 35. as an outcome of chemical and biological processes in the nervous system.
 36. Analyzing the components of a system in isolation at a particular time will
 37. therefore, according to Noble, produce data that are only accurate at that
 38. moment and may not reflect the system in its entirety.

Further Questions & Sample Answers

3) What do some reductionists argue?

3) They argue that human beings are merely vehicles in which genes reside.

4) According to Noble, what will analyzing only one component of the system in isolation do?

4) *It will produce data that are only accurate at that moment and not reflect the entire system.*

39. A framework called “systems thinking,” which offers a stark contrast to
40. reductionism emphasizes the complex interconnections between elements in a
41. system. Whereas a reductionist approach to an overall structure would involve
42. simplification and isolation, systems thinking establishes categories for
43. systems and outline techniques for analyzing the interactions of the
44. components within and among systems. One foundation of this approach is
45. understanding and predicting how changes to one element will affect other
46. components both in that system and in the other systems it interacts with. For
47. example, a systems-thinking approach might examine the flows of material and
48. energy through an ecosystem in order to detect patterns that would not be
49. obvious through the examination of the system’s components alone. This
50. framework also promotes cross-disciplinary scientific studies, since systems are
51. often interrelated.

Further Questions & Sample Answers

5) How is “systems thinking” different from reductionism?

5) *It emphasizes the complex interconnections between elements in a system.*

6) What is the foundation of “systems thinking”?

6) *Understanding and predicting how changes to one element will affect other components.*

52. Of course, systems thinking requires a basic understanding of a system’s
53. fundamental parts, so it is impossible to dismiss reductionism altogether.
54. Furthermore, even in a moderately sized system, amassing sufficient data to
55. comprehend the fundamental components and their interrelationships can be a
56. formidable task. Even so, in light of the magnitude and severity of current
57. environmental and other crises, while our embrace of a reductive approach has
58. enabled us to achieve our current technological and scientific successes, a
59. systems-thinking approach may be essential for overcoming such challenges.

Further Questions & Sample Answers

7) Why is it impossible to dismiss reductionism altogether?

7) *Systems thinking requires a basic understanding of a system’s fundamental parts.*

8) Why might a systems-thinking approach be essential?

8) *Because of the magnitude and severity of current environmental and other crises.*

*Choose the correct answer from these choices.



61. (32) According to the author of the passage, what is one of the benefits of
62. reductionism?

63. 1 It makes it possible for scientists to be certain that the external factors have
64. not had an influence on the outcome of an experiment.

65. **2** It enables scientists to spill certain DNA molecules and alter their structure,
 66. thereby allowing them to change the way some genes function.
67. **3** By using drugs to help identify the functions of certain genes, scientists can
 68. improve their understanding of the process of tissue formation.
69. **4** By reproducing systems in their entirety on a much smaller scale, scientists
 70. can more easily manipulate their components to see how each one works.
71. **(33) In Denis Noble’s view, a reductionist approach**
72. **1** tends to cause researchers to emphasize connections between cells and
 73. molecules even when such connections may not really exist.
74. **2** may fail to take into account the interactions occurring between varying
 75. aspects of a system that are not necessarily obvious.
76. **3** does not put enough emphasis on the large degree to which human behavior
 77. is affected and controlled by the genes in the human body.
78. **4** is severely limited by the fact that it can only be applied to systems that
 79. change significantly over an extended period of time.
80. **(34) What is one of the drawbacks of “systems thinking”?**
81. **1** It causes scientists to focus too much on systems that are unrelated to the
 82. ones they are studying.
83. **2** It does not offer a way to address the incredible complexity of the problems
 84. that humans have to deal with as a species.
85. **3** It can require significant effort to gain a sense of how basic elements work
 86. together in order to understand the overall system.
87. **4** It can lead to conflicts between scientists from different fields because of the
 88. different approaches they take to examining systems.



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89. Answer: (32)1 (33)2 (34)3