Classification Lab (*Jelli bellicus*) Lab; SB3 b,c

A branch of biology called taxonomy involves the identification, naming, and classification of species. Assigning scientific names to species is an important part of studying the history of life. To reduce this confusion in discussing organisms, one goal of taxonomy is to assign a universal scientific name to each known species. Linnaeus's system assigns a two-part name, or binomial, to each species. The first part of a binomial is the genus to which the species belongs. The second part of a binomial refers to one species within the genus. The two words together identify a unique species. A diagram that reflects hypotheses of evolutionary relationships has a branching pattern called a phylogenetic tree, but how can a biologist determine the sequence of branching in a phylogenetic tree? The most common method today is called cladistics. The key rule in cladistics is that all of the organisms of a particular clade must share homologous structures that do not occur outside the clade. These unique features that unite the organisms as a clade are called derived characters. A phylogenetic diagram that specifies the derived characters of clades is called a cladogram. However, cladistic analysis of molecular data (i.e., DNA, genes, and proteins) is changing scientists' understanding of certain evolutionary relationships and is now considered the most accurate method for classifying organisms. In this lab you will be classifying jelly beans, which are an ideal model for simulating the multitude of taxonomic relationships. The purpose of this lab is to apply what you have learned about the evolutionary basis of modern classification systems.

Pre-Lab Questions:

1. What is a dichotomous key?
2. What is a species?
3. What is taxonomy?
4. Which scientist started the classification system?
5. How are molecular data used as a taxonomic tool?
6. What is a phylogenic tree?
7. What is cladistics? What is a cladogram?
8. Define derived characters.

Part 1: Dichotomous Key Copy down the following data table and be sure to make each row wide enough to include descriptions. Next, obtain ten jelly beans and use the dichotomous key to identify each bean. Although rare, hybrids and new species of beans are continually evolving, so be sure to document any new discoveries that cannot be determined using the key. Finally, eat the bean to confirm your identification.

Detailed description of bean	Numbers you followed	Common Name	Does bean taste like description?

Part 2: Cladistics

9. Use the following table to create a cladogram. The "X" indicates that the organism has the derived character. You may need to reference figure 15-30 in your textbook to help you.

Derived Characters	Shark	Bullfrog	Kangaroo	Human
Vertebrae	X	X	X	X
Two pairs of limbs		X	X	X
Mammary Glands			X	X
Placenta				X

10. Use your data from Part 1 to create a cladogram for your ten jelly beans. You will need to determine the derived characters and common ancestors, so you might want to create a table like the one in question 9 to help organize the information. Below your new cladogram, write a brief description of your reasoning behind your classification system.

11. *SB5c Foray*: Use the diagram of sedimentary rock layers labeled 11.1 to answer the following questions.
a. What major change in the environment occurred after layers D and E? Explain.
b. What inferences can you make about life forms at the time layer A was formed?
c. If radiometric dating identifies the rock in layer C as 425 million years old, what can you infer about the age of the fossils in layer C? In layers B and D? Explain.
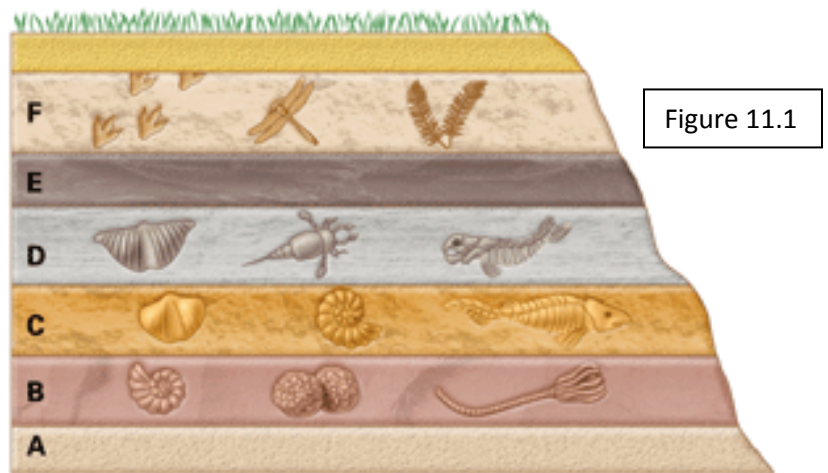
Figure 11.1

12. Discuss reasons why classification systems have changed over time. Which type of evidence is now considered the most accurate for determining classification?

13. Use the internet to find all seven levels of Linnaean classification for the orange-cup coral. Then identify at least one other organism with which it shares a derived character.

14. Use the diagram labeled 14.1to answer the questions that follow.
a. Which species is the common ancestor of all those shown?
b. b. What do 1, 2, and 3 represent?
c. c. To which living species is species H most closely related?
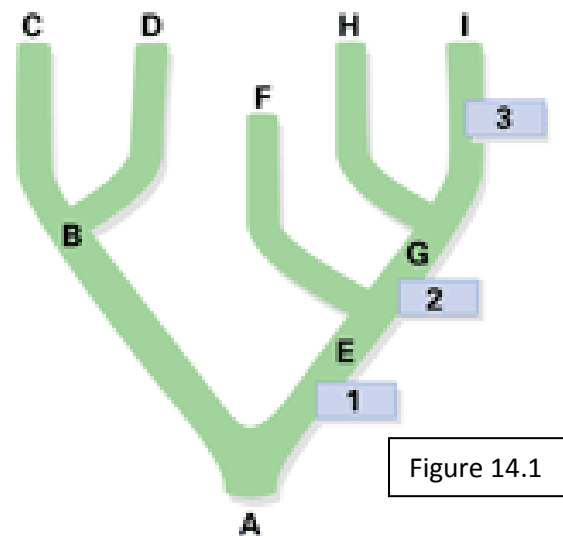**d.** d. How many clades are contained in the diagram? List the species in each clade.

Figure 14.1

Dichotomous Keys →

Jelly Belly Brand Beans

1. Yellow, Orange, Red, Pink… go to 2
   Purple, Green, Blue……… go to 20
   Black, brown, tan, white……. go to 29

2. Yellow or orange………….. 3
   Pink or red……………….. 12

3. Yellow……………………. 4
   Orange…………………….. 7

4. Solid Yellow……………….. 5
   Yellow spots……………….. 45

5. Bright yellow………………. 16
   Light or Pale Yellow……… 6

6. Opaque Yellow…………. Pina Colada
   Transparent Yellow……… Crushed Pineapple

7. Solid Orange……………. 8
   Orange with spots……… 11

8. Opaque Orange…………. 9
   Transparent orange……. 10

9. Bright orange…………. Orange
   Dark orange…………. Sour Orange

10. Tangerine orange……… Tangerine
    Cantaloupe orange…… Cantaloupe
    Foggy orange………… Pink Grapefruit
    Orange orange………….. Orange Juice

11. Orange w/small spots… Sour Peach
    Orange w/large spots… Peach

12. red……………………... 13
    pink……………………... 17

13. Solid Light Red………… 14
    Solid Dark Red ………… 15
    Red w/ spots……………. 39

14. Transparent Red………… Very Cherry
    Opaque Red………………. Red Apple
    Spicy hot…… ……. Cinnamon

15. Red Red………………… Sour Cherry
    Maroon Red………….. Sour Raspberry
    Foggy Maroon Red……. Raspberry

16. Opaque ……………... Sour Lemon
    Transparent………….. Lemon

17. Solid Pink…………….. 18
    Pink w/ spots…………. 19

18. Transparent Pink….. Cotton Candy
    Light Pink…………... Bubble Gum
    Foggy Marbled………. Sour Strawberry

19. Light Pink w/Red Spots. Strawberry Cheesecake
    Dark Pink w/Red Spots. Strawberry Daiquiri
    Pink w/colored spots… Tutti Frutti

20. Blue or Purple………. 21
    Green………………….. 26

21. Purple………………. 23
    Blue………………….. 22

22. Light blue………………. 24
    Dark blue………………. 25

23. Dark Purple………….. Grape Jelly
    Light Purple……………. Island Punch
    Black Purple………….. Wild Blackberry

24. Opaque……………….. Sour Blueberry
    Transparent…………. Berry Blue

25. Solid Blue………………. Blueberry
    Blue w/ spots…………. Plum
    Foggy Blue……….. Sour Grape

26. Solid Green……….. 27
    Green w/ spots…. 28

27. Light Green………….. 34
    Dark Green………..… 41

28. Green Spots………….. 33
    Red Spots……………. Watermelon
    Green and Brown Spots. Juicy Pear

29. Brown or Tan……….. 30
    Black or white…………. 36

30. Solid shade of Brown or tan.. 31
    Spotted…………...….. 42

31. Brown………………. 32
    Tan…………………… 35

32. Red brown……………. Dr. Pepper
    Chocolate Brown…… Chocolate Pudding
    Dark Brown……………. A&W Root Beer

33. Light Green w/ Dark Spots Mango
    Dark Green.…………. Margarita

34. Yellow Green…………… 38
    Bike Tube Slime Green.. Sour Apple

35. Light Tan………………. Peanut Butter
    Dark Tan………………. Carmel Apple

36. White…………………… 37
    Black or Gray ………… 43

37. White w/ spots………… 40
    Solid white……………… 44

38. Opaque……………….. Kiwi
    Transparent…………… Lemon Lime

39. Yellow spots………….. Sizzling Cinnamon
    Dark Spots……………… Strawberry Jam

40. Black spots………….. French Vanilla
    Brown spots…………. Toasted Marshmallow

41. Opaque………………. Sour Watermelon
    Transparent…………… Green Apple

42. White spots…………… Cappuccino
    Orange/brown spots…….. Caramel Corn

43. Black………………… Licorice
    Gray…………………… Café Latte

44. Opaque……………….. Coconut
    Transparent…………. A&W Cream Soda

45. Brown spots…………… Top Banana
    White spots…………… Lemon Drop
    Yellow spots………….. Buttered Popcorn

Sams Club Jelly Bean Key

1. Yellow, Orange, Red, Pink… go to 2
   Purple, Green, Blue………… go to 16
   Black, brown, tan, white……. go to 24

2. Yellow or orange………….. 3
   Pink or red………………… 10

3. Yellow………………….. 4
   Orange……………….….. 7

4. Solid Yellow………………. 5
   Yellow with brown spots… Banana

5. Bright yellow………………. Pineapple
   Light or Pale Yellow……… 6

6. Light Yellowish orange…. Lemon meringue
   Pale Yellow………………. Pina Colada

7. Solid Orange……………. 8
   Orange w/red spots……… Peach

8. Bright Orange…………… Orange 'N Crème
   Light or pale orange……. 9

9. Pale orange……………… Tangerine
   Yellowish orange……….. Passion fruit

10. Red………………………. 11
    Pink……………………… 14

11. Solid Red…………………. 12
    Red w/spots………………. 13

12. Bright Red……………….. Wild Cherry
    Dark Red…………………. Cinnamon
    Reddish pink…………….. Raspberry

13. Red w/yellow spots…....... Spicy Cinnamon
    Red w/pink spots……….... Fruit punch

14. Solid Pink………………. 15
    Pink w/ spots…………… 28

15. Dark Pink……………….. Cotton Candy
    Medium Pink…………..… Pink Grapefruit
    Light pink……………….... Bubble gum

16. Blue or Purple………… 17
    Green……………….….. 20

17. Purple……………..…… 18
    Blue……………….….. 19

18. Purple……………..…… Grape
    Lavender……..……….. Boysenberry

19. Royal Blue…………….. Blueberry
    Light blue……………… Verry blue

20. Solid Green…………..... 21
    Green w/brown spots…. Perfectly pear

21. Dark Green…………..... 22
    Light Green………….... 23

22. Bright Green………….... Green apple
    Dark green……..…….... Watermelon

23. Light Green…………….. Kiwi
    Pale Green…………….. Key Lime

24. Brown……….………..... Root Beer
    Black or white………..… 25

25. White……………..……. 26
    Black……………..……. Licorice

26. Bright White…………… Coconut
    White w/ spots………… 27

27. White w/ black spots…. French vanilla
    White w/ brown spots… Roasted marshmallow
    White w/ yellow spots… Buttered popcorn

28. Pink w/colored spots…… Tutti Frutti
    Pink w/red spots……….. Strawberry cheesecake
    Pink w/white spots………. Strawberry