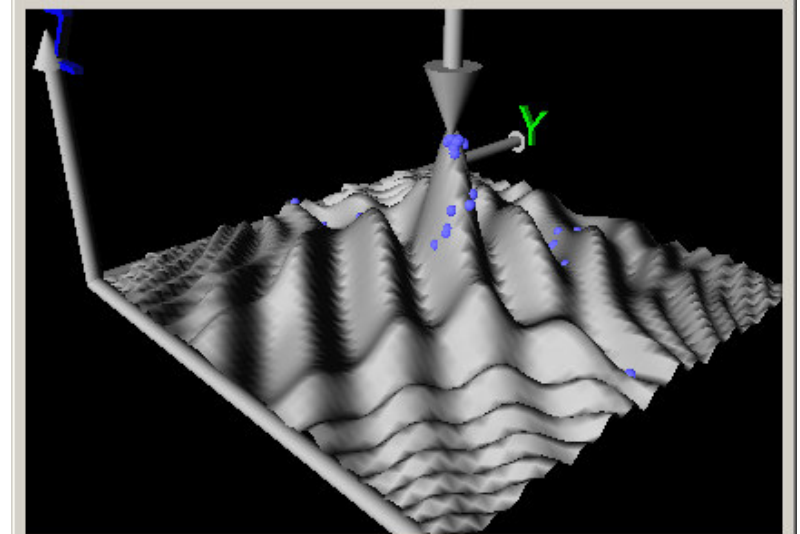
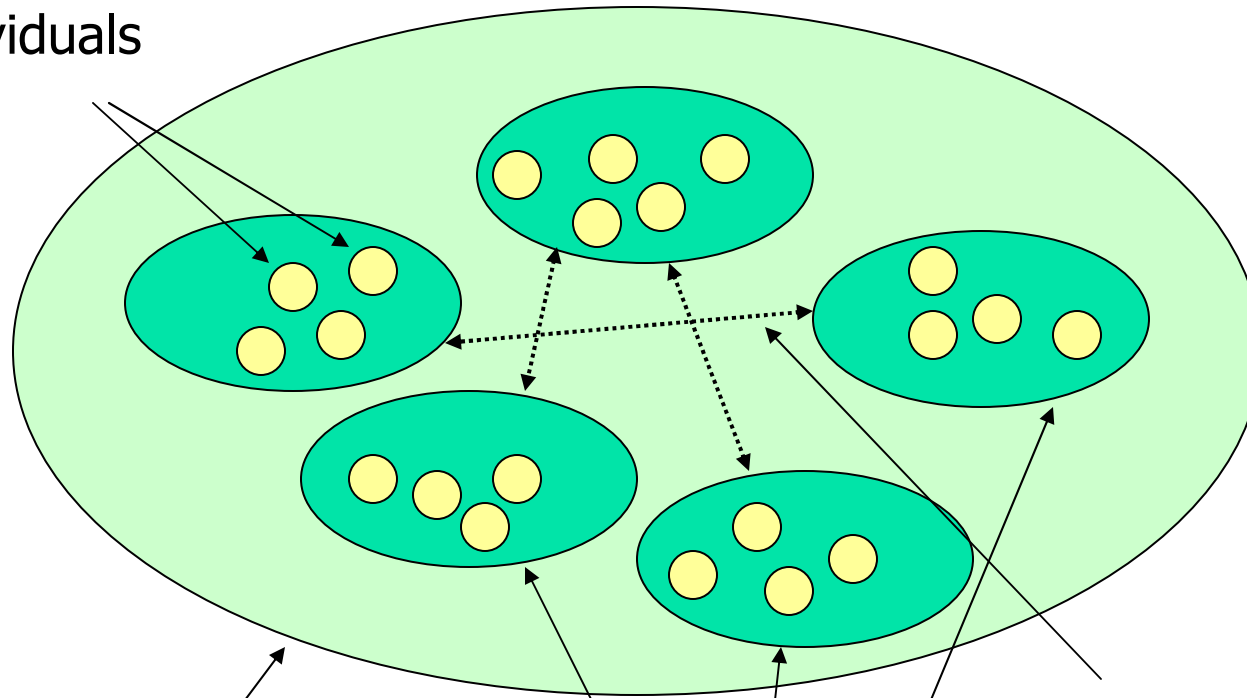


**EAs are good at avoiding local optima**



Individuals



Population

Subpopulations

Tunneling  
(occurs with  
low probability)

## Chromosome numbers in selected species

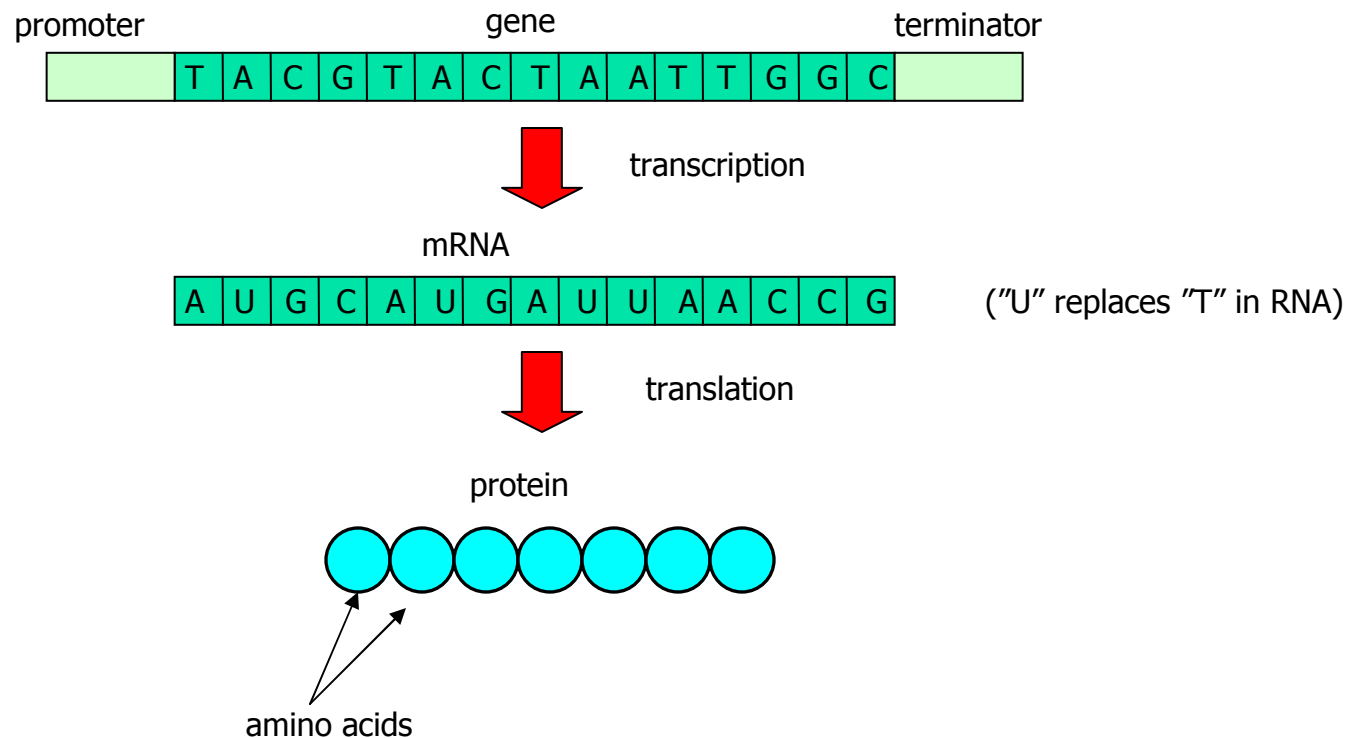
Fruit fly	8
Cat	38
Human	46
Ape	48
Horse	64
Dog	78
Carp	104

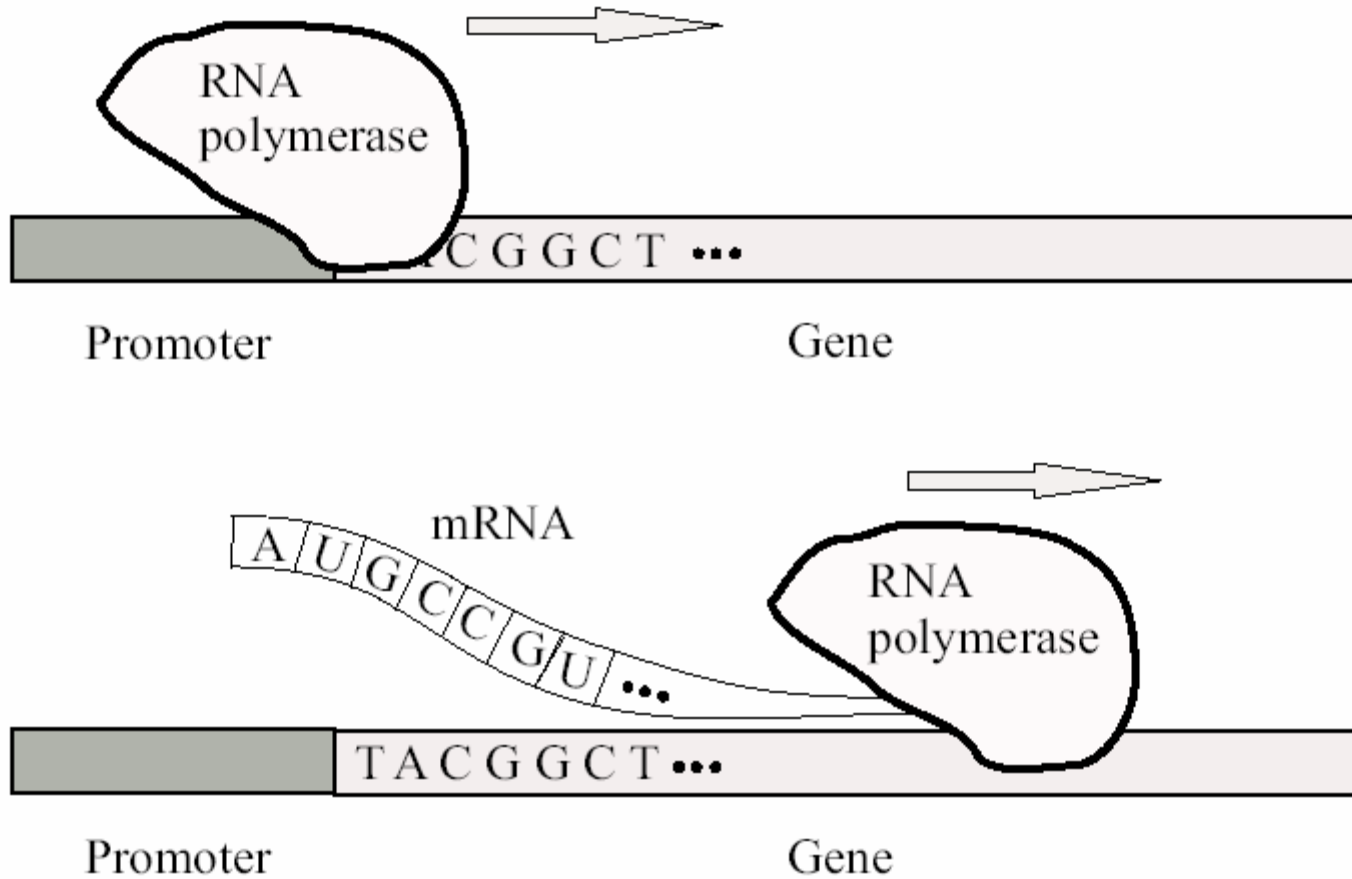
## Number of genes in selected species

Bacterium	500-6,000
Yeast	6,000
Fruit fly	13,600
Human	~25,000

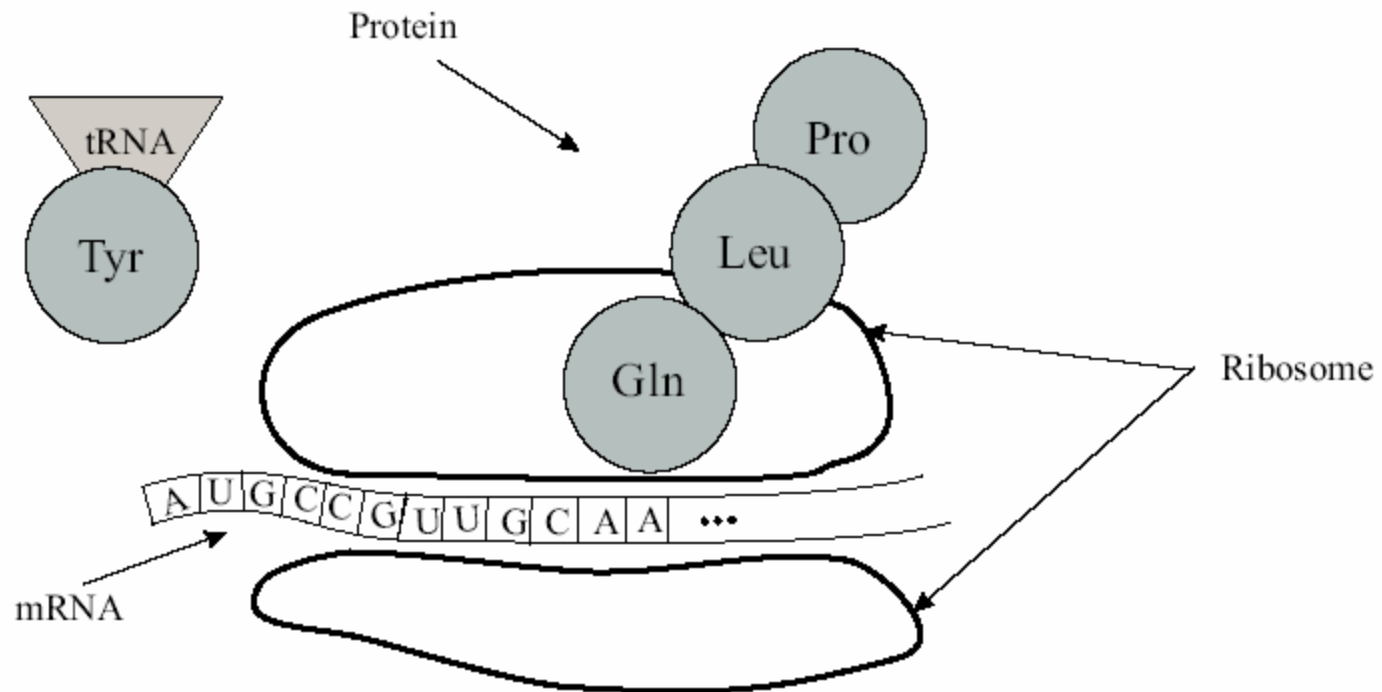
(However, there are many species (e.g. some fish) with more genes than humans)

Genes are used for making proteins, through the two steps of *transcription* and *translation*:

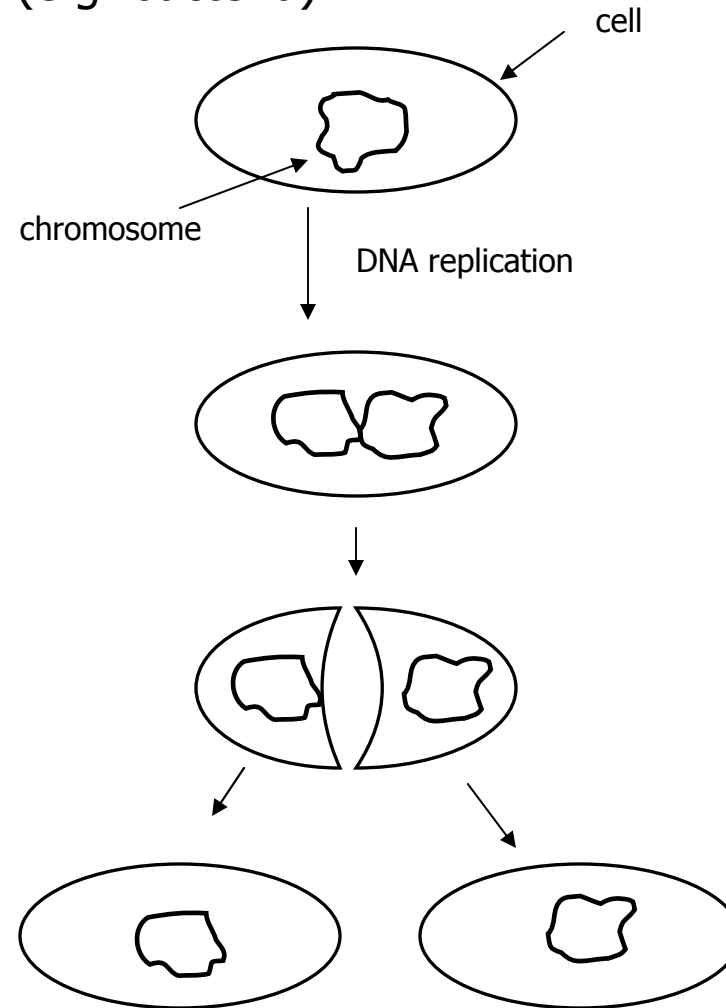




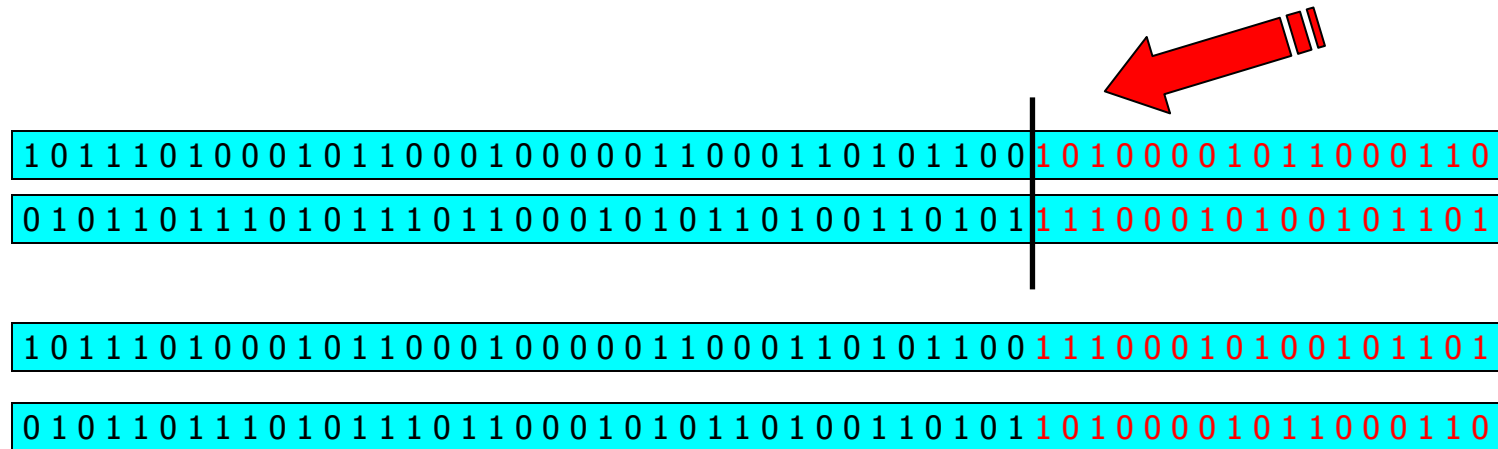
Translation: (mRNA producing protein)



## Asexual reproduction (e.g. bacteria)

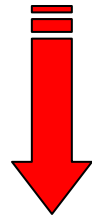






Reproduction (crossover) in EAs.

0 1 0 1 1 1 0 1 1 1 1 0 0 1 0 1 1 0 0 0 0 1 0 0 1 1 0 1 0 0 1 1 0 1 0 1 0 0 0 0 1 1 1 0 1 0 1 1 0 0 0 1 0 1



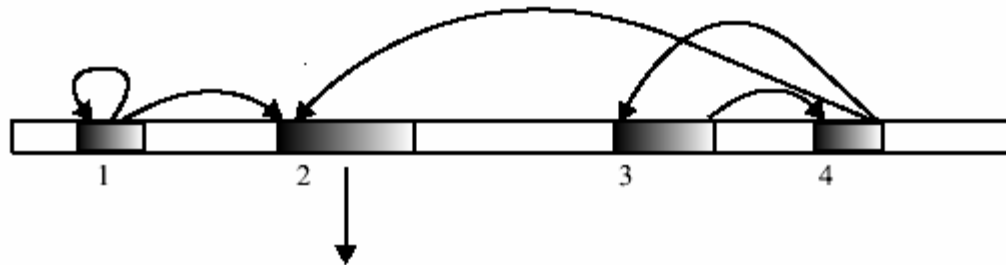
$x, y$

The decoding procedure in EAs is, in general, strongly simplified!

010110110101011010000110110111010100100011011101101101



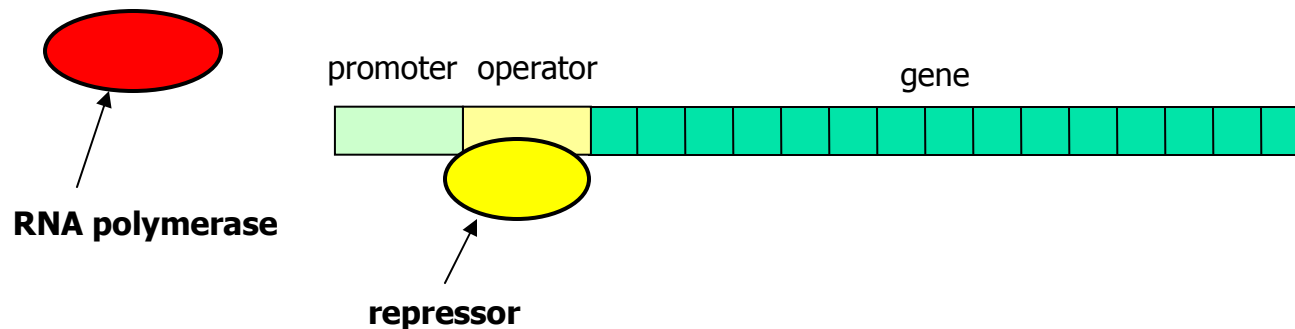
$x_1, x_2$



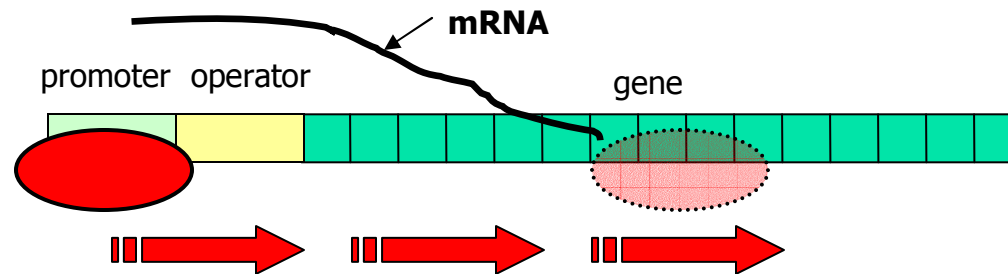
Regulatory genes: (transcription factors) genes that regulate the expression of other genes.

Example of gene regulation:

Repressor protein (= the product of some other (regulatory) gene) bound to operator site: transcription is prevented



Repressor *not* bound to operator: the RNA polymerase can reach the promoter and proceed with transcription:



## Evolution

- Acts on **populations** of individuals (of a given species).
- Information is stored in the form of **chromosomes**.
- Each chromosome contains many **genes**.
- Well adapted individuals spread their genetic material (**reproduction**)
- Sexual reproduction: combination of genetic material from two individuals.
- Mutations generate new material for evolution to work with.

