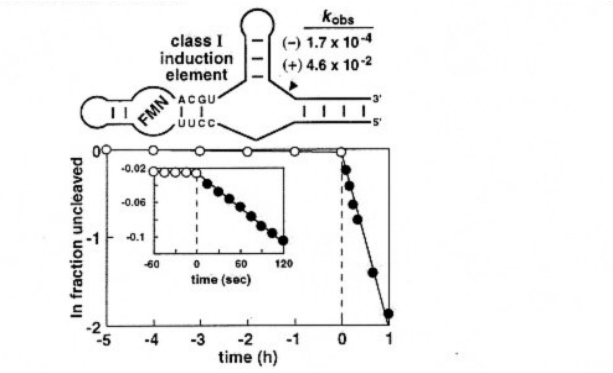
Breaker Laboratory

Molecule of the Year

1999

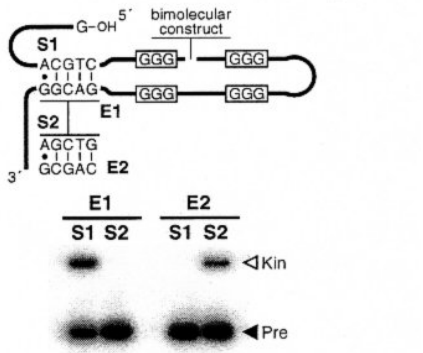
RNA Molecular Switches

Fig. 1. Structure and reaction kinetics of an RNA molecular switch.



Kinase Deoxyribozymes

Fig. 2. Structure and activity of a deoxyribozyme with ATP-dependent DNA kinase activity.



In recognition of the precise function of engineered allosteric ribozymes and in recognition of the diverse and fundamental action of kinase deoxyribozymes, the status of Breaker Laboratory "Molecule of the Year" has been jointly conferred upon these two classes of molecules.

Precise molecular recognition and catalytic function are the hallmarks of enzyme action and these characteristics are essential for successful biocatalysts as well as for engineered enzymes that are to find practical application. It is now clear that ribozymes can be engineered by modular rational design and *in vitro* evolution to respond rapidly and selectively to various effector compounds. DNA is also capable of extraordinary substrate selectivity and catalytic function, as exhibited by the *in vitro* evolution of nearly 50 new classes of (d)NTP-dependent self-phosphorylating DNAs. These classes of molecules showcase the catalytic sophistication of nucleic acids and support the hypothesis that similar RNAs and DNAs could be made to function in living systems.

Yale University Investigators: Dr. Garrett Soukup, Ph.D.; Dr. Yingfu Li, Ph.D.; Dr. Ronald R. Breaker, Ph.D.

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[1] Soukup, G. A. and Breaker, R. R. (1999) Engineering precision RNA molecular switches. *Proc. Natl. Acad. Sci. USA* **96**, 3584-3589.

[2]Li, Y. and Breaker, R. R. (1999) Phosphorylating DNA with DNA. *Proc. Natl. Acad. Sci. USA* **96**, 2746-2751.