

→ **PRE-CLASS ACTIVITY:** Read through these 26 quotes and select the # of the quote . . .

(a) that you like best # _____ (b) that surprises you the most (as coming from a scientist): # _____

QUOTES FROM SCIENTISTS ABOUT DOING SCIENCE

[All quotes are from: *The Mind of God & Other Musings -- The Wisdom of Science*, ed. by Shirley A. Jones, 1994.]

FACTS

1. Facts are the air of science. Without them you never can fly. *Ivan Petrovich Pavlov (1849-1936) Russian physiologist*
2. Sit down before fact like a child, and be prepared to give up every preconceived notion, follow humbly wherever and to whatever abyss Nature leads, or you shall learn nothing. *Thomas H Huxley (1825-1895) British biologist*
3. Science is built up with facts, as a house is with stones. But a collection of facts is no more a science than a heap of stones is a house. *Jules Henri Poincare' (1854-1912) French scientists*
4. It is the fate of theories to be washed away . . . I hold them all very lightly, and have used them chiefly as convenient pegs on which to hang my collection of facts. *James G. Frazier (1854-1941) British anthropologist*
5. Science is organized common sense where many a beautiful theory was killed by an ugly fact. *Thomas H. Huxley (1825-1895) British biologist*

DISCOVERY

6. We are more easily persuaded, in general, by the reasons we ourselves discover than by those which are given to us by others. *Blaise Pascal (1623-1666) French physicist*
7. . . . I think that the context of discovery is very different from the context of explanation or explication. But you don't discover things the way you write them down. There are subterranean processes which occur, and only at a certain point suddenly do things begin to gel and you know where you're going. *Jule Charney quoted in: The Atmosphere -- A challenge, The Science of Jule Gregory Charney by Lindzen et al., eds., 1990*
8. Any scientist who is not a hypocrite will admit the important part that luck plays in scientific discovery. *Sir Peter Brian Medawar (1915-1987) British zoologist*
9. In the fields of observation, chance favors only the mind that is prepared. *Louis Pasteur (1822-1895) French chemist-microbiologist*
10. Don't laugh . . . I felt I was born for that moment. To stand there, on that street in Paris in the middle of the night, with this idea at last clarified in my mind, Oh, that clarification! It was as though the idea had come into my head so that one day I would know the incredible joy of the clarification. Nothing else can touch that experience for me. Let me tell you, there's not an "I love you" in the world that can touch it. Nothing. *Laura Levin, US biophysicist (discovering the muscle mechanism of the clam)*
11. Besides learning to see, there is another art to be learned -- not to see what is not. *Maria Mitchell (1818-1889) US Astronomer*
12. There is no logical way to the discovery of . . . elemental laws. There is only the way of intuition, which is helped by a feeling for the order lying behind the apparatus. *Albert Einstein (1879-1955) Swiss-American physicist*
13. It is like finding the handwriting of God. *Joe Primack (b. 1945) US astrophysicist (on discovering "ripples" in space)*

PERSEVERENCE

14. Results! Why, man, I have gotten a lot of results. I know several thousand things that won't work. *Thomas Alva Edison (1847-1931) US Scientist*

15. If I have ever made any valuable discoveries, it has been owing more to patient attention, that to any other talent. *Sir Isaac Newton (1642-1727) British physicist*

AWE

16. The joy of insight is a sense of involvement and awe, the elated state of mind that you achieve when you have grasped some essential point; it is akin to what you feel on top of a mountain after a hard climb or when you hear a great work of music. *Victor Weisskopf (b. 1908) Austrian-American physicist*

17. The most beautiful experience we can have is the mysterious . . . He to whom this emotion is a stranger, who can no longer pause to wonder and stand rapt in awe, is as good as dead. *Albert Einstein (1879-1955) Swiss-American physicist.*

18. Do not become a mere recorder of facts, but try to penetrate the mystery of their origin. *Ivan Petrovich Pavlov (1849-1936) Russian physiologist*

19. In one pool, on the right side of the path, is a family of otters; on the other side, a family of beavers . . . I was transfixed. As I now recall it, there was only one sensation in my head: pure elation mixed with amazement at such perfection . . . I wished for no news about the physiology of their breathing, the coordination of their muscles, their vision, their endocrine systems, their digestive tracts. I hoped never to have to think of them as collections of cells. All I asked for was the full hairy complexity, then in front of my eyes, of whole, intact beavers and otters in motion. *Lewis Thomas (1913-1993) US biologist*

CURIOSITY

20. Those who do not stop asking silly questions become scientists. *Leon Lederman (b. 1822) US Nuclear physicist*

21. Ask questions. Don't be afraid to appear stupid. The stupid questions are usually the best and the hardest to answer. They force the speaker to think about the basic problem. *Paul Ehrenfest (1880-1933) Austrian physicist*

22. The equations we seek are the poetry of nature. . . . Why is nature that way? Why is it possible for these powerful manifestations of forces to be trapped in a very simple, beautiful formula? This has been a question which many people have discussed, but there is no answer. *Chen Ning Yang (b. 1922) US physicist*

CHANGE

23. The one universal ever-operating law throughout has been the law of change. Nature never stands still and never duplicates herself. Life is always in the process of becoming something else. *Laurence M. Gould (b. 1896-1995), US scientist*

FALSIFICATION

24. A null result would kill off the whole present crop of theories. *Philip Lubin (b. 1953) US Astrophysicist*

25. No amount of experimentation can ever prove me right; a single experiment may at any time prove me wrong. *Albert Einstein (1879-1955) Swiss-American physicist*

26. I have steadily endeavored to keep my mind free so as to give up any hypothesis, however much beloved (and I cannot resist forming one on every subject), as soon as the facts are shown to be opposed to it. *Charles Darwin (1809-1882) British biologist*