Real-Time Evolution of New Genes by Innovation, Amplification, and Divergence

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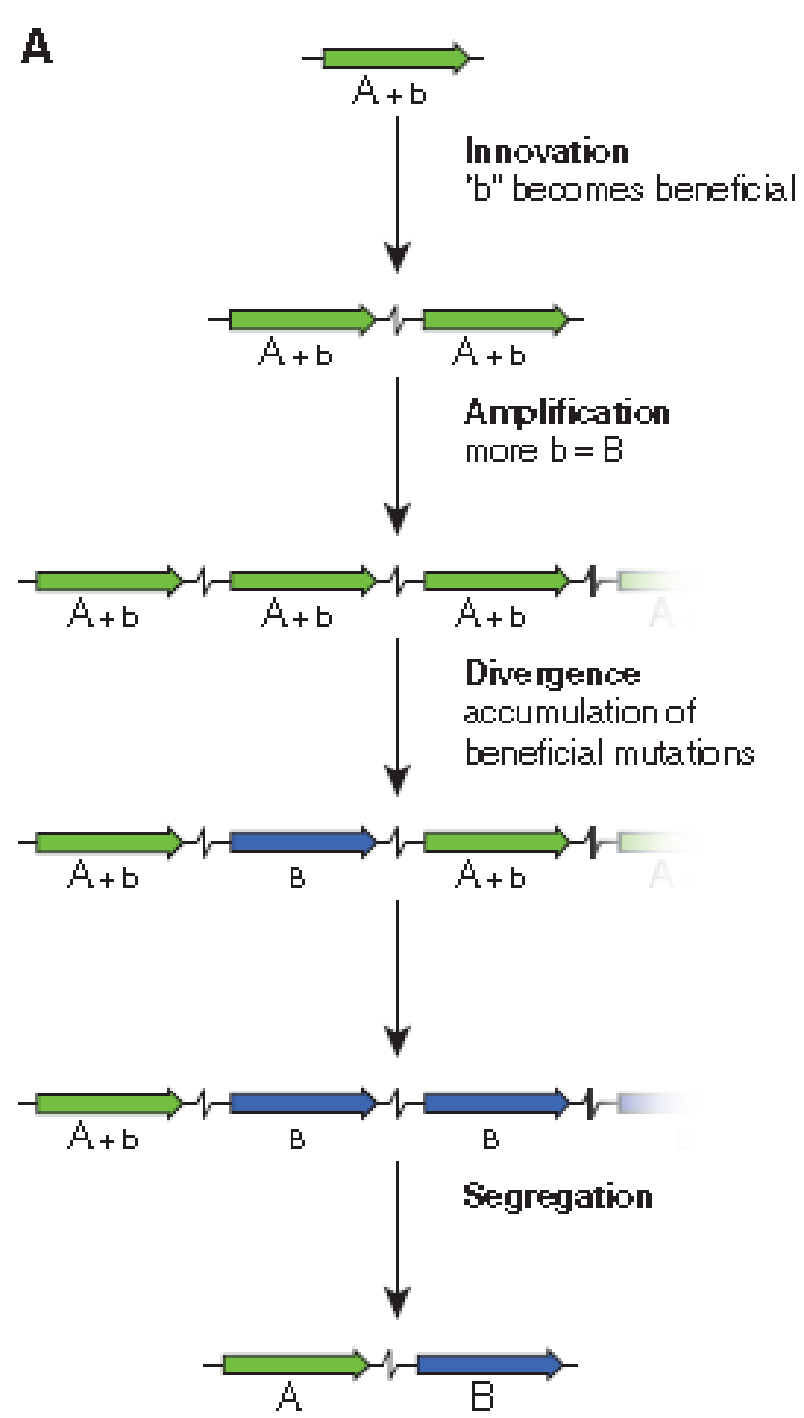
- 1 the innovation-amplification-divergence (IAD) model
- 2 the exampel:a preexisting parental gene in *Salmonella enterica* that has low levels of two distinct activities.
- 3 supplement



1. the IAD model

The emergence of gene B

无or隐形

↓

复制

↓

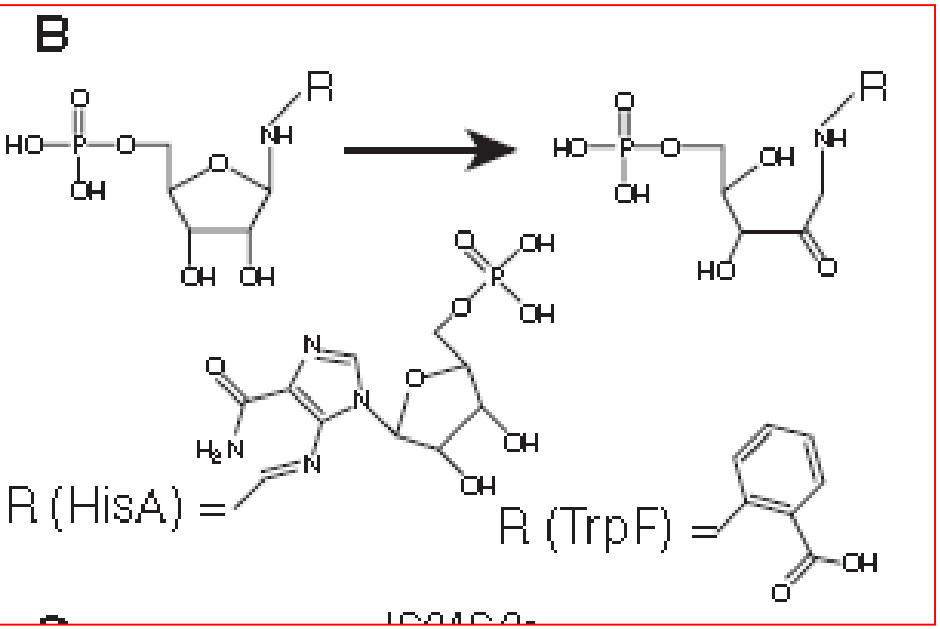
突变

↓

有or显性

新基因产生的过程模型

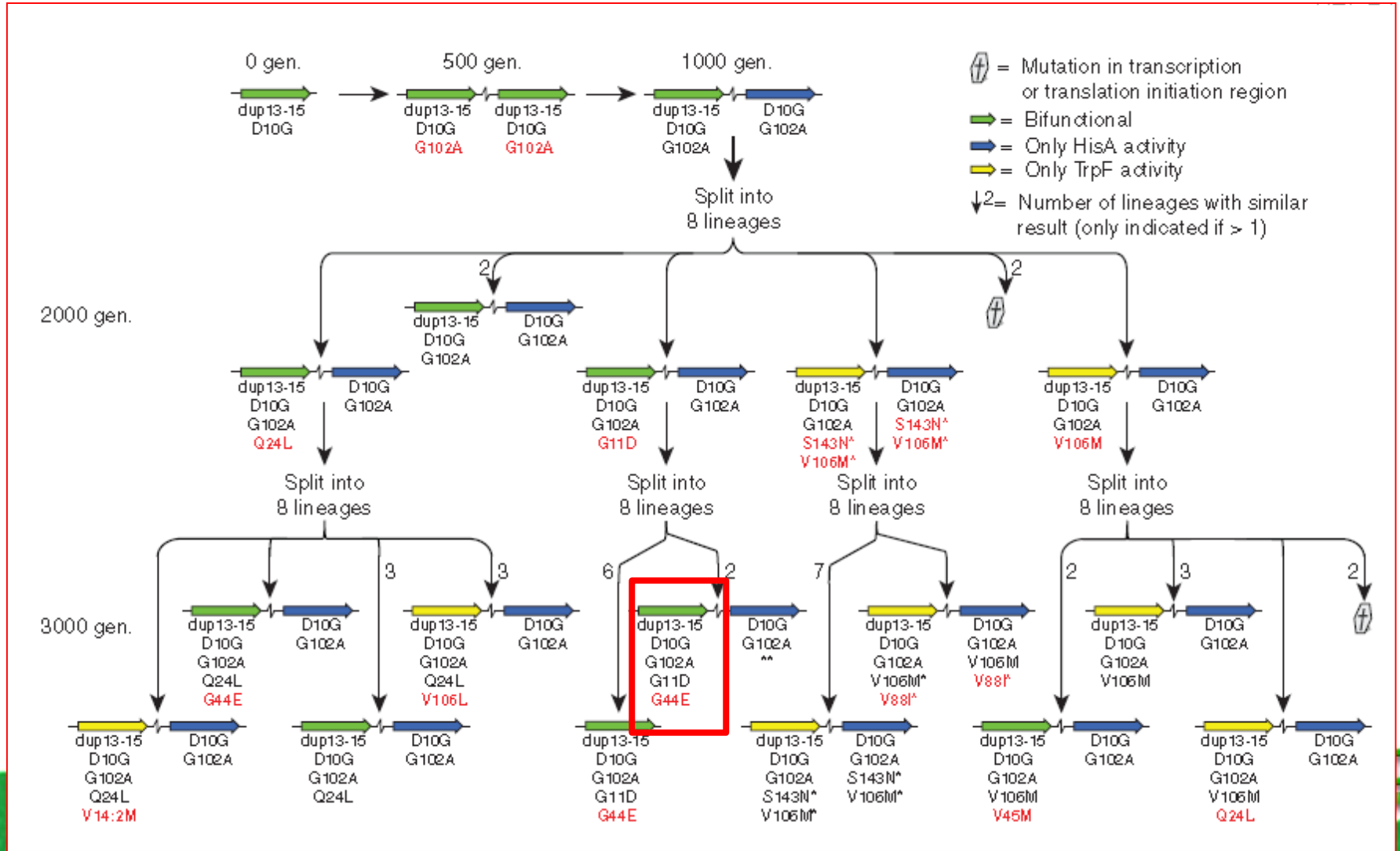
2 the example



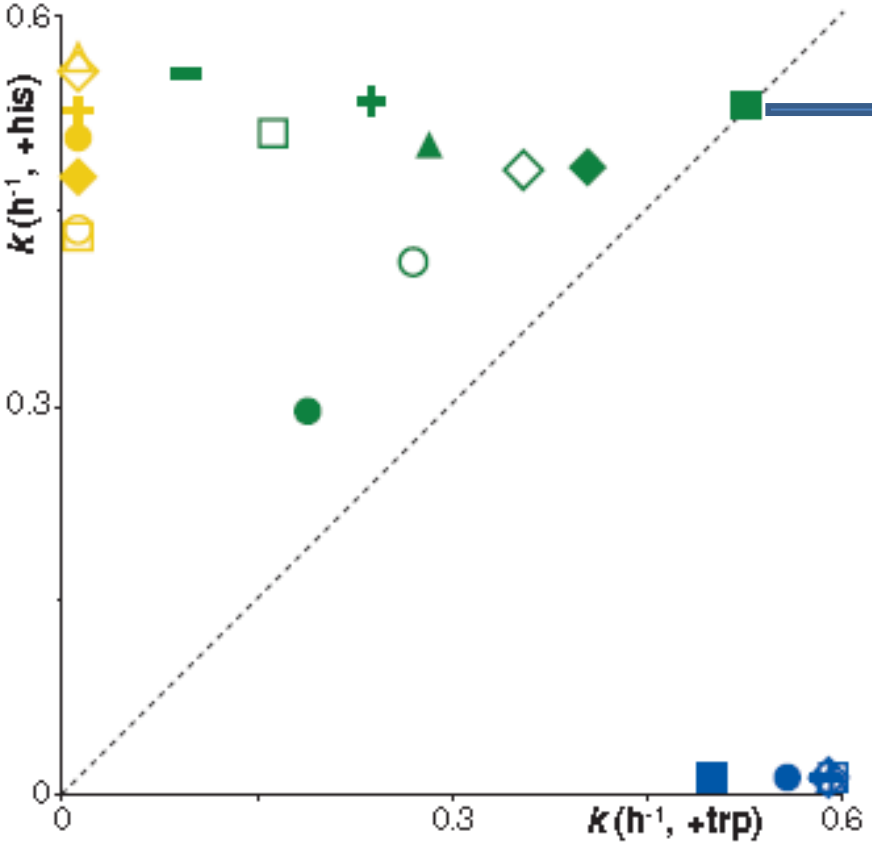
Salmonella enterica

	generation time
Have no any of both	5.1h
Only HisA activity	2.6h
Only TrpF activity	2.8h
Have both of them	1.5h

placed this bifunctional parental gene (dup13-15, D10G) under the control of a constitutive promoter that cotranscribed a yellow fluorescent protein (yfp) gene.



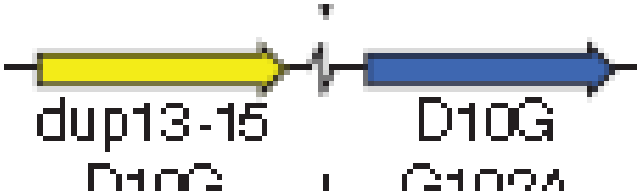
To test the HisA and TrpF activities of the evolved enzymes, 22 different genes from the evolved strain were individually cloned into the chromosomal cobA gene of a strain (lacking both the hisA and trpF genes) that had never been subjected to a histidine-tryptophan selection .



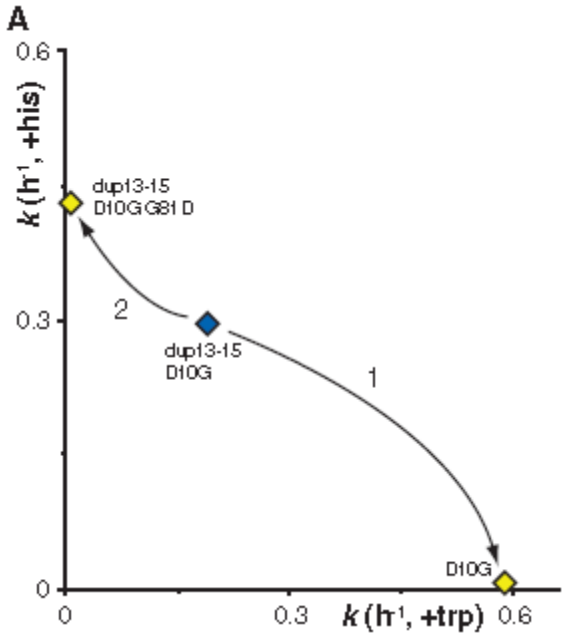
Dup13-15 D10G G102A G11D G44E

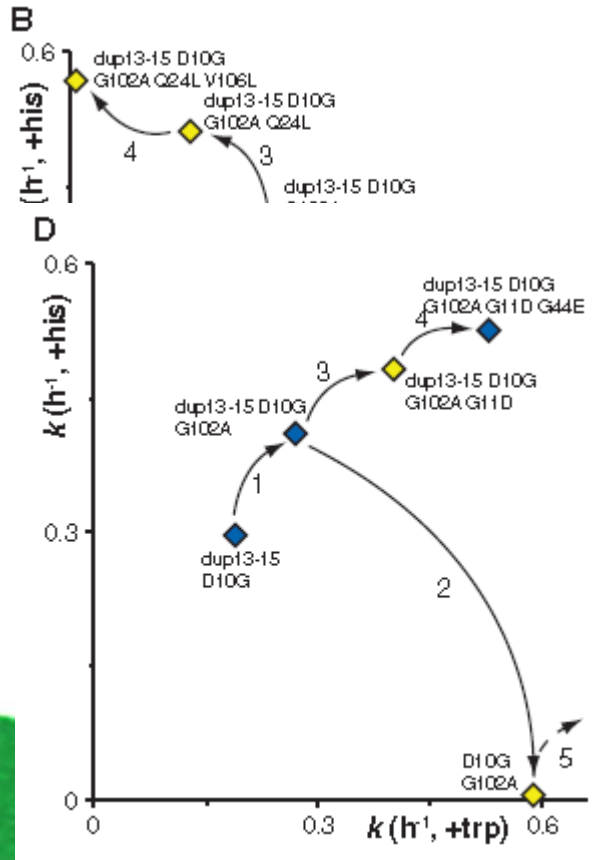
G → A

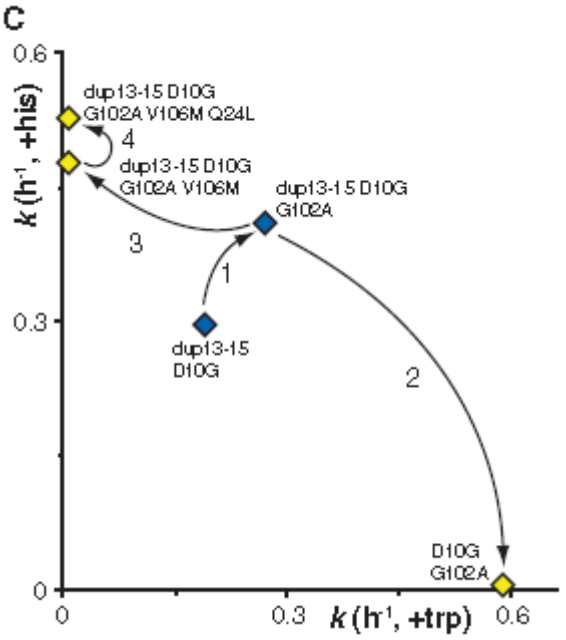
Specialized mutant genes of both types



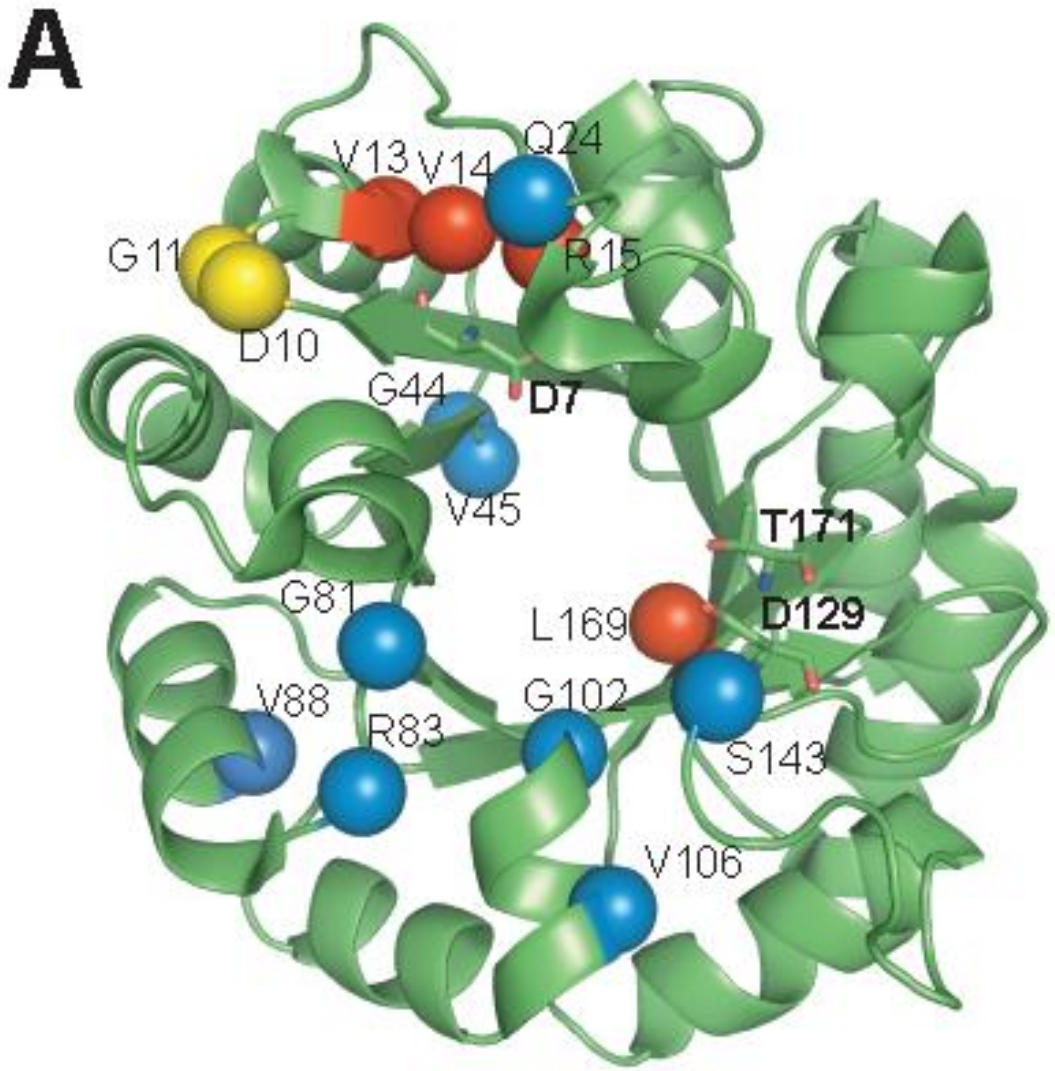
Specialized mutant genes transform







the locations of the identified mutations on the HisA structure from Thermotoga maritima.



3 supplement

- The delayed appearance of point mutations suggests that the accumulation of a point mutation is the rate-limiting step in the IAD process.
- in bacteria duplicate genes most commonly arise via HGT(水平转移), but the IAD process could still generate newgenes that can be distributed to other organismsby HGT.