

Application of RNABuilder to Group I Intron RNA Modeling

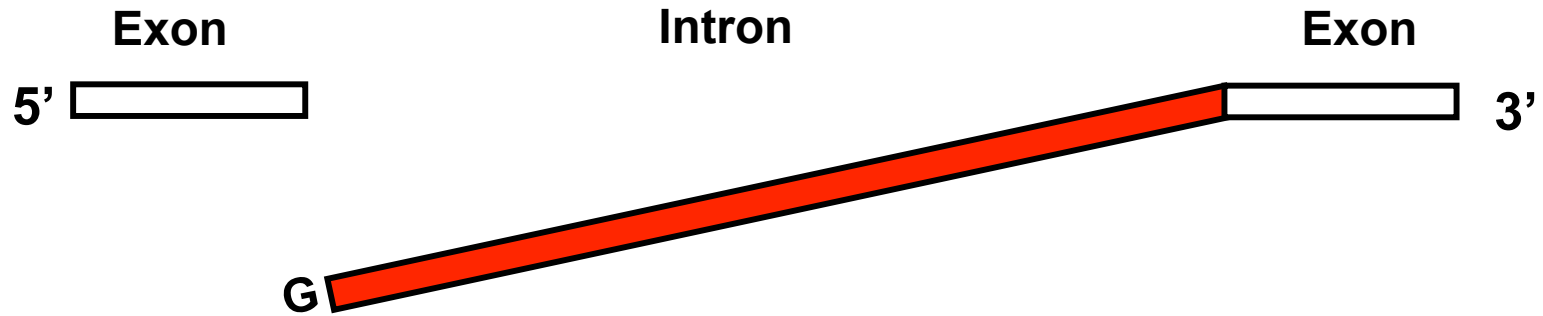
Russell Lab

Altman Lab

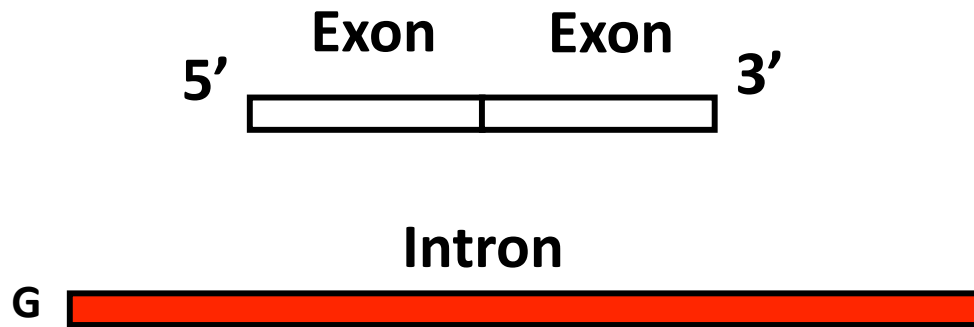
Group I Intron Self-splicing Reaction



Group I Intron Self-splicing Reaction



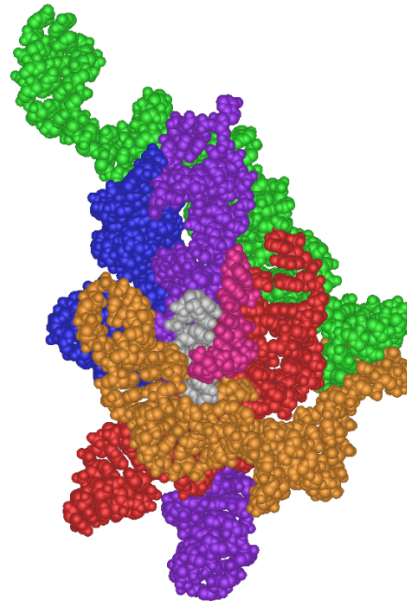
Group I Intron Self-splicing Reaction



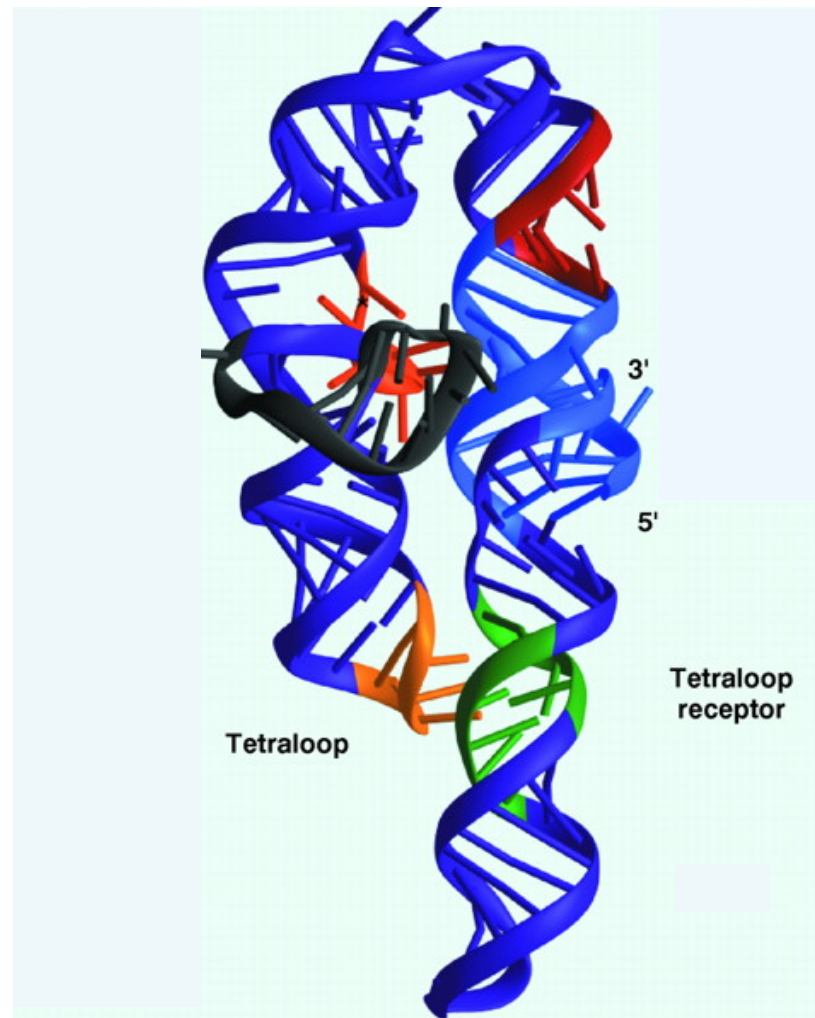
Group I Intron Self-splicing Reaction



Intron

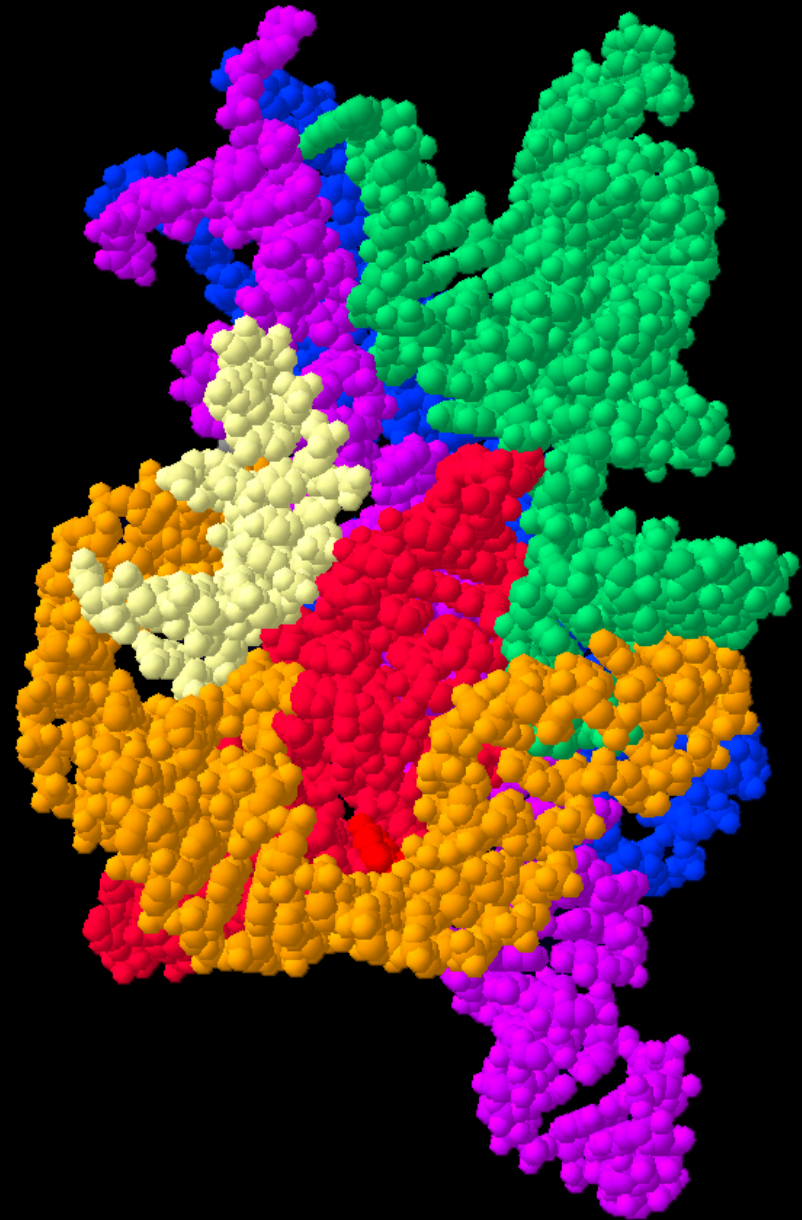
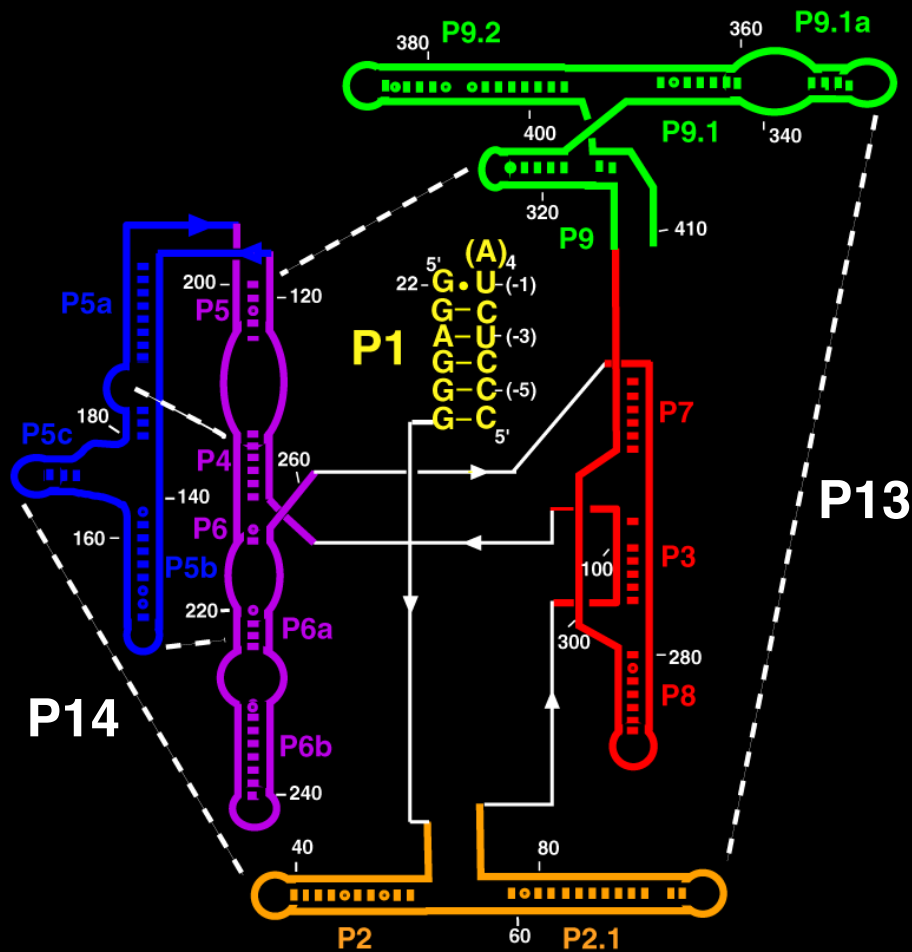


Group I Intron RNA Provides Information on RNA Structure

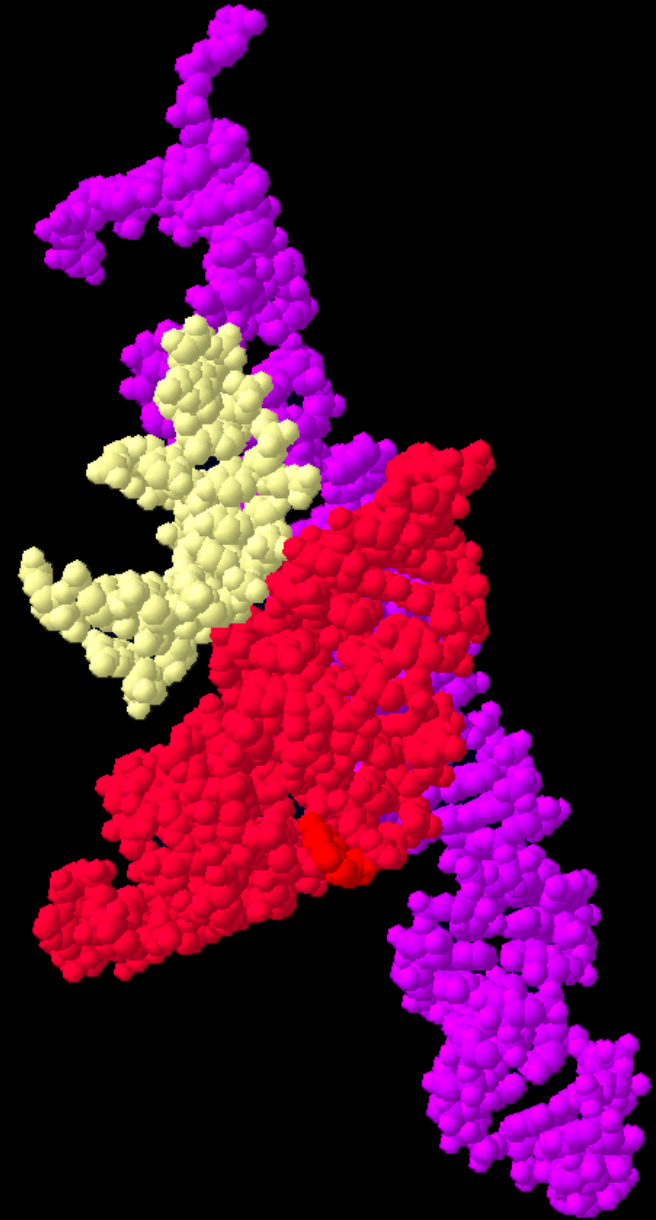
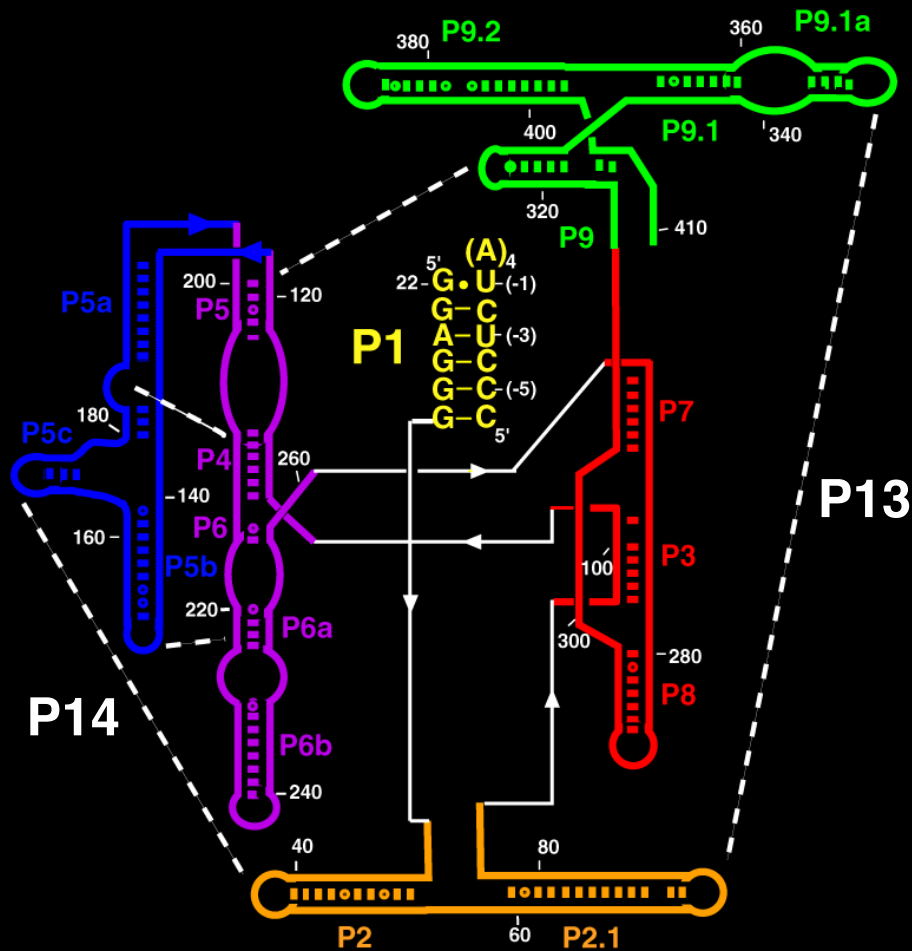


J.H.Cate, et al. 1996, Science

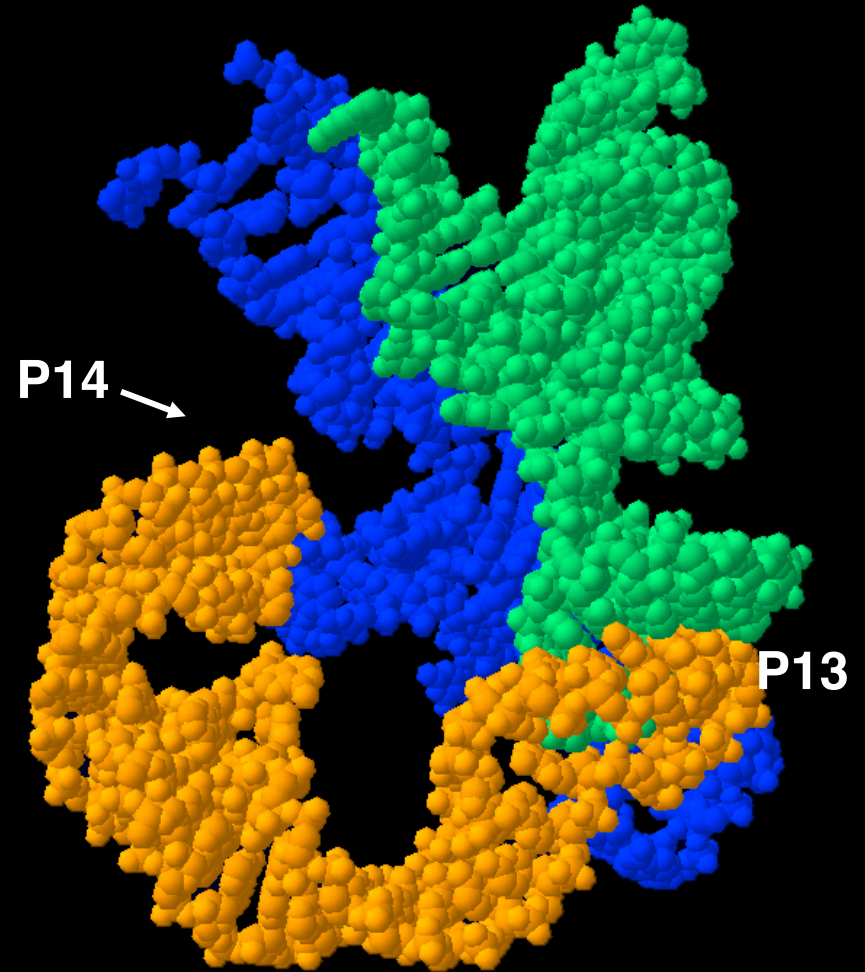
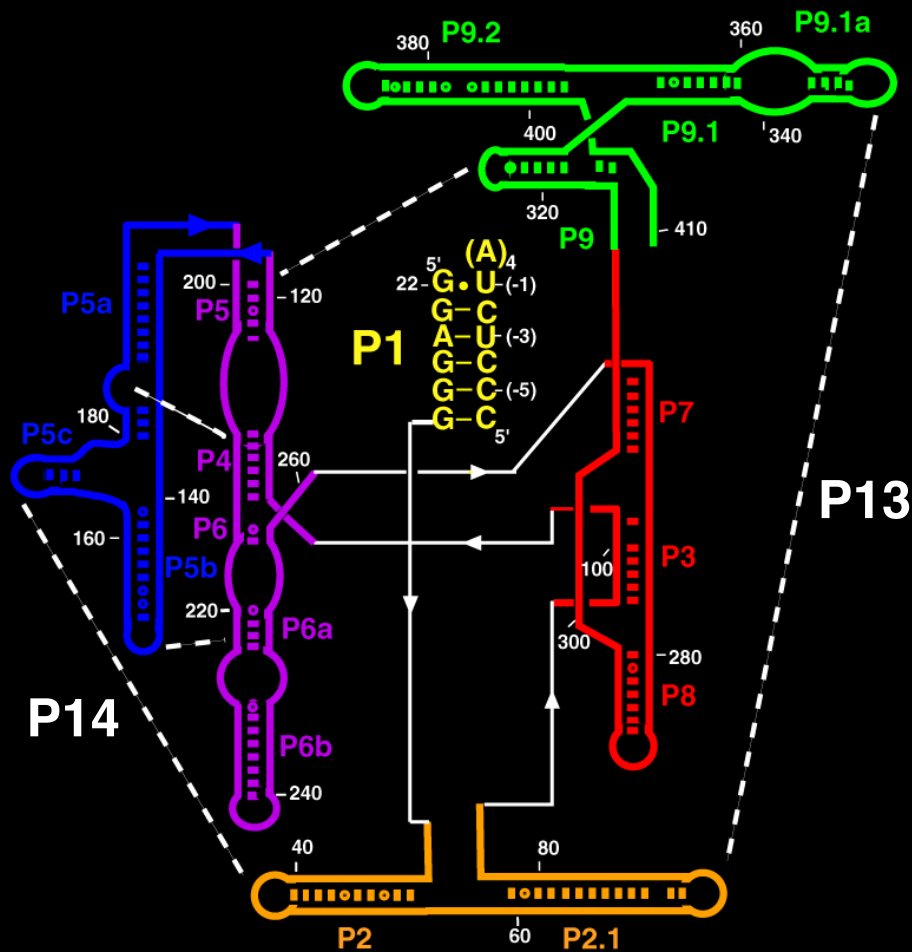
The *Tetrahymena* Group I Intron



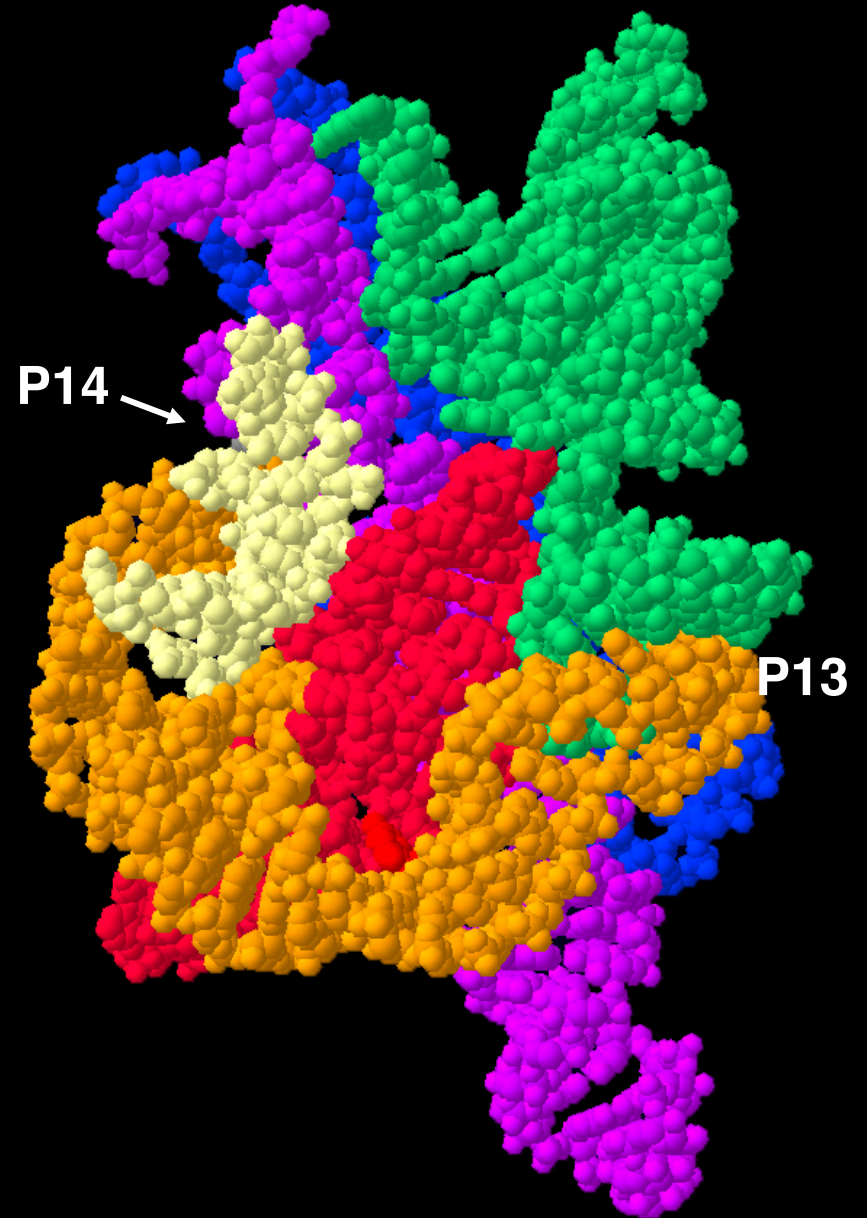
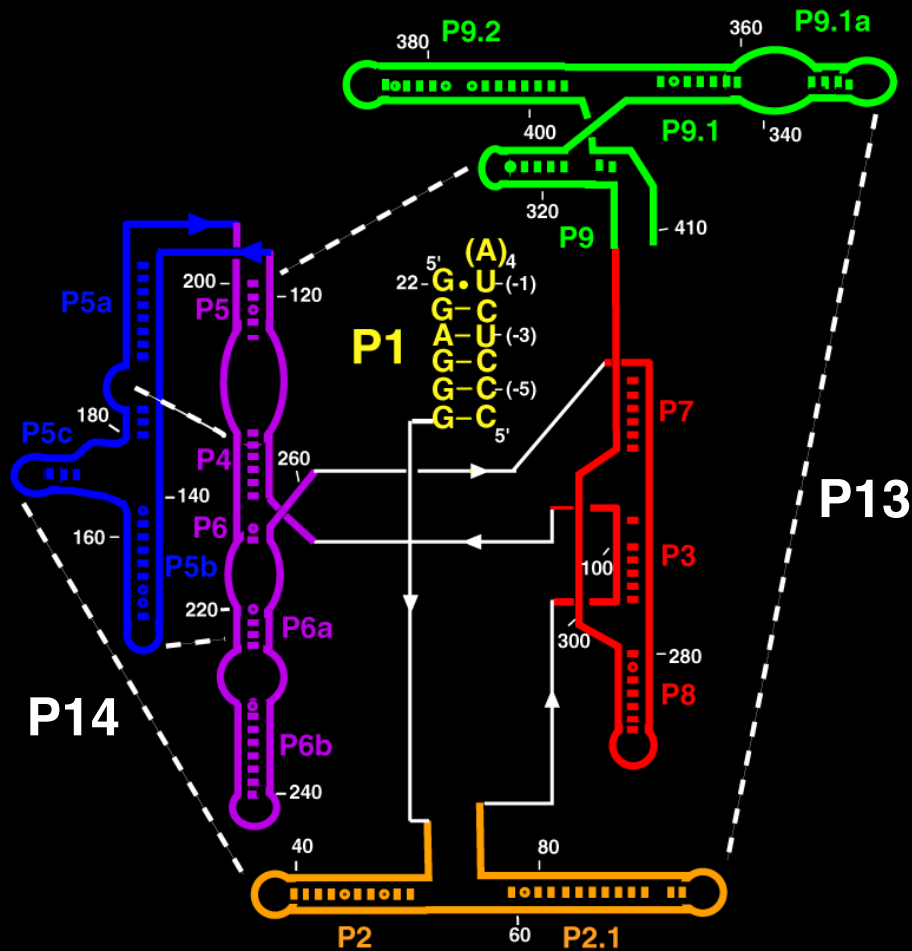
The *Tetrahymena* Group I Intron



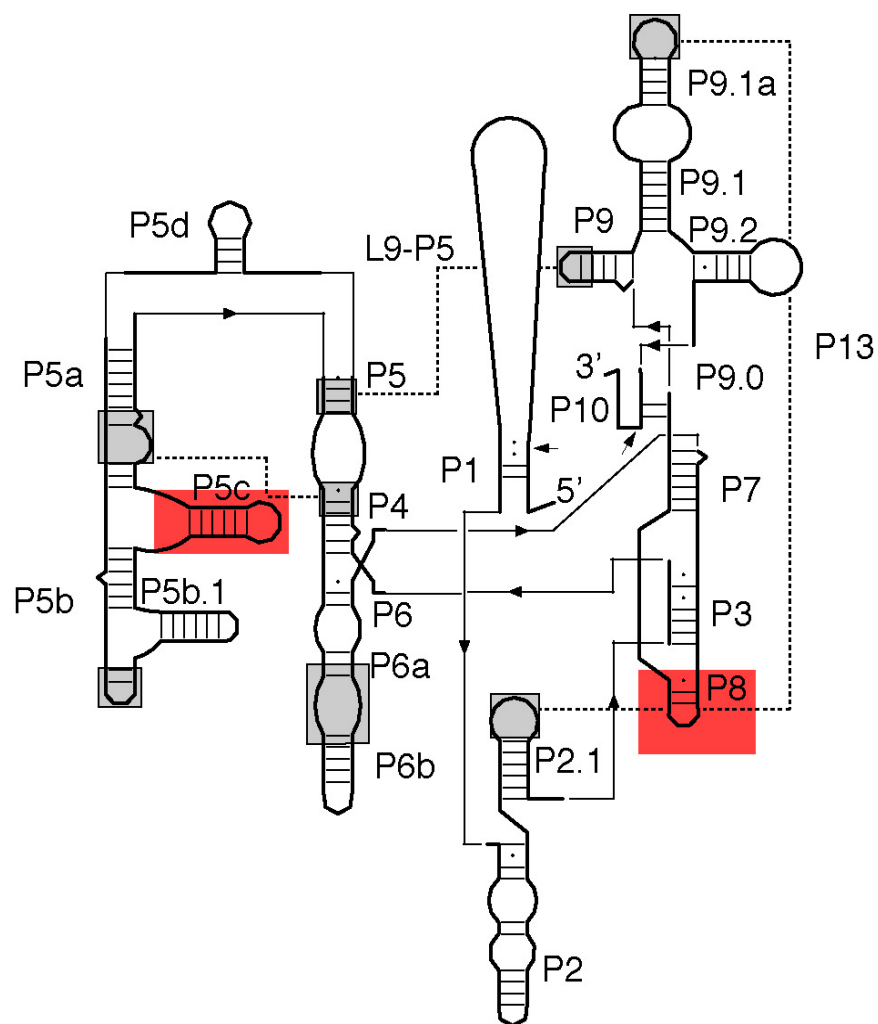
The *Tetrahymena* Group I Intron



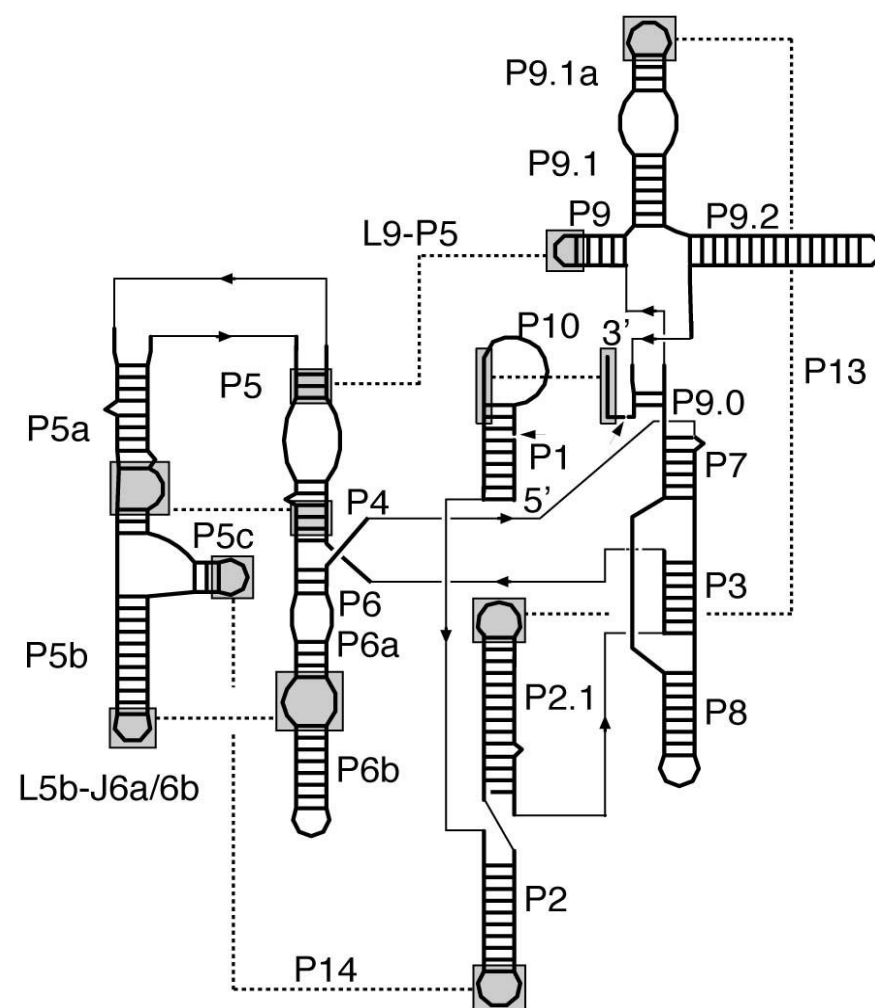
The *Tetrahymena* Group I Intron



A Novel Group I Intron RNA

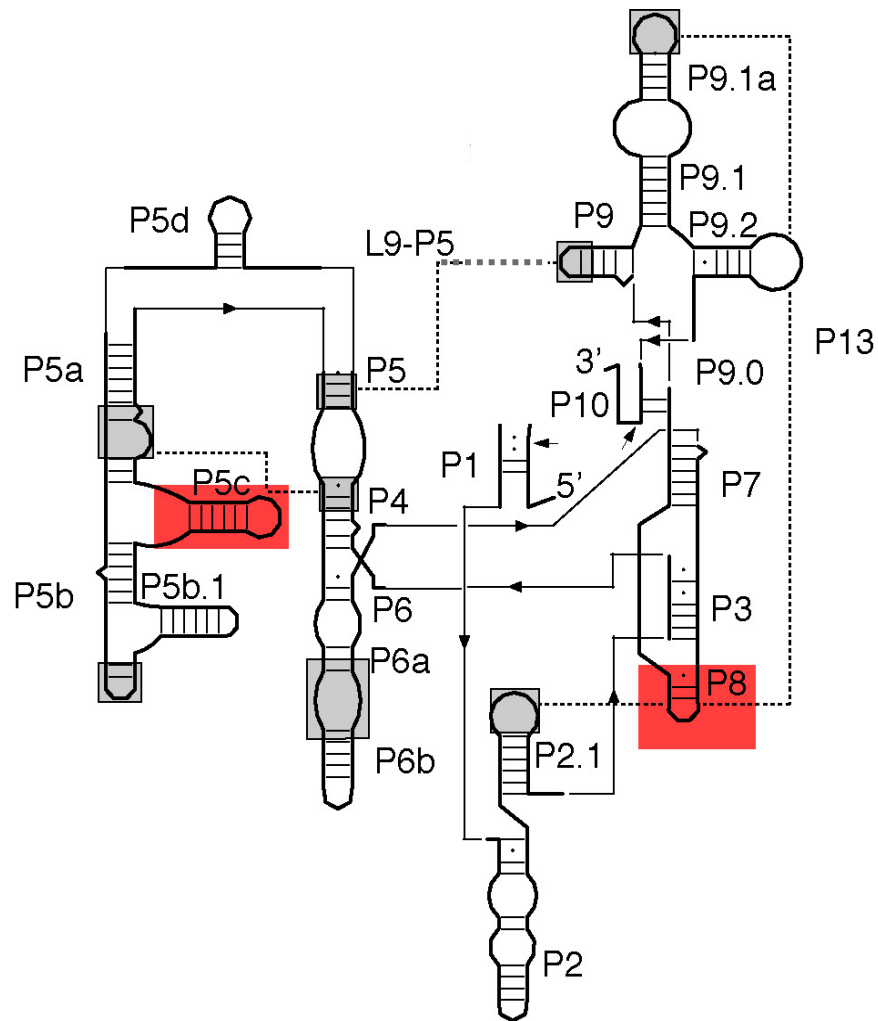


Bangia group IC1 intron

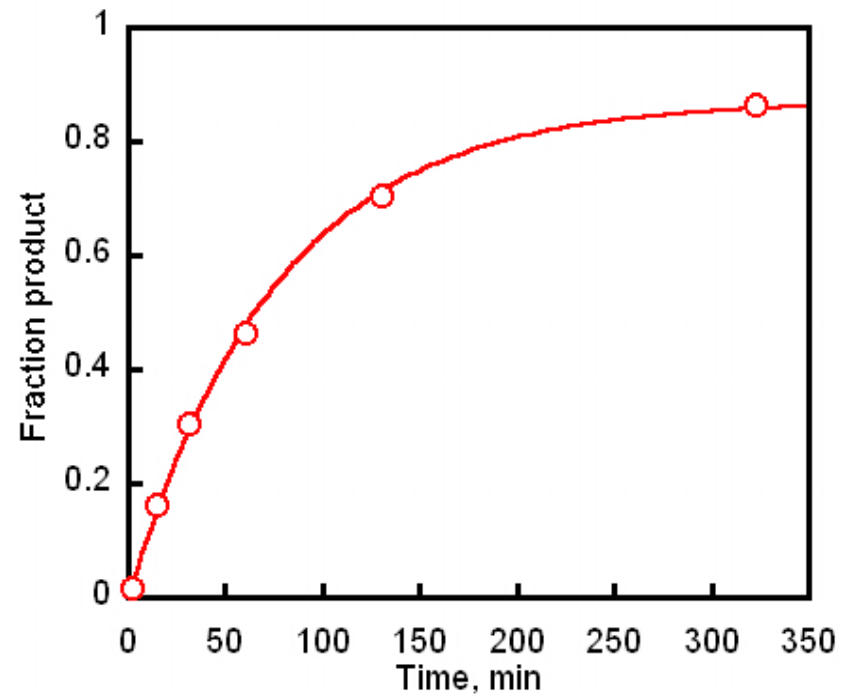


Tetrahymena group IC1 intron

Establishing Tertiary Contacts of the *Bangia* Intron

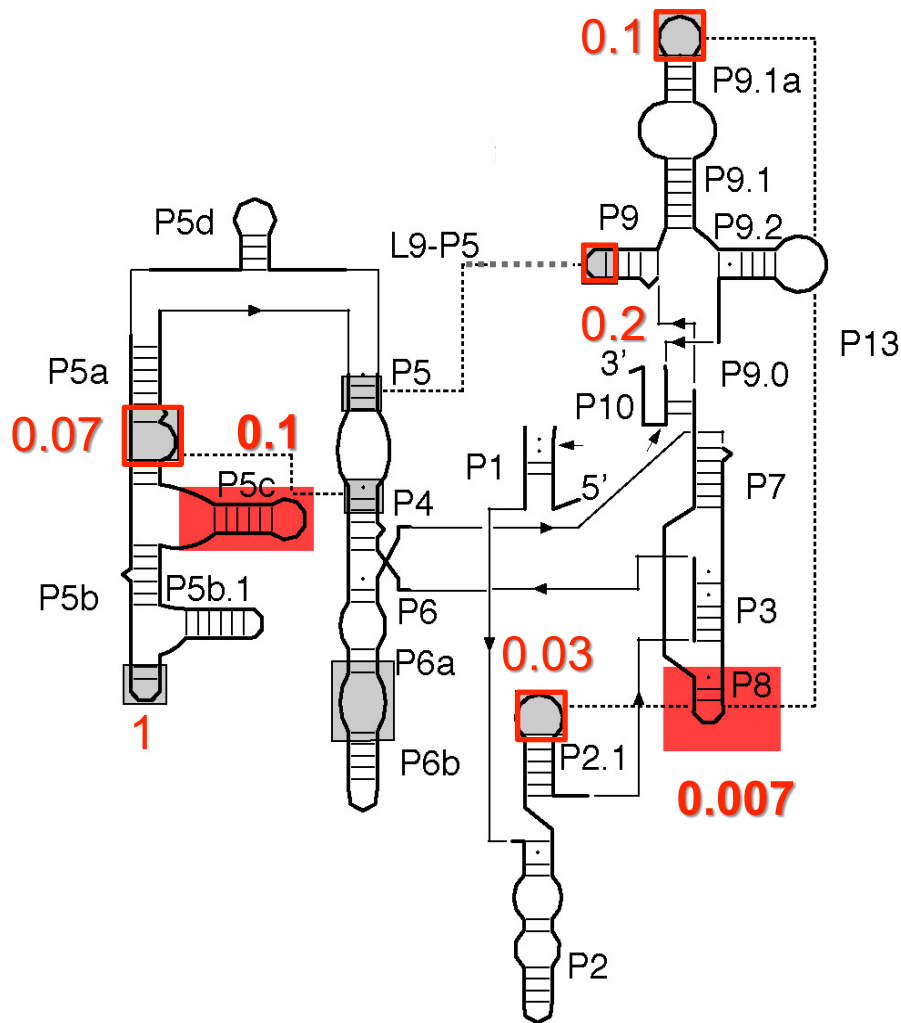


Bangia group IC1 intron

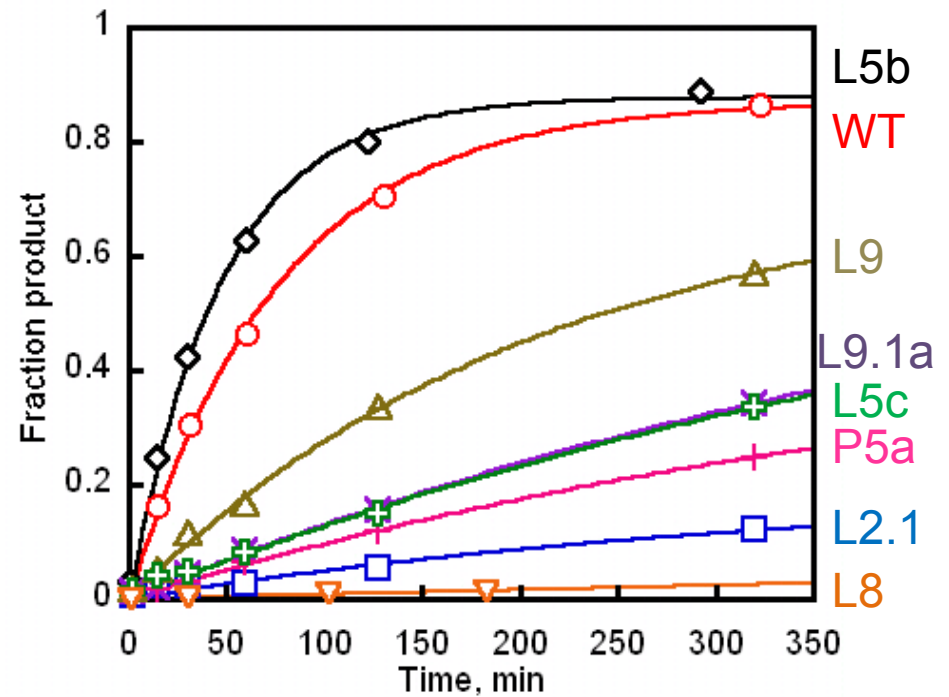


25°C, pH7, 10mM Mg²⁺, 50mM Na-MOPS, 500μM Guanosine, 100nM ribozyme

Establishing Tertiary Contacts of the *Bangia* Intron

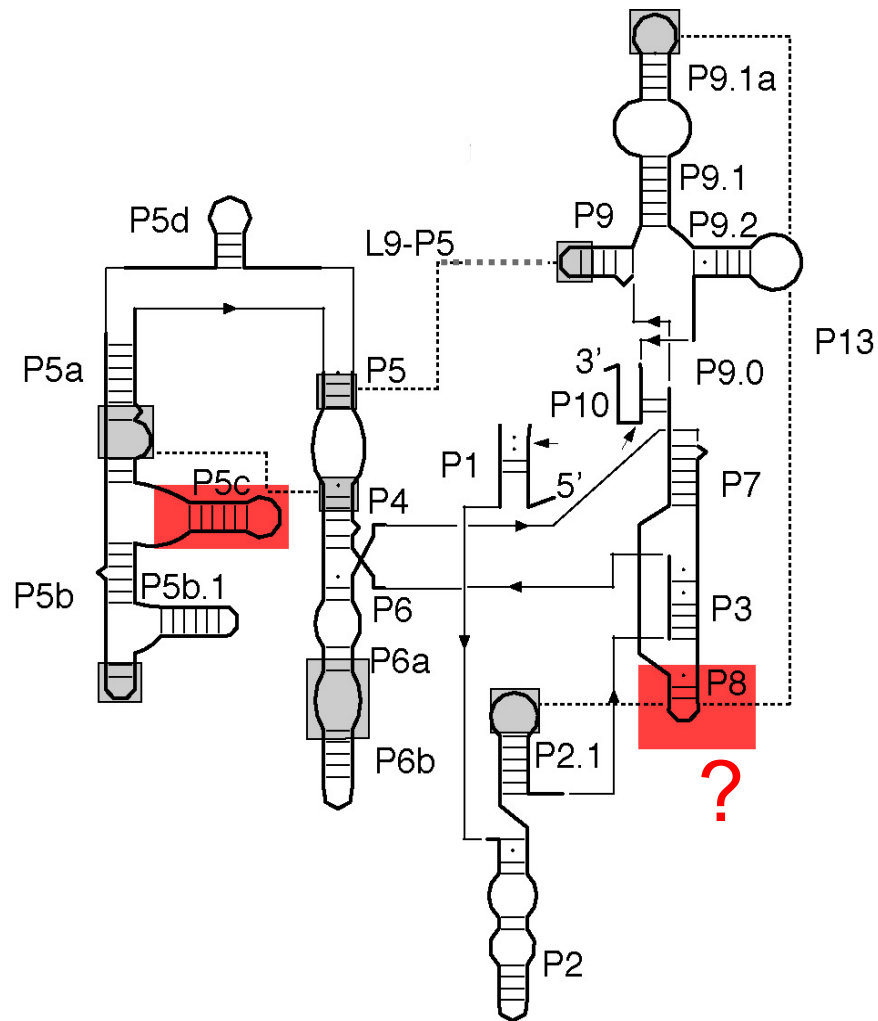


Bangia group IC1 intron



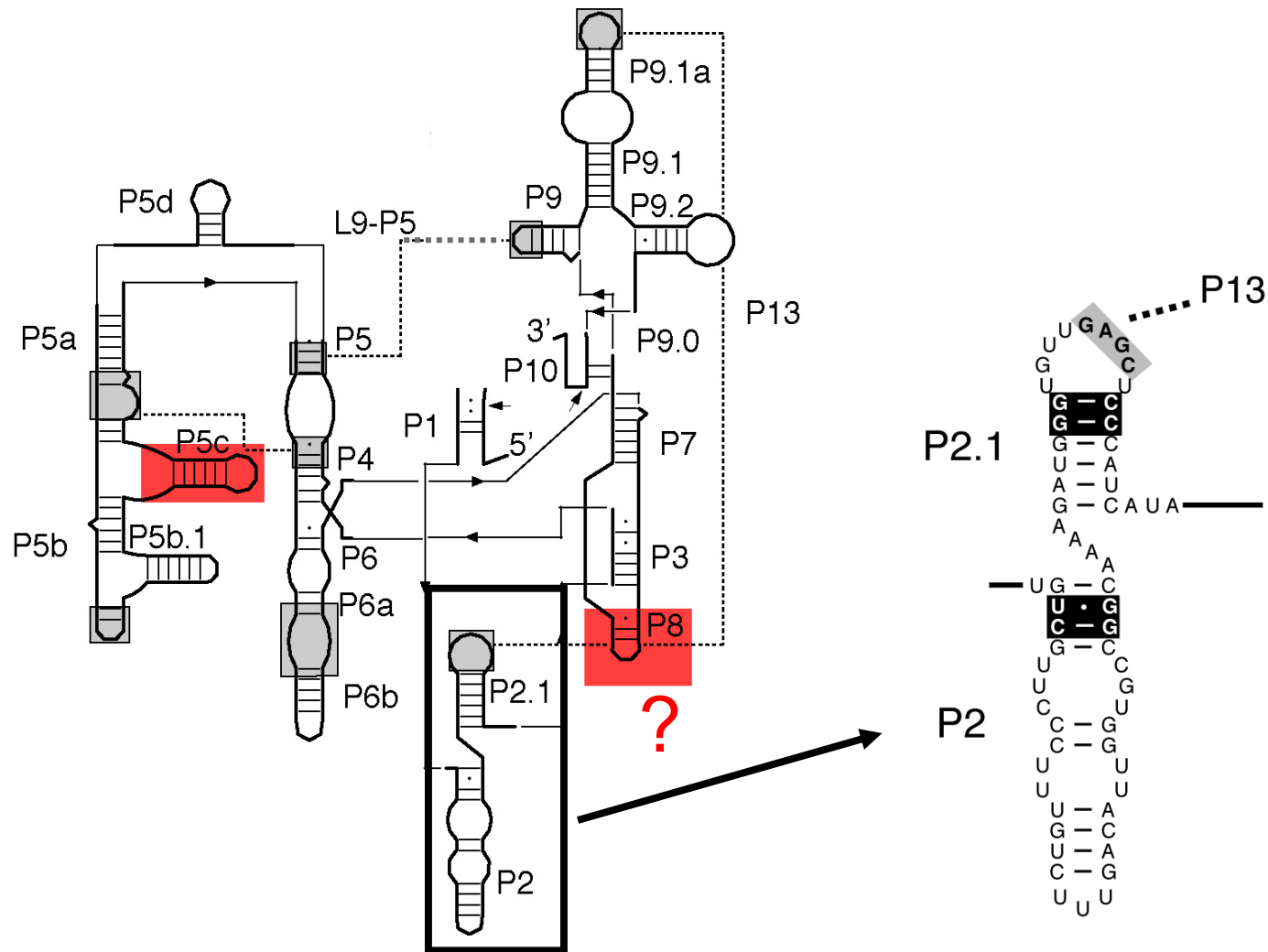
25°C, pH7, 10mM Mg²⁺, 50mM Na-MOPS, 500μM Guanosine, 100nM ribozyme

Potential Receptors for L8 Tetraloop



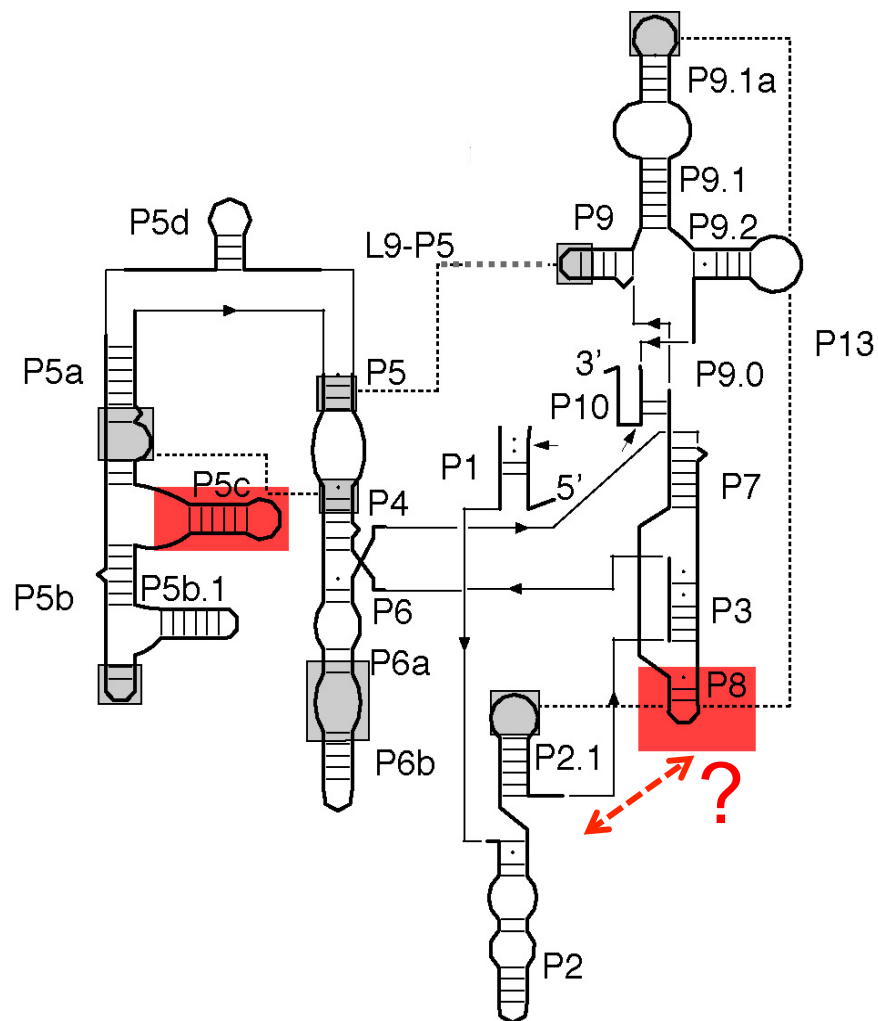
Bangia group IC1 intron

Potential Receptors for L8 Tetraloop

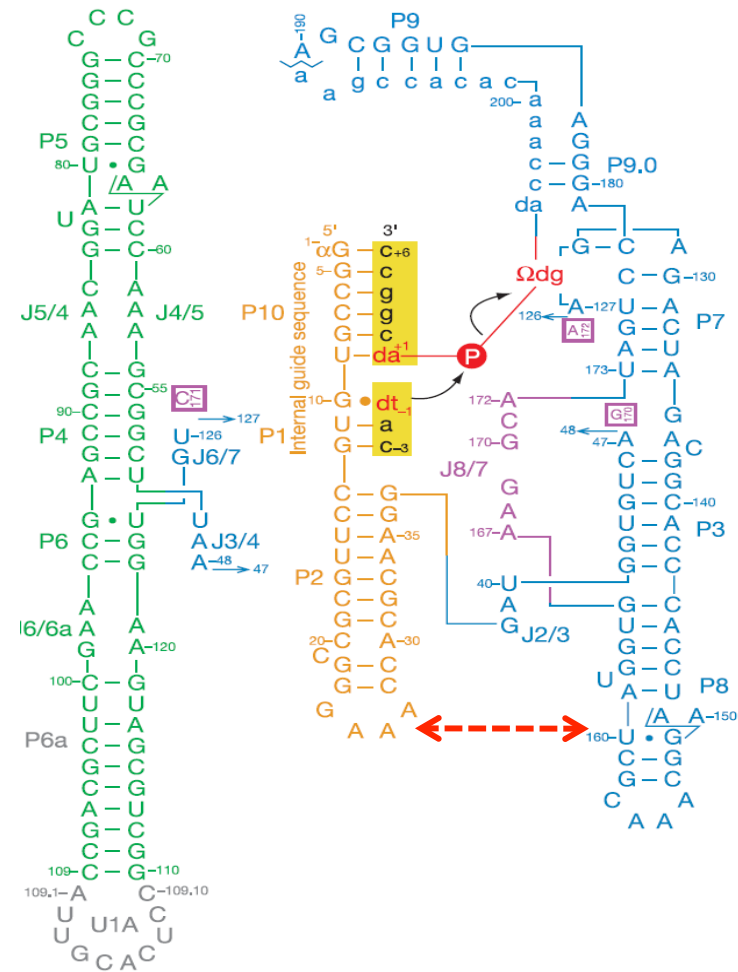


Bangia group IC1 intron

Similar Contact in *Azoarcus* Intron

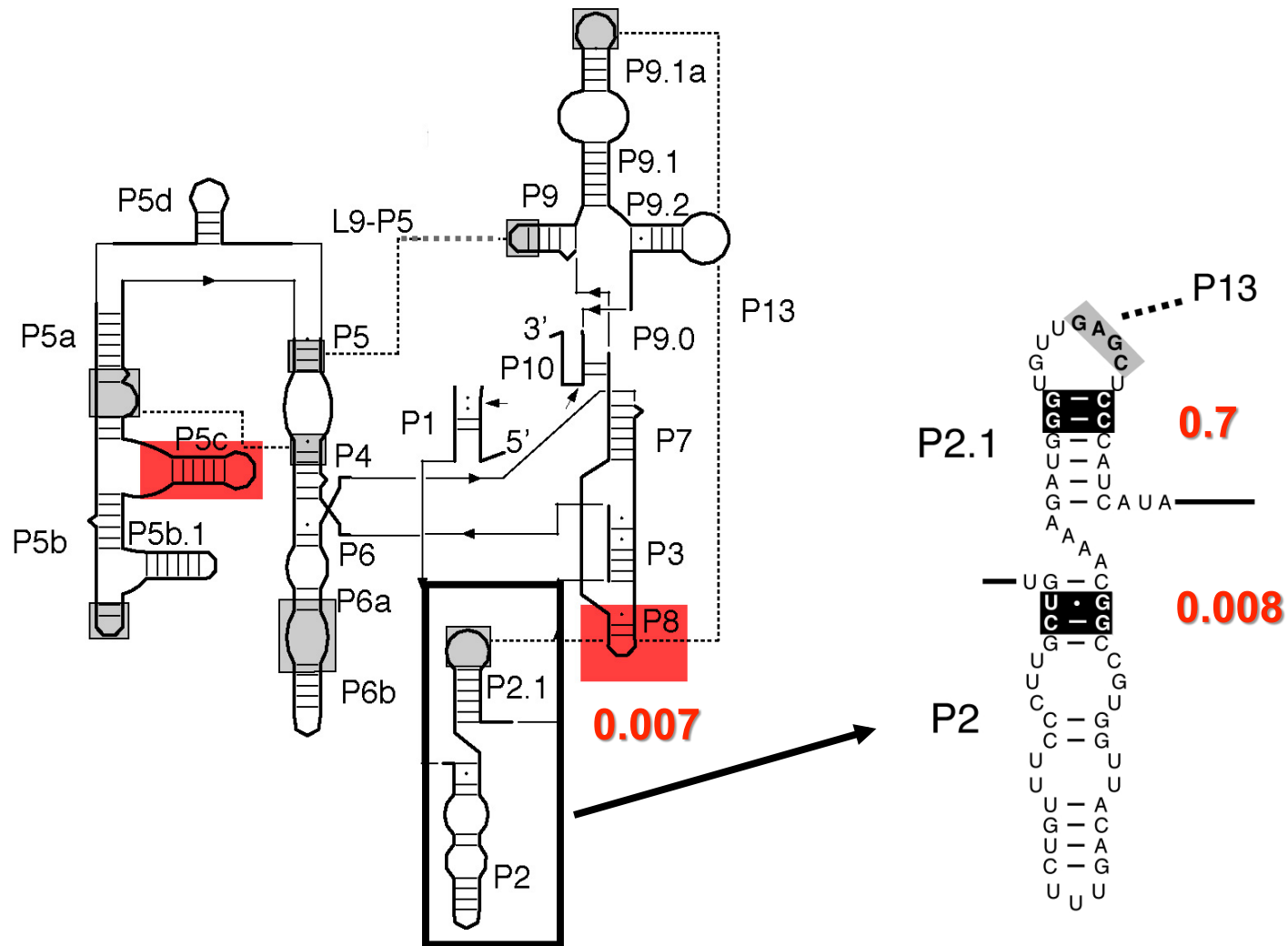


Bangia group IC1 intron



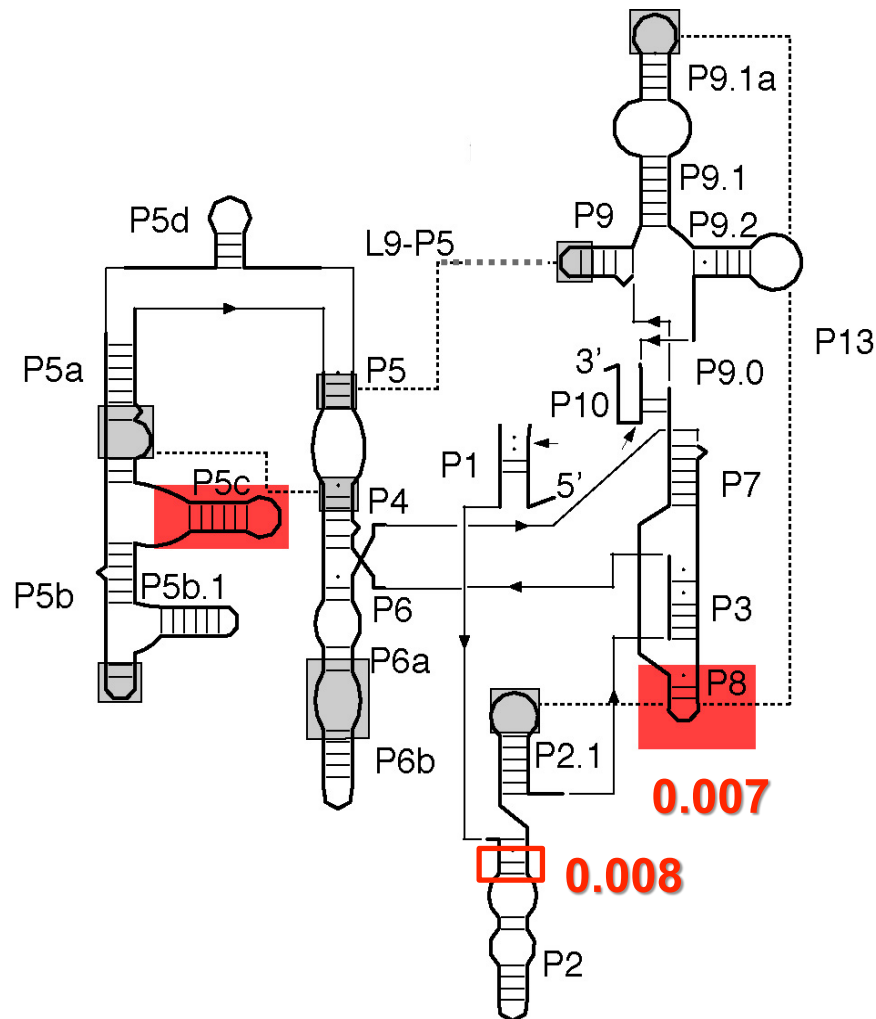
Azoarcus group IC3 intron

Potential Receptors for L8 Tetraloop

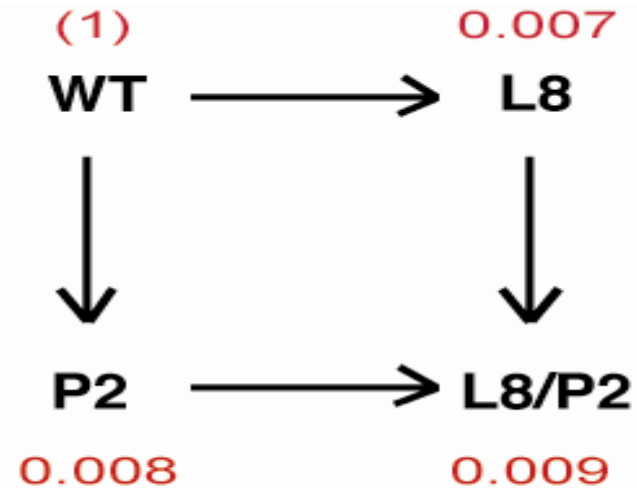


Bangia group IC1 intron

Potential Receptors for L8 Tetraloop



Bangia group IC1 intron



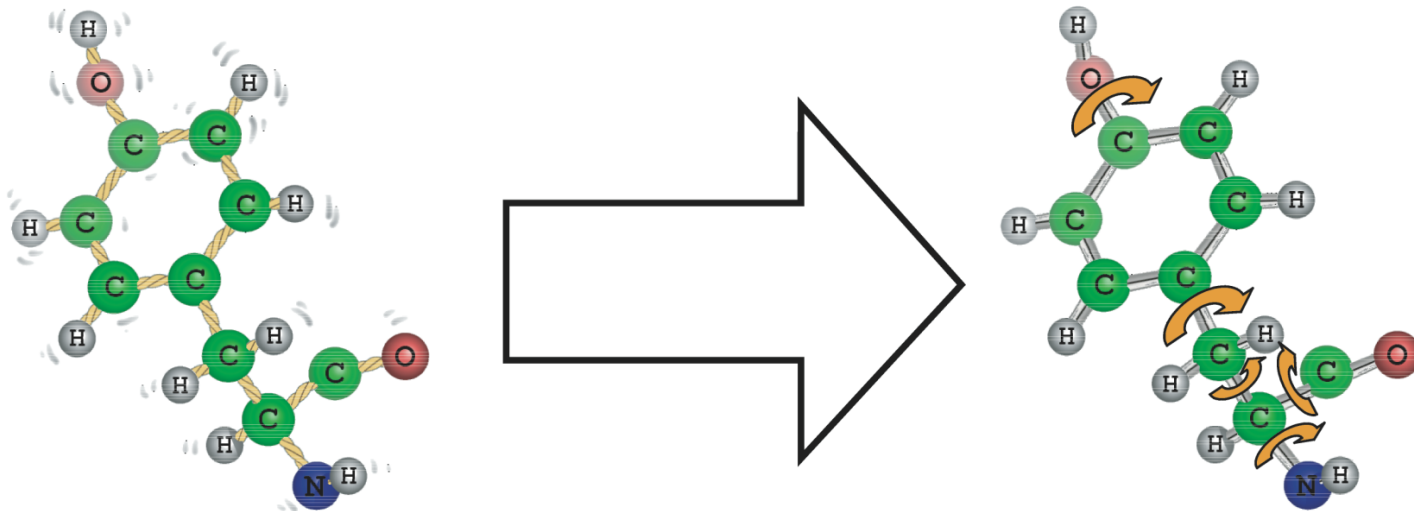
However, the attempts to rescue the contact by compensatory mutants failed...



Structural Modeling with RNABuilder

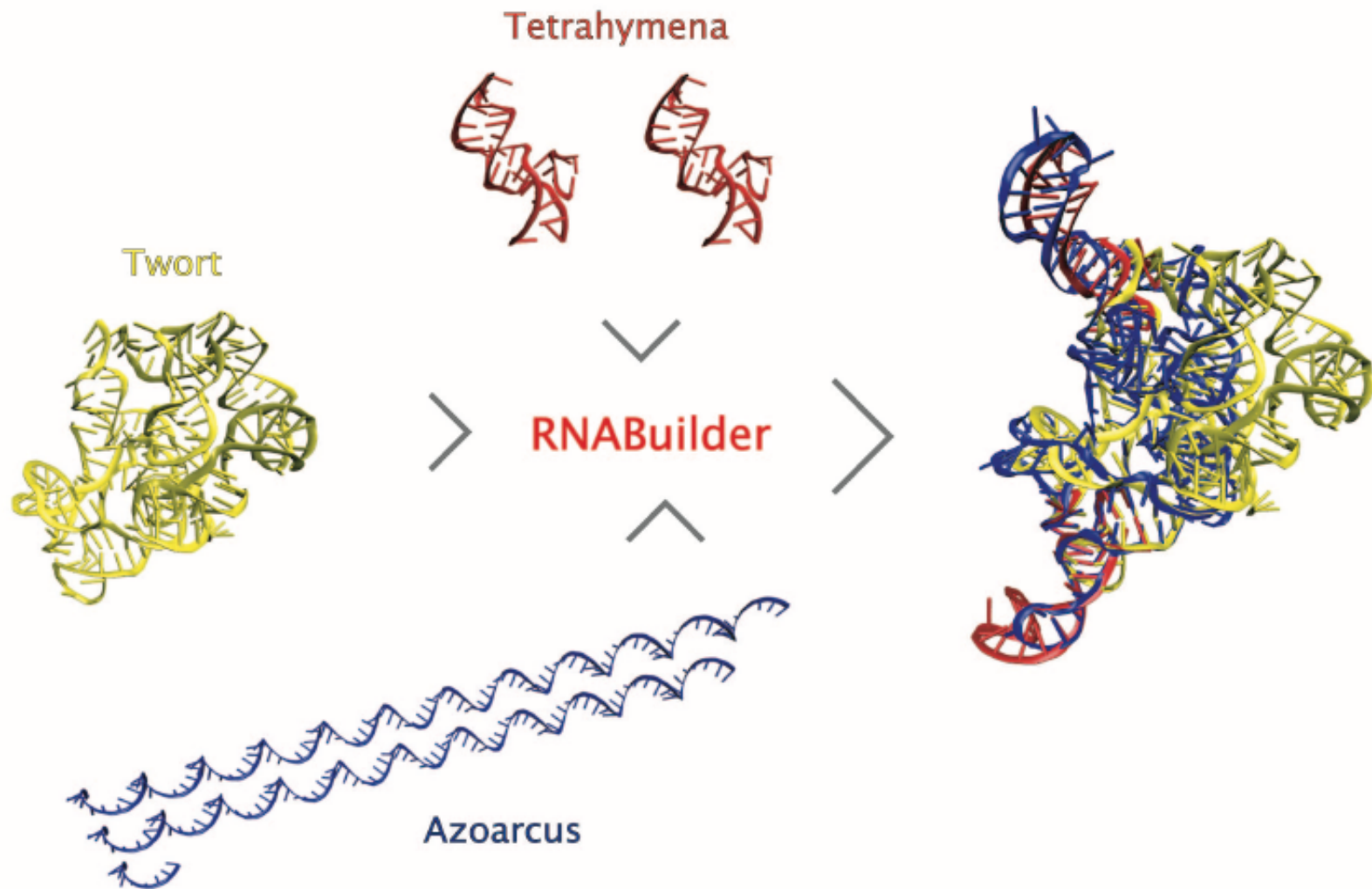
- Samuel Coulbourn Flores, PhD
 - Altman lab
 - Stanford University

Structural Modeling with RNABuilder

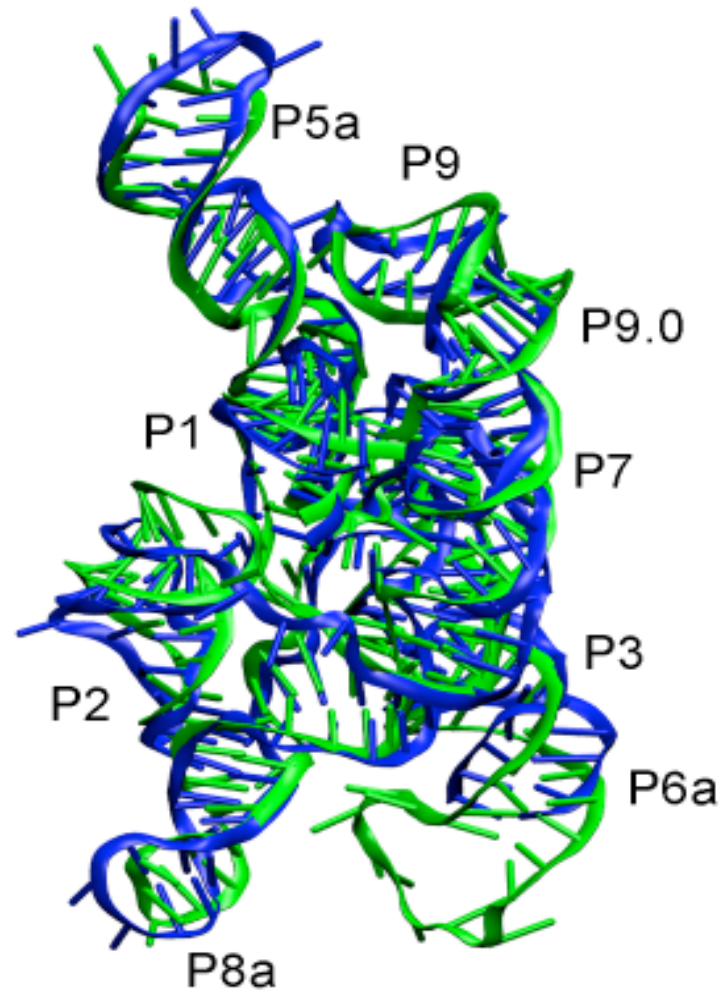


- Internal coordinates can eliminate many of the fast degrees of freedom

Threading of *Azoarcus* Intron by RNABuilder

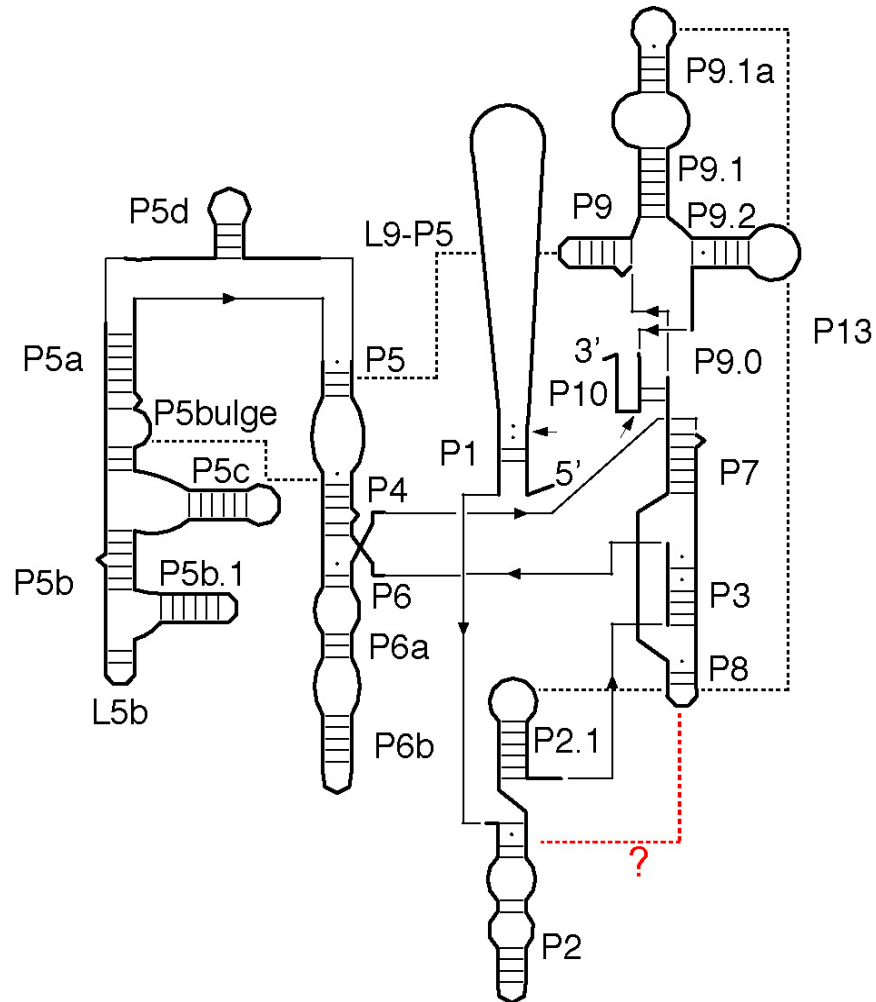


Threading of *Azoarcus* Intron by RNABuilder



Blue-Model
Green-Crystal structure
RMSD: 4.6 Å

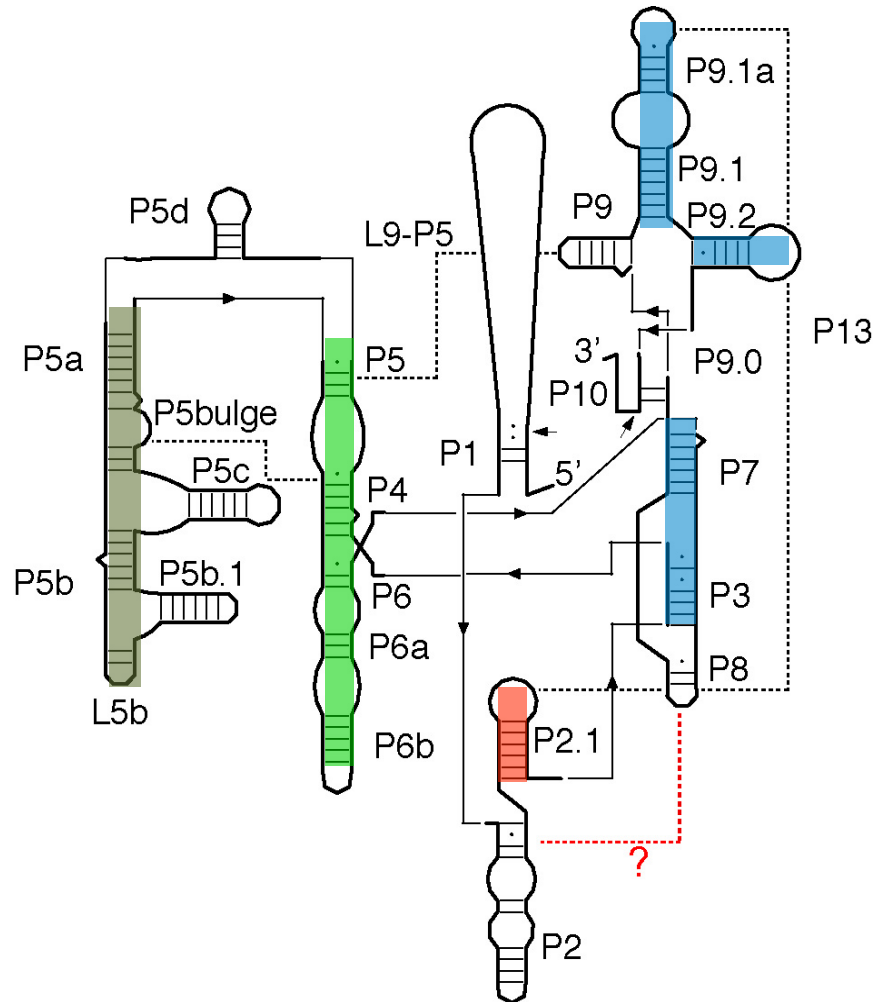
Modeling *Bangia* Intron by RNABuilder



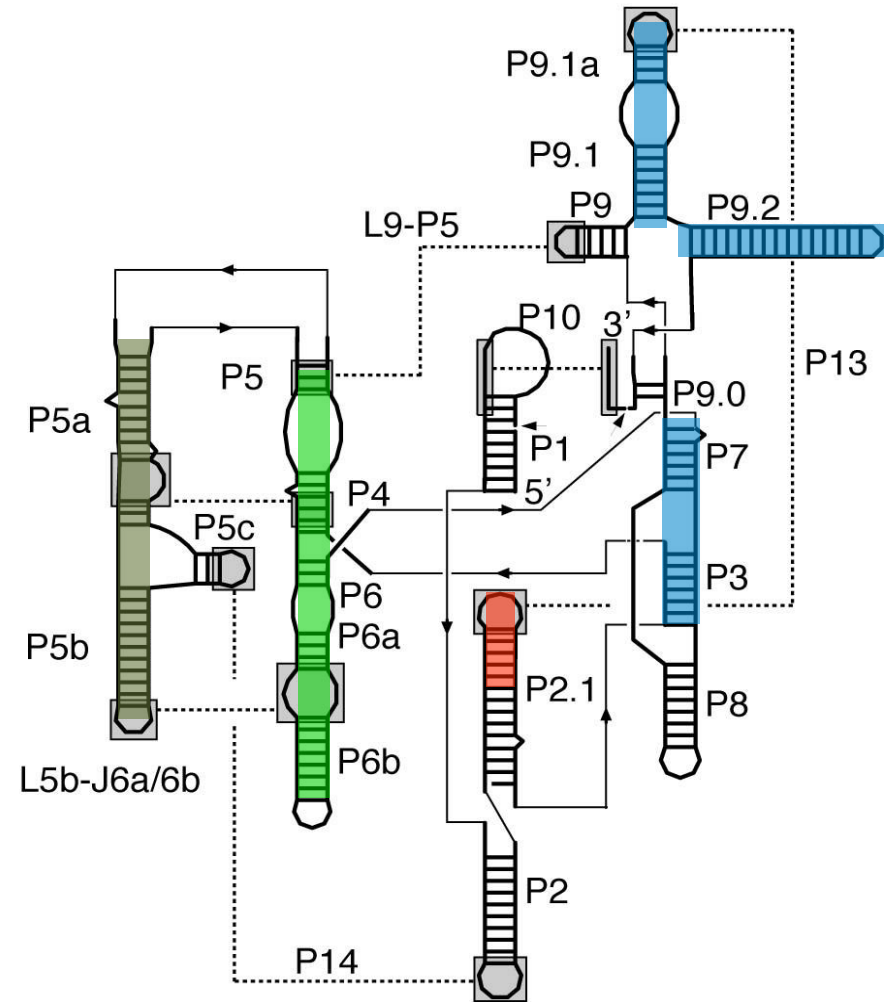
Bangia group IC1 intron



Threading of *Bangia* Intron to *Tetrahymena* RNA

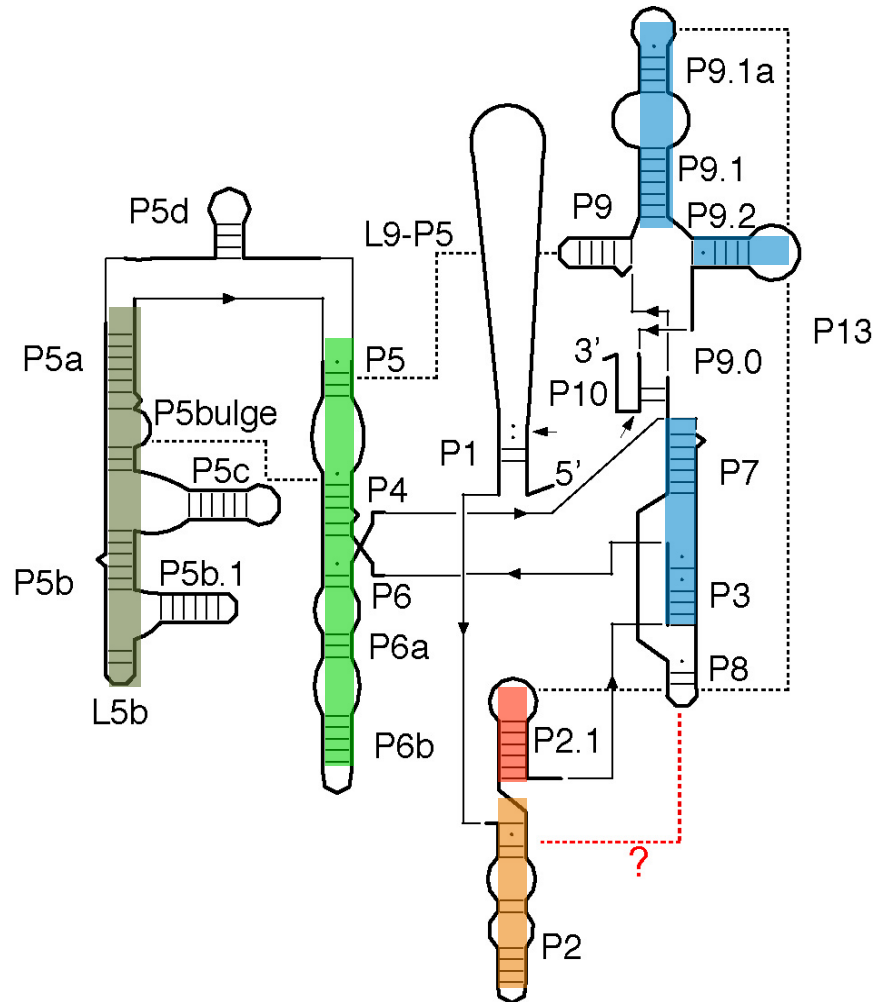


Bangia group IC1 intron

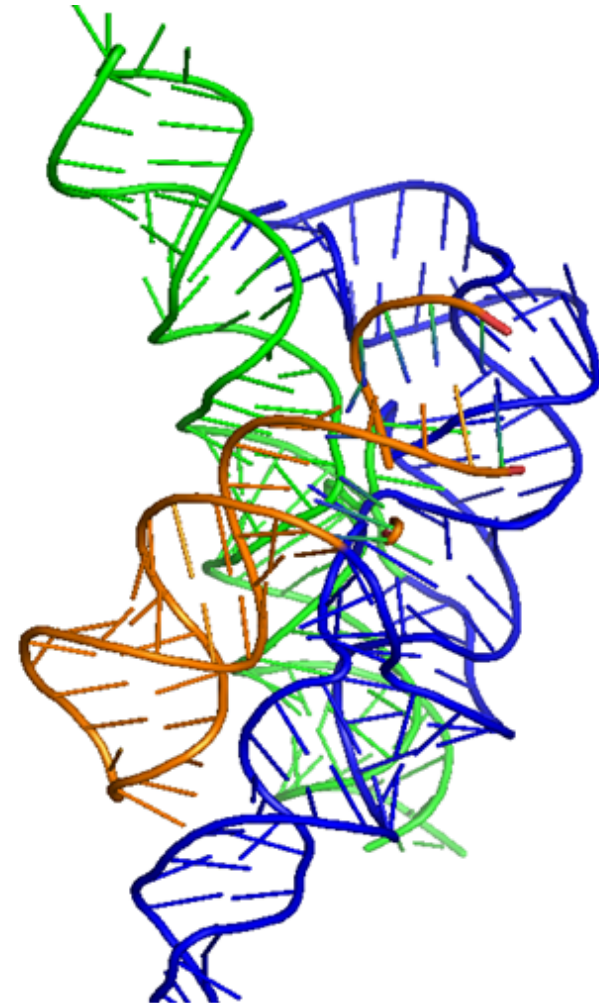


Tetrahymena group IC1 intron

Threading P2 of *Bangia* Intron to *Azoarcus* RNA



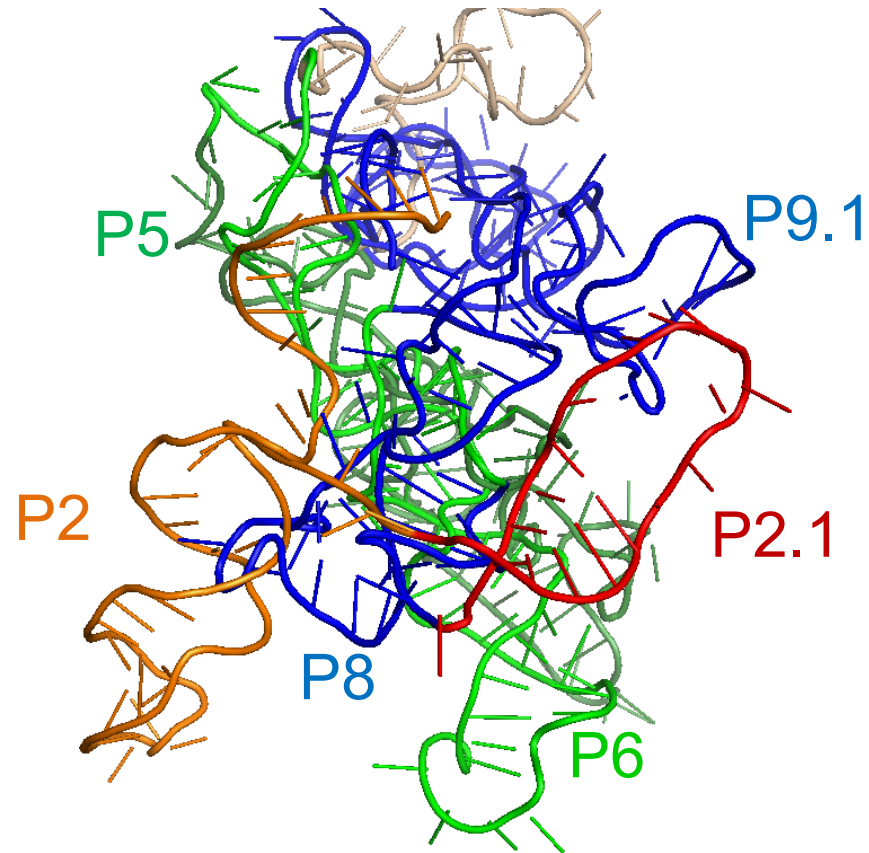
Bangia group IC1 intron



Azoarcus group IC3 intron

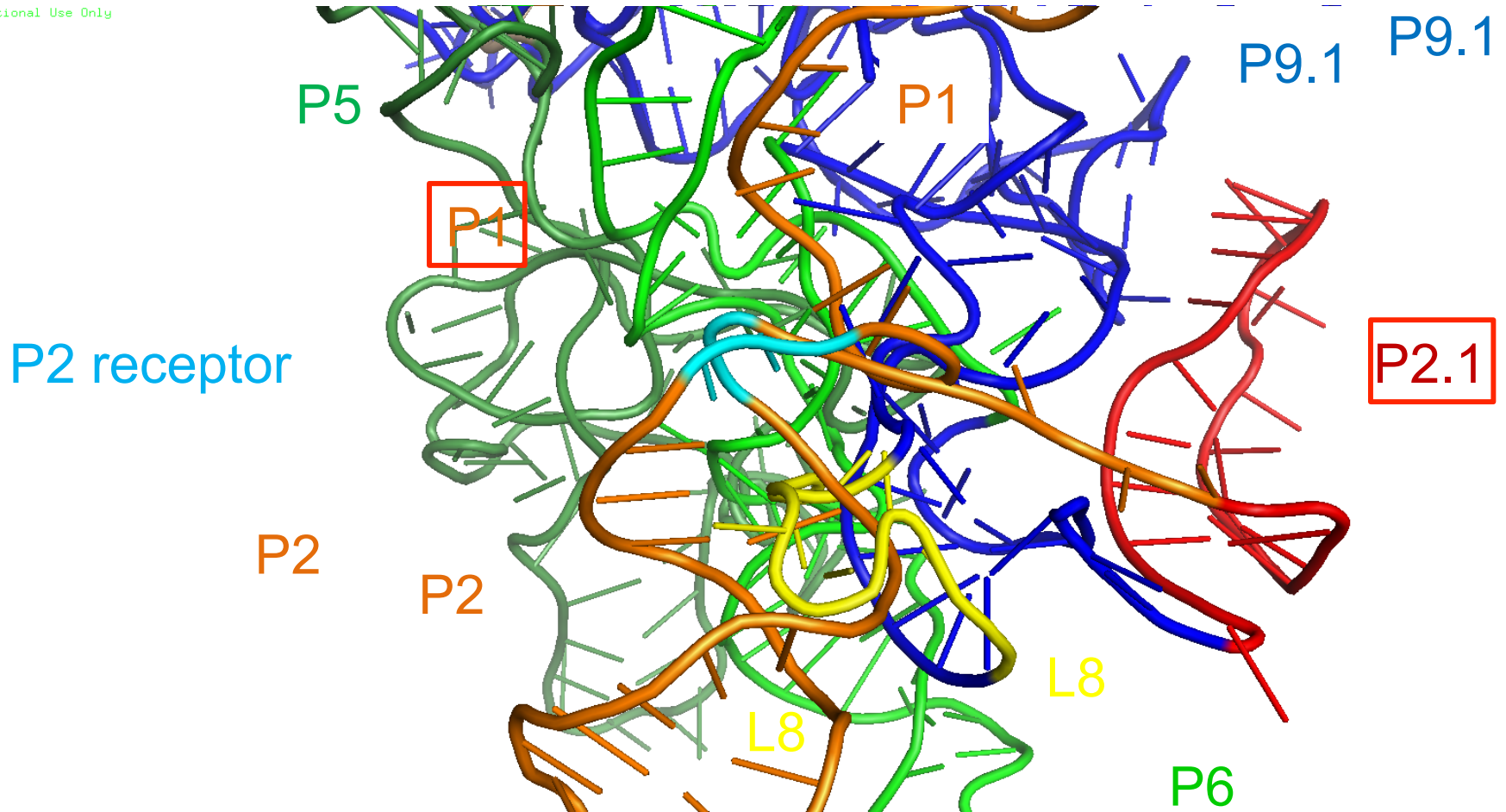
Threading P2 of *Bangia* Intron to *Azoarcus* RNA

For Educational Use Only

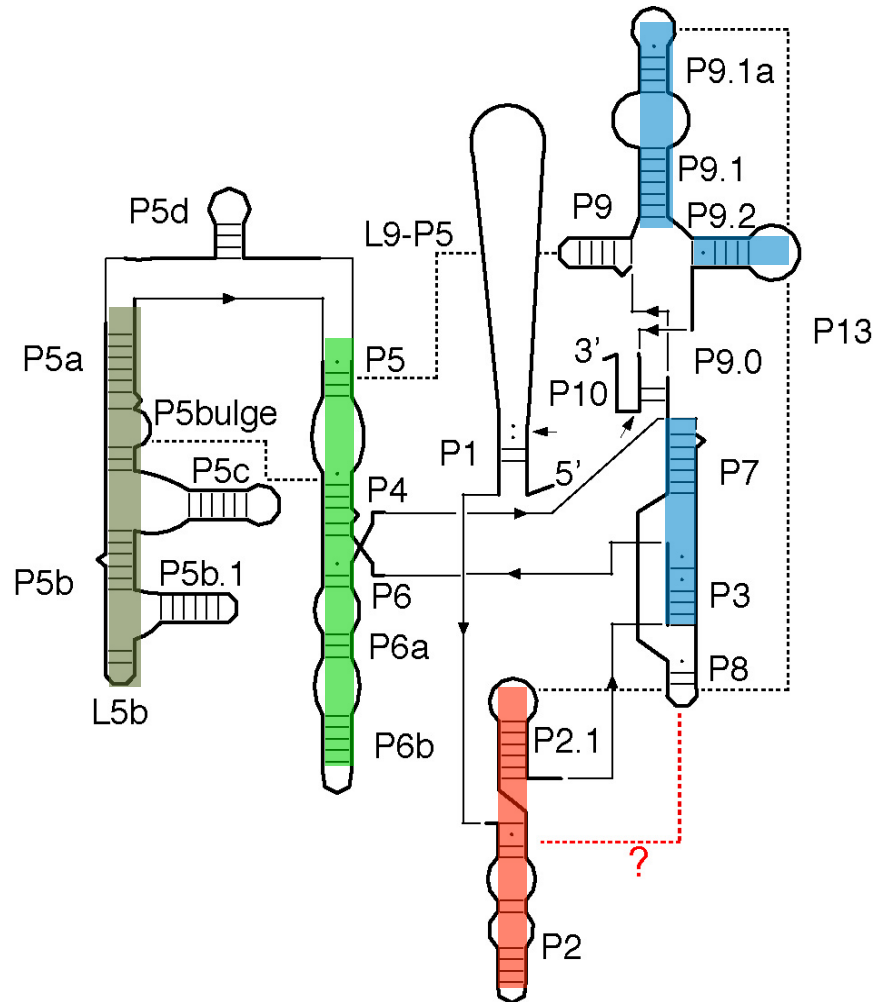


Threading P2 of *Bangia* Intron to *Azoarcus* RNA

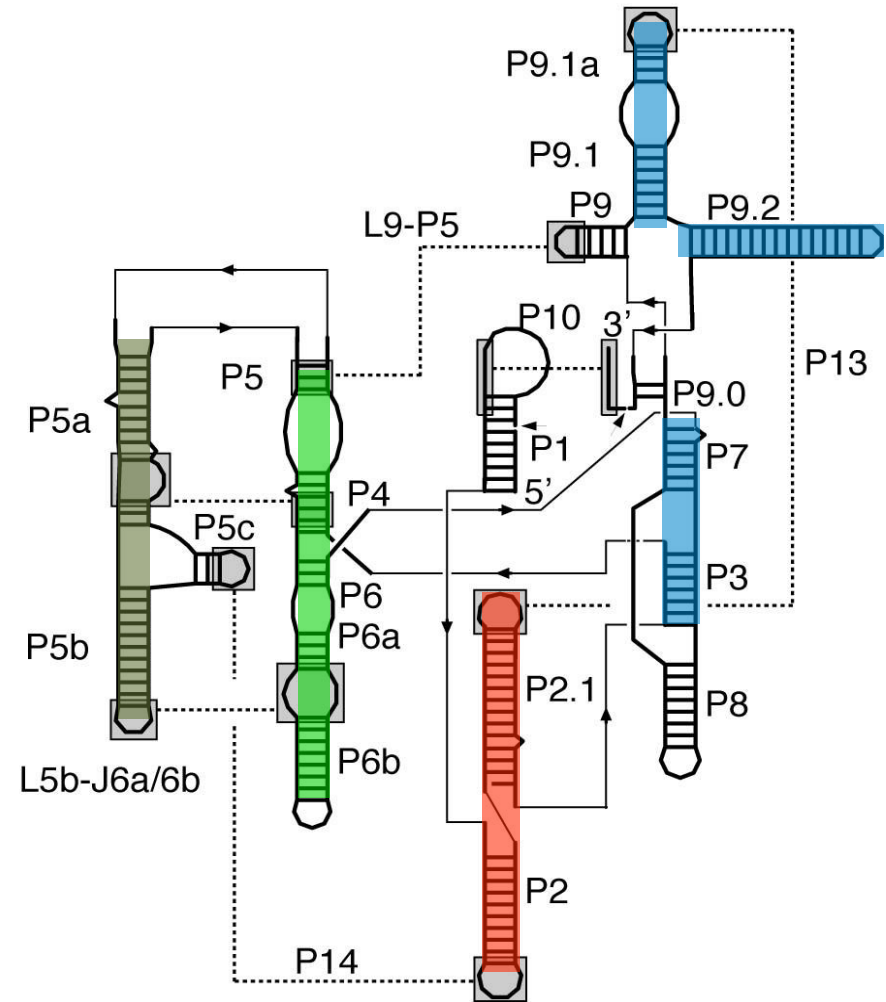
For Educational Use Only



Threading P2 of *Bangia* Intron to *Tetrahymena* RNA

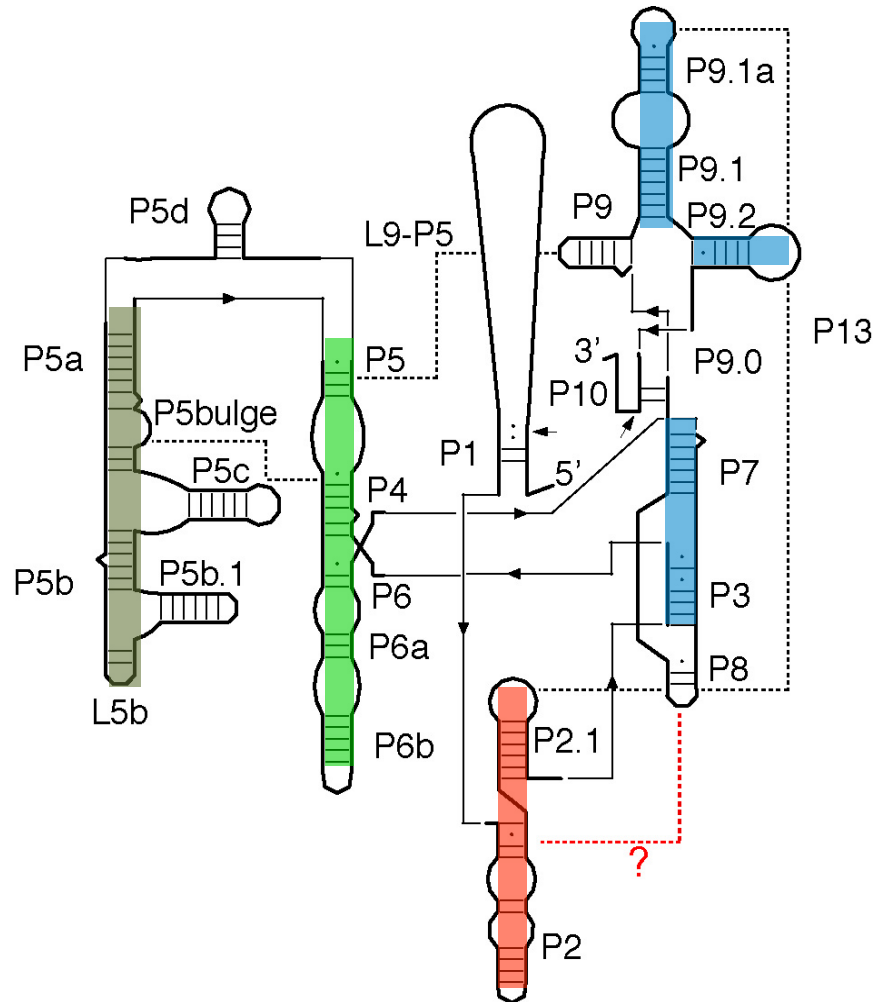


Bangia group IC1 intron

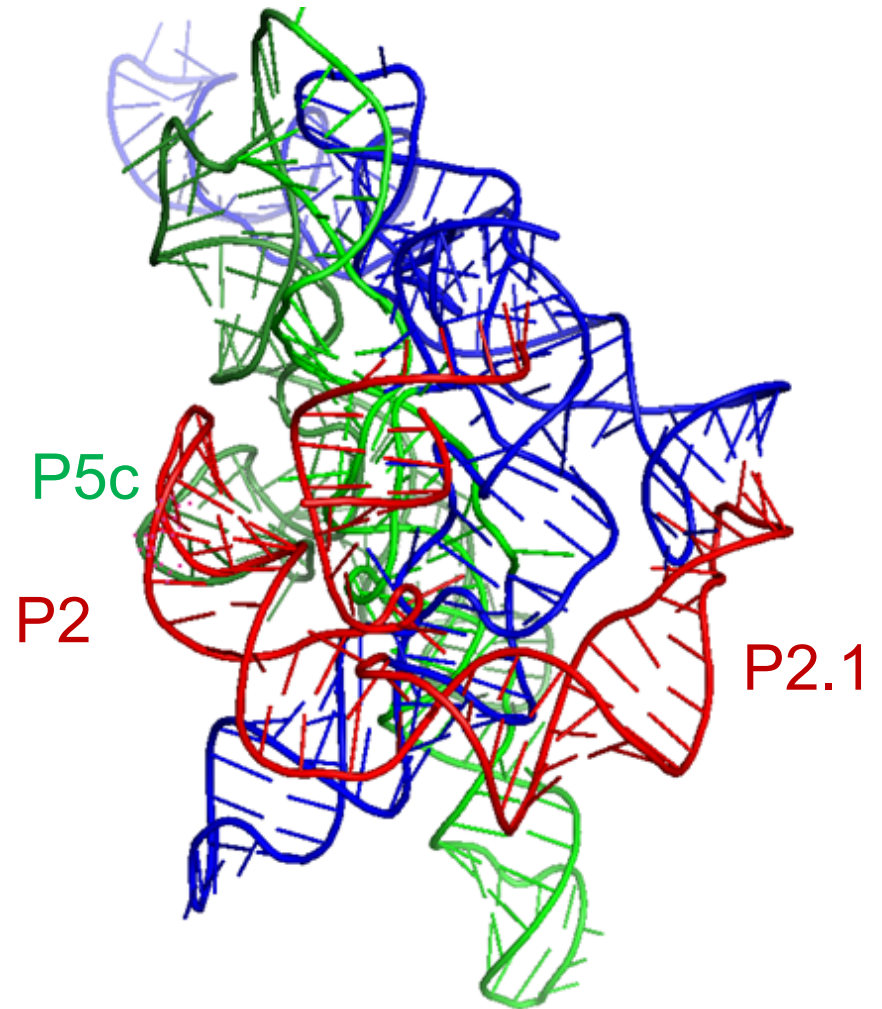


Tetrahymena group IC1 intron

Threading P2 of *Bangia* Intron to *Tetrahymena* RNA

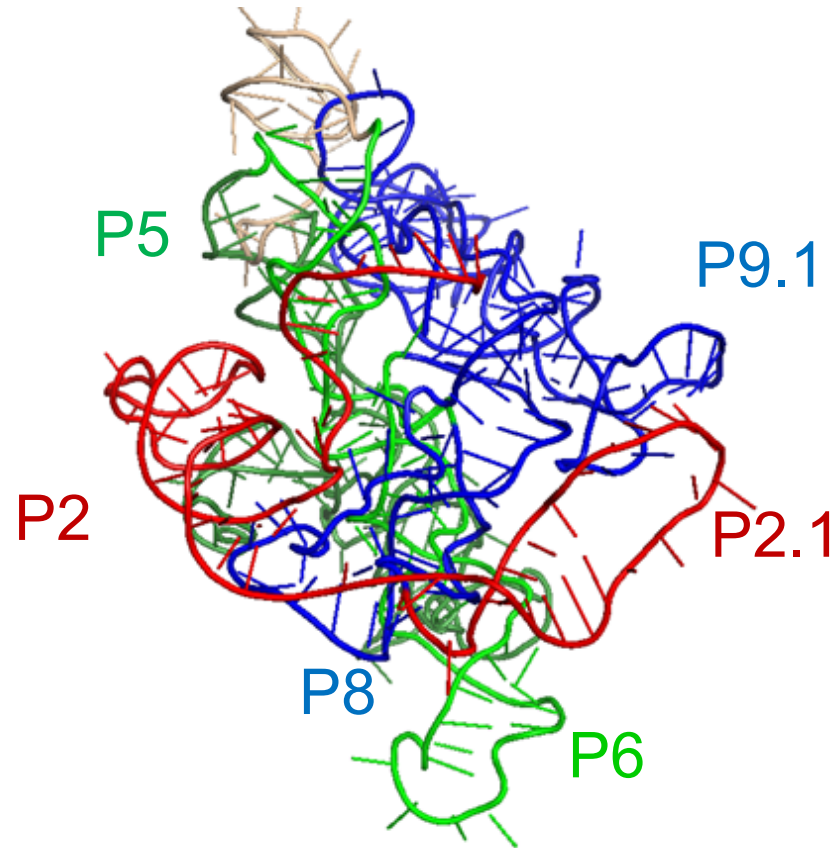


Bangia group IC1 intron



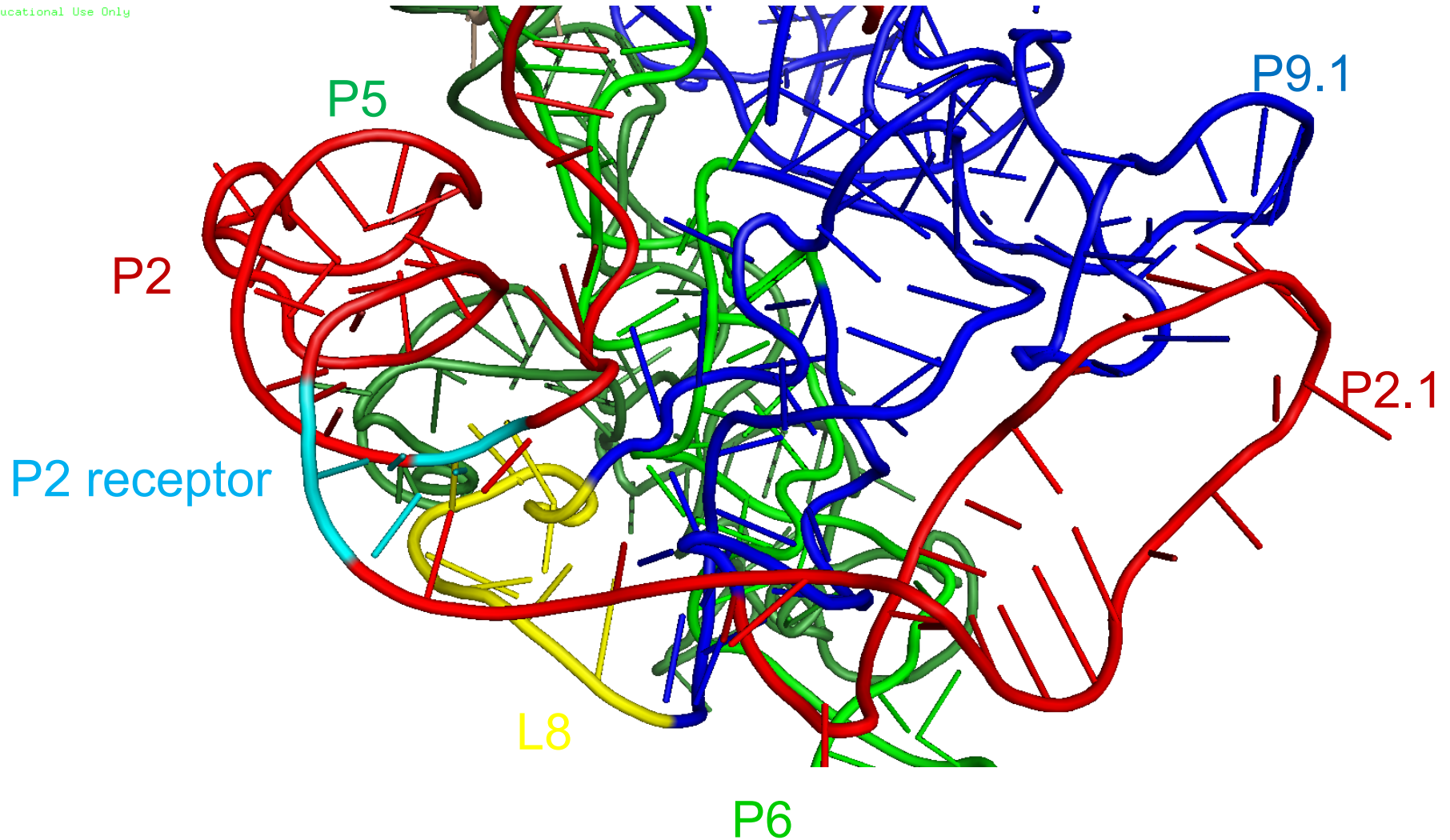
Tetrahymena group IC1 intron

Threading P2 of *Bangia* Intron to *Tetrahymena* RNA

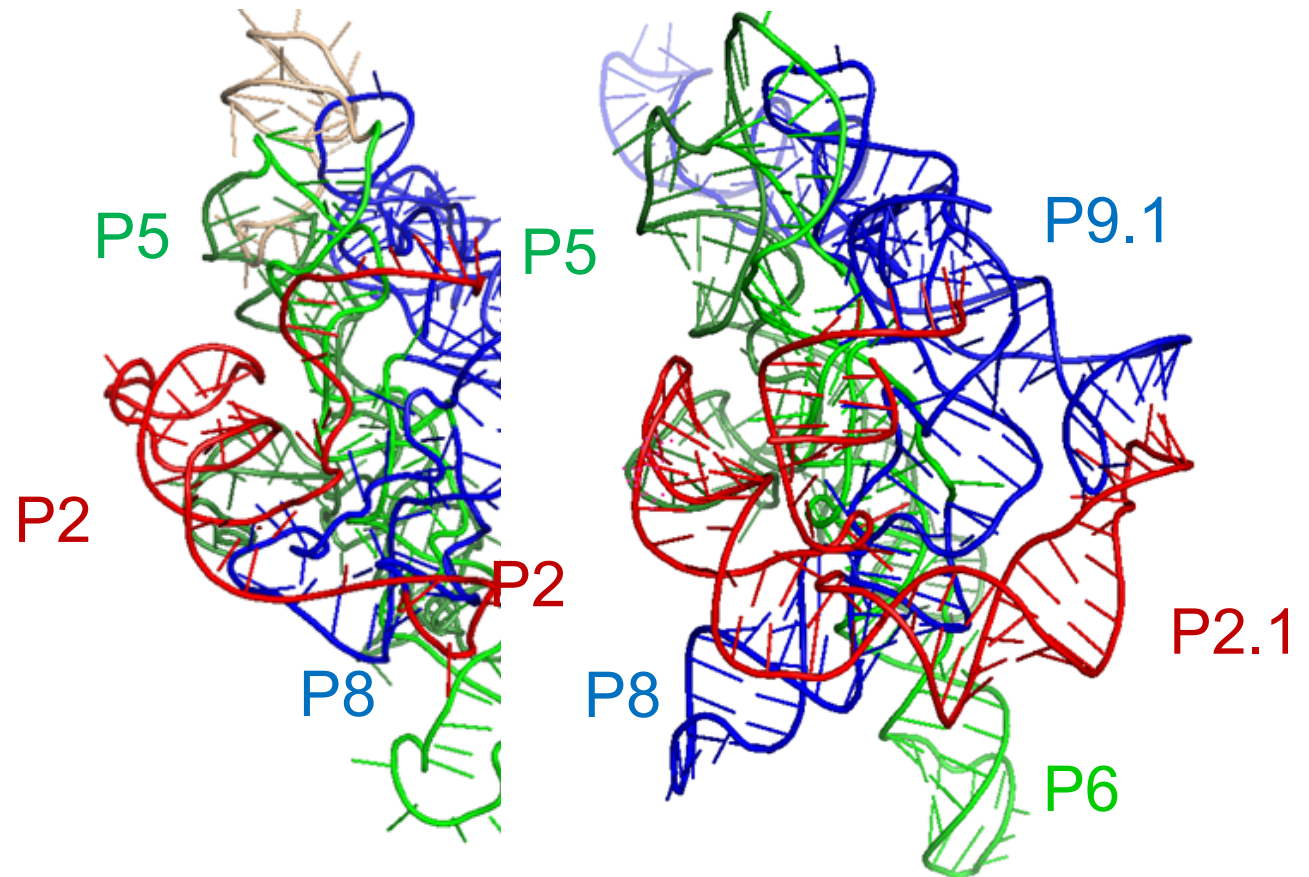


Threading P2 of *Bangia* Intron to *Tetrahymena* RNA

For Educational Use Only



Structural Model of the *Bangia* Intron

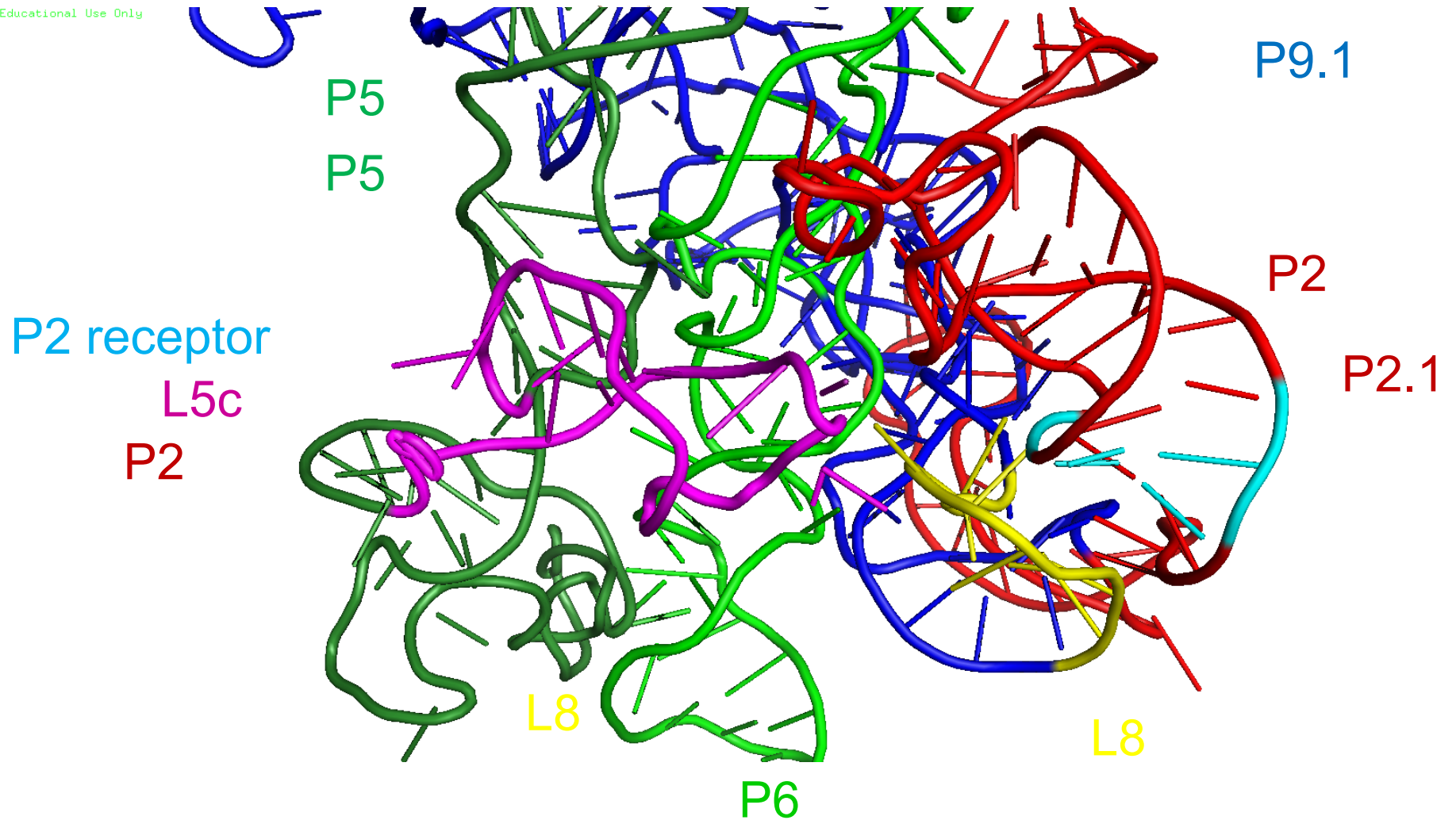


Bangia model

Tetrahymena group IC1 intron

Tetraloop-receptor Interaction of L5c and P2?

For Educational Use Only



Conclusions

- ❖ RNABuilder provides strong support for a tertiary contact that was refractory to experimental validation
- ❖ Suggests that *Bangia* intron has the same overall architecture as close relatives and adds a new contact
- ❖ Introduces further experimental tests of new contacts and architecture

Acknowledgements

Yaqi Wan

Sam Flores
Russ Altman

Jung Lee
Robin Gutell

NIH, Welch Foundation