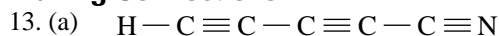


## Making Connections



linear shape

- (b) Astronomers detect molecules in space by spectroscopic analysis of electromagnetic radiation (light) absorbed and emitted by regions of space.

## Explore an Issue: Take a Stand: Linus Pauling and the Vitamin C Controversy

(Page 250)

- (a) It is claimed that large doses of vitamin C:
- reduce occurrence and severity of common cold,
  - lower the risk of heart disease and stroke,
  - reduce risk for most common types of cancer,
  - increase survival time and improve quality of life in terminal cancer patients,
  - improve blood vessel dilation, and
  - lower blood lead (Pb) levels.
- (b) The main criticism of Pauling's claims for the benefits of large doses of vitamin C are:
- The results of Pauling's studies using vitamin C to prevent the common cold are not reproducible. Numerous well-designed studies have shown that vitamin C does not prevent common colds; at best, vitamin C may slightly reduce cold symptoms.
  - Pauling's analyses of vitamin C therapy for the prevention and treatment of cancer is flawed. Independent analyses of the same studies show no significant effect.
  - The Linus Pauling Institute of Medicine is largely funded by the pharmaceutical company that produces most of the world's supply of vitamin C.
  - Pauling has lost scientific credibility by his association with the health food industry, which is notorious for making unsubstantiated claims.
- (c) To be scientifically valid, a claim must be experimentally testable. Then there must exist empirical evidence from well-designed experiments that have suitable controls and controlled variables. Finally, the evidence must be reproducible by independent investigators.
- (d) Pauling's fame was very likely a large factor in influencing public and scientific opinion about the benefits of vitamin C. Pauling's two Nobel Prizes represented significant achievements, and both involved contradicting conventional thinking of the time. It seemed plausible that once again Pauling knew more than his contemporaries.

A person unknown to the public and with no scientific training would not be taken seriously if he/she made the same claims about vitamin C, because the public would have no basis to believe the claims.

Reproducible evidence from well-designed studies provides the most reliable basis for deciding which claims to believe. When the empirical evidence is unclear or contradictory, the claim is inconclusive or shown to be false.

- (e) A scientist who goes against the rest of the scientific community risks his career and reputation, if independent research proves his claim to be wrong. On the other hand, if independent research supports his claim, he may enhance his career and receive much recognition.

The practice and work of science is not always completely objective, especially when new theories are proposed that contradict accepted knowledge. However, if continuing research consistently shows that the new theory is better than the old theory at explaining and predicting experimental evidence, the new theory will eventually be accepted (although this may occasionally take a long time).