

Tom Schneider
National Cancer Institute
Laboratory of Mathematical Biology
Frederick, Maryland 21702-1201

*'New Approaches in Mathematical Biology: Information Theory and
Molecular Machines'*

ABSTRACT

My research uses classical information theory to study genetic systems. Information theory was founded by Claude Shannon in the 1940's and has had an enormous impact on communications engineering and computer sciences. Shannon found a way to measure information. This measure can be used to precisely characterize the sequence conservation at nucleic-acid binding sites. The resulting methods, by completely replacing the use of "consensus sequences", provide better models for molecular biologists. An excess of conservation led us to do experimental work on bacteriophage T7 promoters and the F plasmid IncD repeats. The wonderful fidelity of telephone communications and compact disk (CD) music can be traced directly to Shannon's channel capacity theorem. When rederived for molecular biology, this theorem explains the surprising precision of many molecular events. Through connections with the Second Law of Thermodynamics and Maxwell's Demon, this approach also has implications for the development of technology at the molecular level. Discussions of these topics are held on the internet news group bionet.info-theo.