"All rats run under condition X." Such hypotheses can be evaluated by inductive inference only and must be reducible to direct statements. The chain of events required in testing an indirect statement is shown in Figure 1.5-1.

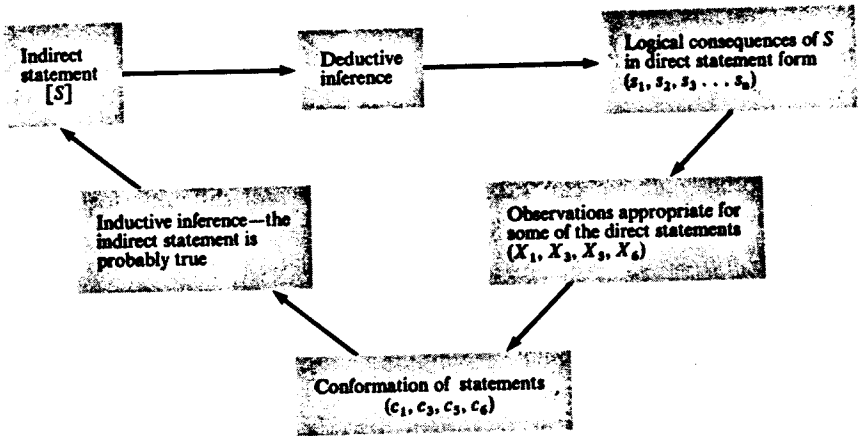

Figure 1.5-1 Test of indirect statement by deductive and inductive inferences.

If, in Figure 1.5-1, the term *scientific hypothesis* is substituted for indirect statement and *statistical hypothesis* for direct statement, the analogy with hypothesis testing is readily apparent. The experimenter has the task of translating his research hypotheses into a dichotomous set of mutually exclusive statistical hypotheses. It should be noted that the chain of deductive reasoning from a *question* concerning nature to a *research hypothesis* to a *statistical hypothesis* and the reverse process of inductive reasoning from the *statistical hypothesis* to the *question* is an exercise in logic rather than statistical inference. If an error occurs in the chain, the statistical hypotheses subjected to test may have no bearing on the original question, or incorrect inferences concerning the question may be made. Grant (1962), Binder (1963), and Edwards (1965) have examined in detail the relation between scientific and statistical hypotheses.

KINDS OF STATISTICAL HYPOTHESES

A null hypothesis (H_0) is the statistical hypothesis that is subjected to a test. The notion that the null hypothesis refers to a parameter value of zero is a simplification; the hypothesis can specify the parameter as having any value, including zero. Less confusion will result if the null hypothesis is considered as the hypothesis that is tested. The hypothesis that remains tenable if the null hypothesis is rejected is called the alternative hypothesis (H_1). Hypothesis testing can be viewed as a procedure whereby an experimenter decides which one of a dichotomous set of mutually exclusive and