

# LES MÉCANISMES DE L'ÉVOLUTION

L'innovation génétique est une des causes du polymorphisme des espèces. Elle est le résultat, d'une part de mécanismes strictement génétiques, duplication des gènes, translocation des chromosomes et, d'autre part, de l'action conjuguée du milieu sur les associations alléliques. On arrive ainsi à la formation d'espèces différentes ou spéciation.

## Les mécanismes de l'innovation génétique

### ► Duplication des gènes et mutations

La duplication des gènes a pour résultat la multiplication des gènes et la formation de *famille multigénique*.

On peut envisager deux causes possibles de duplication :

– La duplication d'un gène par *enjambement inégal* (duplication en tandem) dont le principe est illustré par la figure 15.1.

L'apparition d'une nouveauté génétique à partir d'un gène ancestral peut se faire grâce au mécanisme de la *duplication de l'ADN par enjambement inégal* entre les deux chromosomes d'une paire. Dans un des lots, la fonction biologique correspondant au gène représenté sera assurée par deux loci. Si une *mutation* affecte un locus, elle sera sans effet puisque l'autre locus maintiendra la fonction. La duplication du gène met donc un locus à l'abri de la sélection, l'autre locus pourra subir diverses mutations jusqu'à ce qu'un gène nouveau, codant pour une nouvelle fonction utile à l'organisme fasse son apparition. Il sera désormais conservé par la sélection naturelle dans les générations successives.

C'est ainsi que la différence fonctionnelle très nette entre la myoglobine et l'hémoglobine et les homologies des chaînes sont deux observations conciliables si l'on admet l'existence d'une lignée évolutive dans les gènes codant pour ces polypeptides. Dans le cas de l'hémoglobine, le gène initial était certainement du type de la myoglobine. Une première duplication donne un gène d'une hémoglobine ancestrale (on retrouve cette hémoglobine à une chaîne chez un poisson cartilagineux, le Requin). Une deuxième duplication donne un gène de type  $\alpha$  et un gène de type  $\beta$ . Deux duplications successives ont encore affecté le gène  $\beta$ , donnant les gènes  $\gamma$  et  $\delta$ .

L'homologie confirme cette lignée : les chaînes  $\beta$ ,  $\gamma$  et  $\delta$  se ressemblent plus entre elles qu'elles ne ressemblent à la chaîne  $\alpha$ .

Ainsi, la duplication des gènes suivie de mutation a-t-elle conduit, à partir d'un gène responsable d'une seule fonction (stockage d' $O_2$ ), à l'apparition à ses côtés d'autres gènes responsables d'une autre fonction (stockage + transport d' $O_2$ ). En revanche, les seules mutations dans les gènes actuels de l'hémoglobine créent des allèles nocifs (HbS).

Les études de la séquence de l'ADN ont montré que les gènes des chaînes  $\gamma$ ,  $\delta$  et  $\beta$  sont situés en tandem dans cet ordre sur le chromosome, alors que le gène de la chaîne  $\alpha$  est porté par un autre chromosome. La figure 15.2 illustre cette filiation moléculaire de l'hémoglobine.

Ainsi l'apparition de fonctions biologiques nouvelles peut se réaliser sans

# Linnovation Moteur De Leacuteconomie Destruction Creacutiatricice

**de Woot,Philippe Delterme, Philippe**



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