Jake and Alice are siblings. Alice was born in 1988, and Jake was born in 1992. Although there is a four-year difference in age, they get along well. When Jake was in high school, Alice helped him choose classes she had enjoyed, with teachers that she liked and thought he would find interesting. Naturally, Jake and Alice don't share all the same interests. Alice is fascinated with natural science and took all the advanced biology courses in high school, eventually selecting a major in plant biology in college. Jake likes science but he's more interested in making things, like complicated recipes he finds in his collection of cookbooks, and painting over the mural in his bedroom. There must be at least 16 layers of mural on the largest wall of his room—he just can't seem to settle on a design.

When Alice’s friends threw her a surprise 20th birthday party, Jake helped them coordinate with his and Alice’s parents to make sure the party was kept a secret until the big day. Alice recommends new music to Jake, and he does the same for Alice. Both Alice and Jake’s friends are impressed that they have such a broad knowledge of obscure bands in different musical genres. Jake is interested in becoming a chef someday—he often tries out new recipes on his family. Alice likes to cook, but doesn't get as excited about new food combinations like her brother.

Both siblings are medium height, with dark blonde hair and hazel eyes. Their mother, Rachel, has dark brown hair, and Pete, their father, when he had hair on his head, was blonde. The whole family is lightly freckled. While they all love music, none are particularly excellent singers, and only Jake knows how to read music and play an instrument: the trumpet. They all have small feet except Rachel, who wears a size 10 women's sneaker when she jogs on the treadmill.

Jake and Alice each have a collection of traits that make them unique that distinguish them from their family and friends. Some of these traits are physical—dark blonde hair, light eyes, freckles—and some are behavioral—curious about the world around them, generous, heavy-sleepers.

**Where do traits come from?**

What would Alice and Jake be without their traits? Is there some essential “Alice-ness” or “Jake-ness” that would still exist without blonde hair, hazel eyes, a gentle demeanor and great taste in underground folk
music?

When two organisms—in this case, those organisms would be Alice and Jake's parents: Pete and Rachel—create a third organism through reproduction, many variables come into play. It's a complex lottery in which an offspring of the first two organisms inherits a combination of their genetic material. The possible variations inherent in recombining the parents' DNA is very, very broad—larger than the pool of entries in the state lotto jackpot! And that's where we get so much variation even within the population of a particular sexually reproducing species.

Although Alice and Jake's unique collection of traits is originally the product of chance, there are systems to which every freckle, hair, and skin tag can be traced. Personality quirks are another story altogether.

When we think about how our personalities are formed, we can certainly think about genes we acquired from our parents—but we also have to think about other complexly intertwined factors like environment and upbringing. For now, we'll simplify things by just focusing on the physical aspect of inherited traits.

It would be very, very unlikely for two parents with identically coded chromosomes to sexually reproduce. Even in the case of intrafamilial (or consanguine) pairings, which are discouraged in our society, the chromosome pairings would never be perfectly identical—that's a good thing for us as a civilization! The worst thing for our survival is for like to be paired with like. It's in the best interest of our population that lots of different genes are mixed together in an evolutionary soup, so that many new variations on living organisms can be exposed to the environment; develop adaptations to changing conditions; and promote the survival of the species.

Another interesting variable that lets organism populations adapt to changing environments is mutation in genes. Sometimes, unpredictable changes in genetic code will appear within a new generation, not traceable back to a parental source.

Our blonde-haired, tone-deaf siblings, Alice and Jake, almost definitely have some sort of mutation somewhere within their respective makeups. A mutation can be as tiny as a freckle, or as conspicuous as an extra finger. As long as a trait has never appeared in an organism's lineage before, it is a mutation. Jake, for example, has an oddly shaped toe in his left foot. It cleaves down the center. It doesn't hurt, and he's never had an infection or needed to buy special socks for the condition. It's just a benign mutation that exists because something in his DNA has instructed that mass of protein to cleave. If he has children someday, they may inherit this trait. But it didn't come from Pete, his father, and it didn't come from Rachel, his mother. It is a mutation.

Mutation is a fascinating concept, so it's not surprising that artists and writers have latched onto it as a metaphor. Creators of superheroes like the X-men and Teenage Mutant Ninja Turtles have used the idea of extreme mutation as a narrative device to provide commentary on racism. Mutations are where new adaptations to existing or dynamic conditions are field tested in competition to whatever has worked for a population in the past. If a mutation pops up that happens to be advantageous for a particular organism within a population, that organism is more likely to survive and therefore more likely to procreate.

Who knows? Maybe Jake's funny big toenail will come in handy someday.
1. How are Jake and Alice related?
   A. They are coworkers.
   B. They are friends.
   C. They are siblings.
   D. They are married.

2. How does the author contrast Jake and Alice?
   A. Alice is interested in science, while Jake is more interested in making things.
   B. Alice is interested in making things, while Jake is more interested in science.
   C. Jake is much more athletic than Alice.
   D. Jake is more like his parents than Alice.

3. Sometimes, changes in genetic code will appear within a new generation that cannot be traced back to a parental source.
   What evidence from the text supports this conclusion?
   A. Both Jake and Alice are medium height, with dark blonde hair and hazel eyes.
   B. Jake has an oddly shaped toe that did not come from his father or mother.
   C. Jake and Alice do not share all of the same interests.
   D. Alice and Jake's unique collection of traits is largely the product of chance.

4. Based on the information in the passage, what can be concluded about the traits that siblings have?
   A. Siblings share all of the same traits.
   B. Siblings share none of the same traits.
   C. Siblings share all of the same physical traits, but have different personality traits.
   D. Siblings share some traits, but each has a unique combination of traits.
5. What is this passage mostly about?
   A. how physical traits are passed down between generations
   B. how similar Jake and Alice are
   C. how siblings are genetically identical
   D. how siblings develop behavioral traits

6. Read the following sentence from the passage: "When two **organisms**-in this case, those **organisms** would be Alice and Jake's parents: Pete and Rachel-create a third **organism** through reproduction, many variables come into play."

As used in the passage, what does the word "**organism**" mean?
   A. a sibling
   B. an individual life form
   C. the parent of a child
   D. a mammal

7. Jake's oddly shaped toe is a mutation, ________ he did not inherit it from either of his parents.

Choose the answer that best completes the sentence below.
   A. but
   B. although
   C. initially
   D. so

8. What does the word "mutation" mean as used in the passage?
9. According to the passage, why is it in the best interest of the human population that lots of different genes are mixed together?

__________________________________________________________________________________________

__________________________________________________________________________________________

10. Explain why it is unlikely for children to have an identical combination of traits to their parents. Use information from the passage to support your answer.

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