

## THE NATURE OF SCIENCE

### SCIENTIFIC WORLD VIEW (1A)

Scientists share certain basic assumptions about the nature of the world and what can be learned about it: The world can be understood through careful, systematic study; scientific knowledge produced through such a process is both durable and subject to change; the scientific process cannot answer some questions, such as those about values and beliefs. In order to follow the science story as it unfolds, students need to understand these shared assumptions.

The map is organized around three strands—*limits of science*, *investigating a knowable world*, and *continuity and change*. In the elementary grades, the focus is on what can be learned from observation and experimentation. In middle school, ideas are introduced about the modifiability of science that results from new discoveries and about what cannot be studied in a scientific way. In high school, various historical episodes serve as examples of generalizations about continuity and change in science and the assumptions underlying a scientific world view.

Several historical episodes mapped in Chapter 10: HISTORICAL PERSPECTIVES illustrate how scientific knowledge is judged, modified, and replaced and exemplify major shifts in the scientific view of how the world works. The CLASSICAL MECHANICS map illustrates scientists' assumptions about the unity and understandability of the natural world.

#### NOTES

The 9-12 benchmark “Science is based on...” in the *investigating a knowable world* strand focuses on two related but separate premises. One is that by careful systematic study, people can figure out how the world works. The other is that the universe is a unified system and knowledge gained from studying one part of it can be applied to other parts.

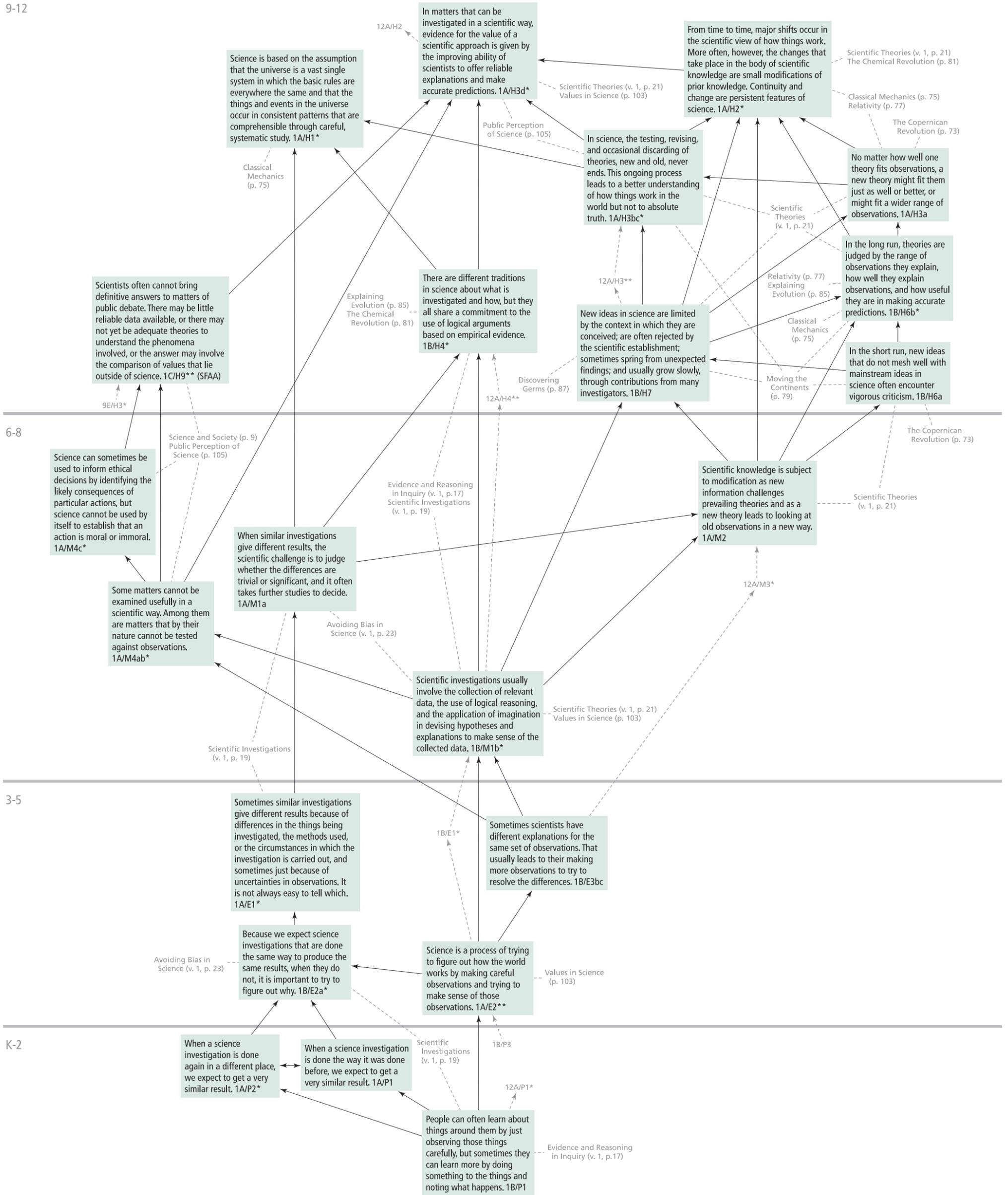
The left-hand side of the strand includes ideas about the unity of nature. Nearly all of these benchmarks also appear in the SCIENTIFIC INVESTIGATIONS map in *Atlas 1* where they are part of a sequence of ideas about the importance of reliability in investigations. The right-hand side of the strand unpacks what is meant by careful systematic study of the world. In the grades 3-5 range, a new benchmark (1A/E2) describes what science is and its purpose at a level of complexity that most early elementary students can understand.

Benchmarks in the *continuity and change* strand also play a role in the *theories modification* strand in the SCIENTIFIC THEORIES map in *Atlas 1*.

#### RESEARCH IN BENCHMARKS

Although most students believe that scientific knowledge changes, they typically think changes occur mainly in facts and mostly through the invention of improved technology for observation and measurement. They do not recognize that changed theories sometimes suggest new observations or reinterpretation of previous observations (Aikenhead, 1987; Lederman & O'Malley, 1990; Waterman, 1983). Some research indicates that it is difficult for middle-school students to understand the development of scientific knowledge through the interaction of theory and observation (Carey et al., 1989), but the lack of long-term teaching interventions to investigate this issue makes it difficult to conclude that students can or cannot gain that understanding at this grade level.

9-12



limits of science

investigating a knowable world

continuity and change