

# 1. ADN et séquences génomiques

- La cellule, atome du vivant
- Au cœur de la cellule, la molécule d'ADN
- L'ADN code l'information génétique
- Qu'est-ce qu'un algorithme ?
- Compter les nucléotides
- Contenu en G-C et A-T des séquences
- **Promenade sur l'ADN**
- Changer l'échelle du chemin
- Prédire l'origine de réplication ?
- Des fenêtres glissantes et recouvrantes

...CCTTTTCATTCTGACTGCAACGGGCAATATGTCTCTGTGTGGATTAAAAAAGAGTGTCTGATAGCAGC  
TTCTGAACTGGTTACCTGCCGTGAGTAAATTTAAATTTTATTGACTTAGGTCCTAAATACTTTAAACCA  
TATAGGCATAGCGCACAGACAGATAAAAAATTACAGAGTACACAACATCCATGAAACGCATTAGCACCACC  
ATTACCACCACCATCACCATTACCACAGGTAACGGTGCAGGCTGACGCGTACAGGAAACACAGAAAAAAG  
CCCGCACCTGACAGTGCGGGCTTTTTTTTTTCGACCAAAGGTAACGAGGTAACAACCATGCGAGTGTGAA  
GTTTCGGCGGTACATCAGTGGCAAATGCAGAACGTTTTCTGCGTGTGCGGATATTCTGGAAAGCAATGCC  
AGGCAGGGGCAGGTGGCCACCGTCTCTGCCCCGCCAAAATCACCAACCACCTGGTGGCGATGATTG  
AAAAAACCATTAGCGGCCAGGATGCTTTACCCAATATCAGCGATGCCGAACGTATTTTTGCGGAACTTTT  
GACGGGACTCGCCGCCGCCAGCCGGGGTTCCCGCTGGCGCAATTGAAAACTTTTCGTCGATCAGGAATTT  
GCCAAAATAAAACATGTCTGCATGGCATTAGTTTGTGGGGCAGTGCCCGGATAGCATCAACGCTCCGC  
TGATTTGCCGTGGCGAGAAAATGTCTGCATTCGCAATTTATGGCCGGCGTATTAGAAGCGCGCGTCAACA  
TACTGTTATCGATCCGGTCGAAAAACTGCTGGCAGTGGGGCATTACCTCGAATCTACCGTCGATATTGCT  
GAGTCCACCCGCCGTATTGCGGCAAGCCGCATTCCGGCTGATCACATGGTGCTGATGGCAGGTTTCACCG  
CCGGTAATGAAAAGGCGAACTGGTGGTGCTTGGACGCAACGGTTCGACTACTCTGCTGCGGTGCTGGC  
TGCTGTTTTACGCGCCGATTGTTGCGAGATTTGGACGGACGTTGACGGGGTCTATACCTGCGACCCGCGT  
CAGGTGCCCGATGCGAGGTTGTTGAAAGTCGATGTCTTACCAGGAAGCGATGGAGCTTTCCTACTTCGGCG  
CTAAAGTTCTTACCCCCGCACCATTACCCCCATCGCCCAGTTCCAGATCCCTTGCCTGATTAAAAATAC  
CGAAAATCCTCAAGCACCAGGTACGCTCATTGGTGCAGCCGTGATGAAGACGAATTACCGGTCAAGGGC  
ATTTCCAATCTGAATAACATGGCAATGTTACGCGTTTCTGGTCCGGGGATGAAAGGGATGGTCGGCATGG  
CGGCGCGCGTCTTTGCAGCGATGTCACGCGCCCGTATTTCCGTGGTGTGATTACGCAATCATCTTCCGA  
ATACAGCATCAGTTTCTGCGTTCACAAAGCGACTGTGTGCGAGCTGAACGGGCAATGCAGGAAGAGTTC  
TACCTGGAAGTGAAGAAGGCTTACTGGAGCCGCTGGCAGTGACGGAACGGCTGGCCATTATCTCGGTGG  
TAGGTGATGGTATGCGCACCTTGCCTGGGATCTCGGCGAAATTTCTTGGCCGACTGGCCCGGCCAATAT  
CAACATGTGCGCATTGCTCAGGGATCTTCTGAACGCTCAATCTCTGTGCGTGGTAAATAACGATGATGCC  
ACCACTGGCGTGCAGGTTACTCATCAGATGCTGTTCAATACCGATCAGGTTATCGAAGTGTGTTGTGATTG  
GCGTCGGTGGCGTTGGCGGTGCGCTGCTGGAGCAACTGAAGCGTCAGCAAAGCTGGCTGAAGAATAAACA  
TATCGACTTACGTGTCTGCGGTGTTGCCAACTCGAAGGCTCTGCTCACCAATGTACATGGCCTTAATCTG  
GAAAACCTGGCAGGAAGAACTGGCGCAAGCCAAAGAGCCGTTAATCTCGGGCGCTTAATTCGCTCGTGA  
AAGAATATCATCTGCTGAACCCGGTCATTGTTGACTGCACTTCCAGCCAGGCAGTGGCGGATCAATATGC  
CGACTTCTGCGGAAGGTTTCCACGTTGTCACGCCGAACAA...

# Mettre des séquences génétiques en musique ?

AGCTTTTCATTCTGACTGCAACGGGCAATATGTCTCGCAGC



- Quatre lettres, quatre fréquences seulement...

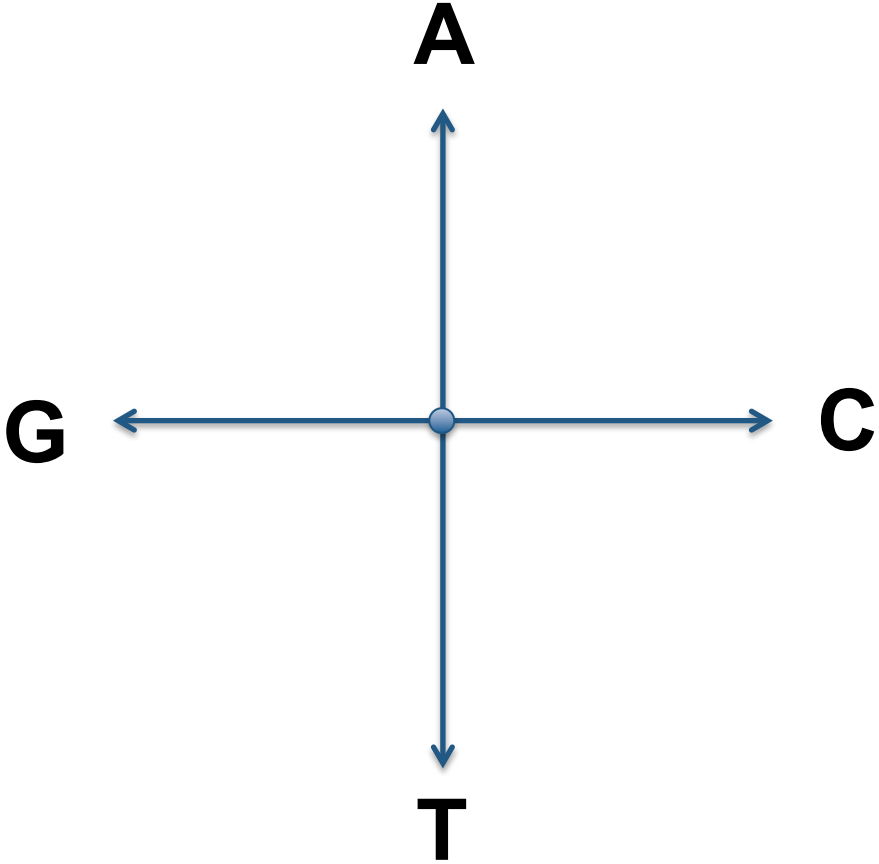
# Mettre des séquences génétiques en musique ?

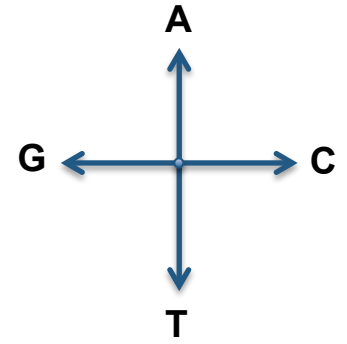
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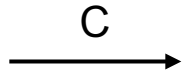
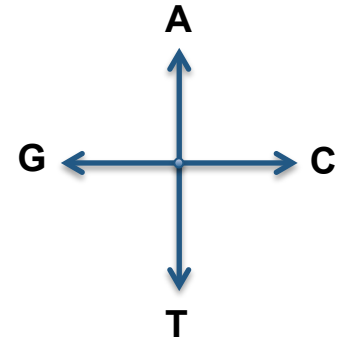
- Quatre lettres, quatre fréquences seulement...
- Grouper les lettres 3 par 3      AGC   TTT   TCA   TTC   TGA   CTG   CAA   CGG
  - $4 \times 4 \times 4 = 64$  triplets différents

**Quatre lettres ? Quatre directions dans le plan !**

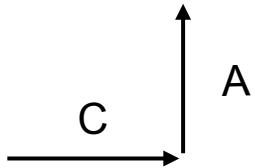
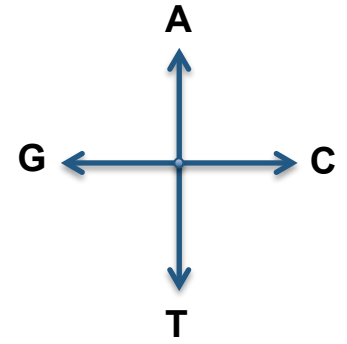




**CAGACCACTCAGACCTCAAGGACCCAGAAGTGAACACC...**

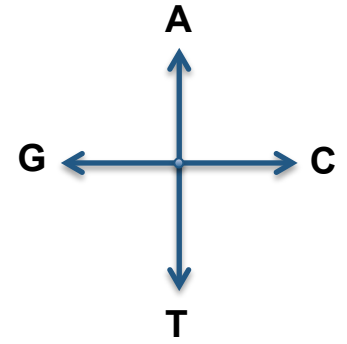
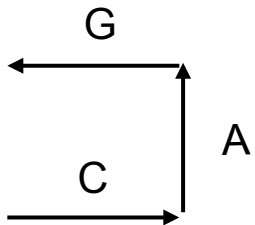


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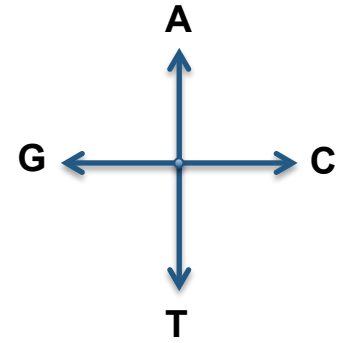
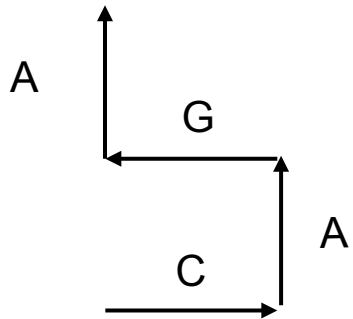


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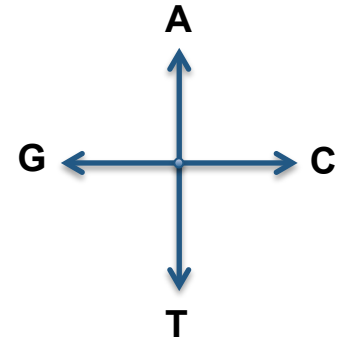
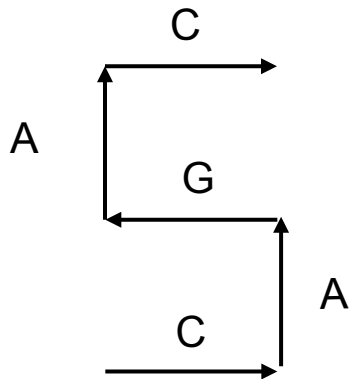




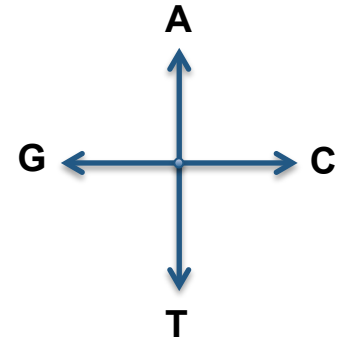
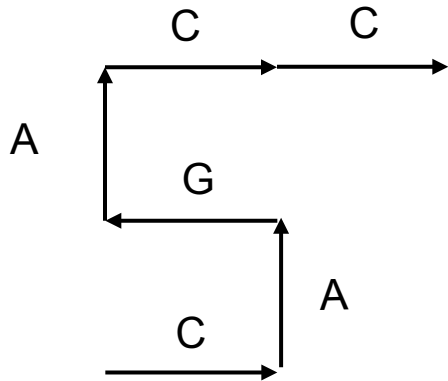
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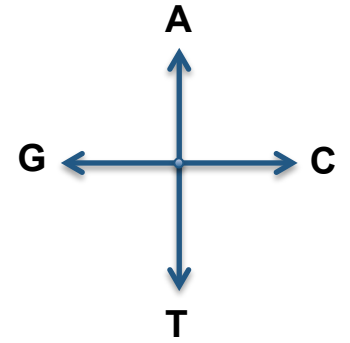
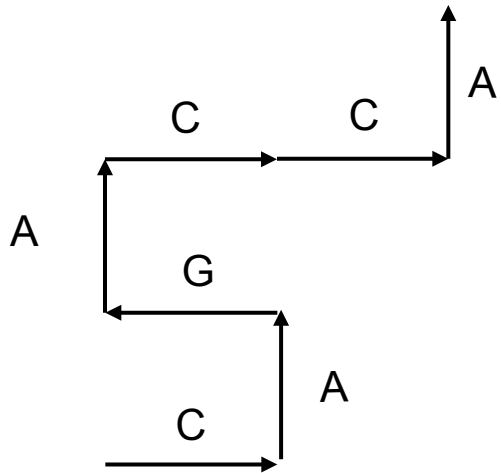
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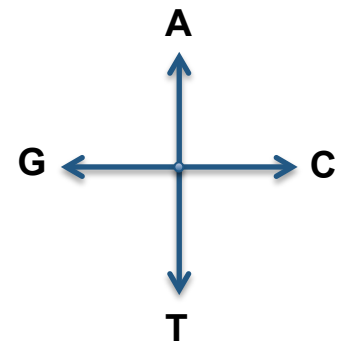
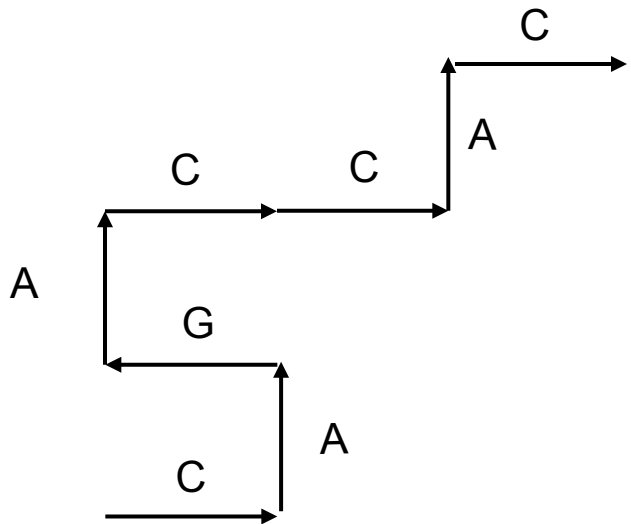
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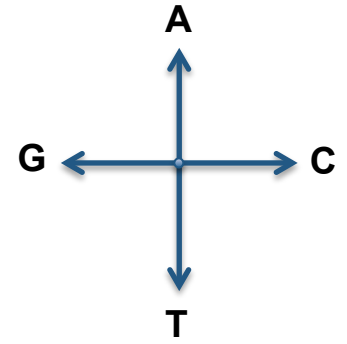
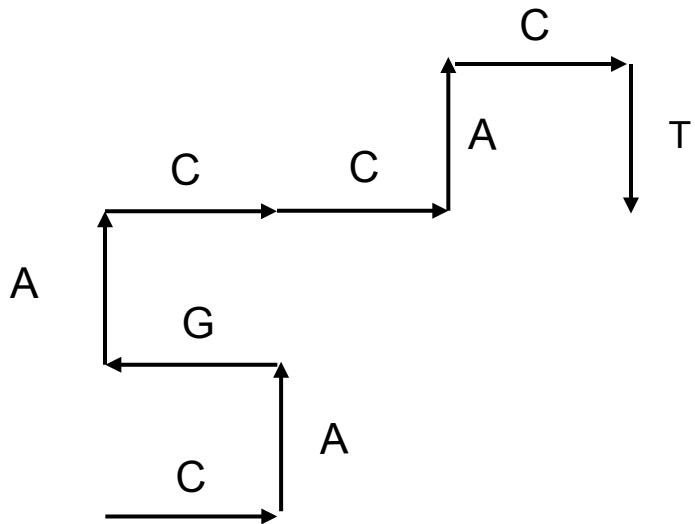
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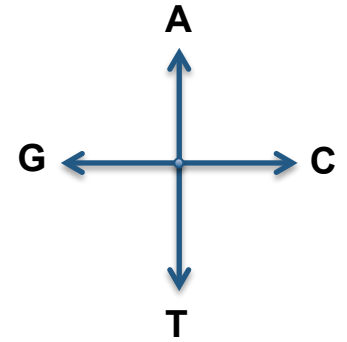


**CAGACCACTCAGACCTCAAGGACCCAGAAGTGAACACC...**



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```
index: integer
sequence: character string [1:*]
index ← 1
repeat
  case sequence [index] of
    "A": drawUp
    "C": drawRight
    "G": drawLeft
    "T": drawDown
  endcase
  index ← index + 1
until sequence [index] = "#"
```





# Oui mais, et la taille de l'écran ?

- **Résolution d'un écran**

- Le nombre de pixels qui peuvent être affichés dans chacune des deux dimensions
- Par exemple : 1024 x 768

- **Problème :**

Comment « faire rentrer » des suites de plusieurs millions, voire milliards, de segments sur un seul et même écran ?

# Illustrations & photos : crédits

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