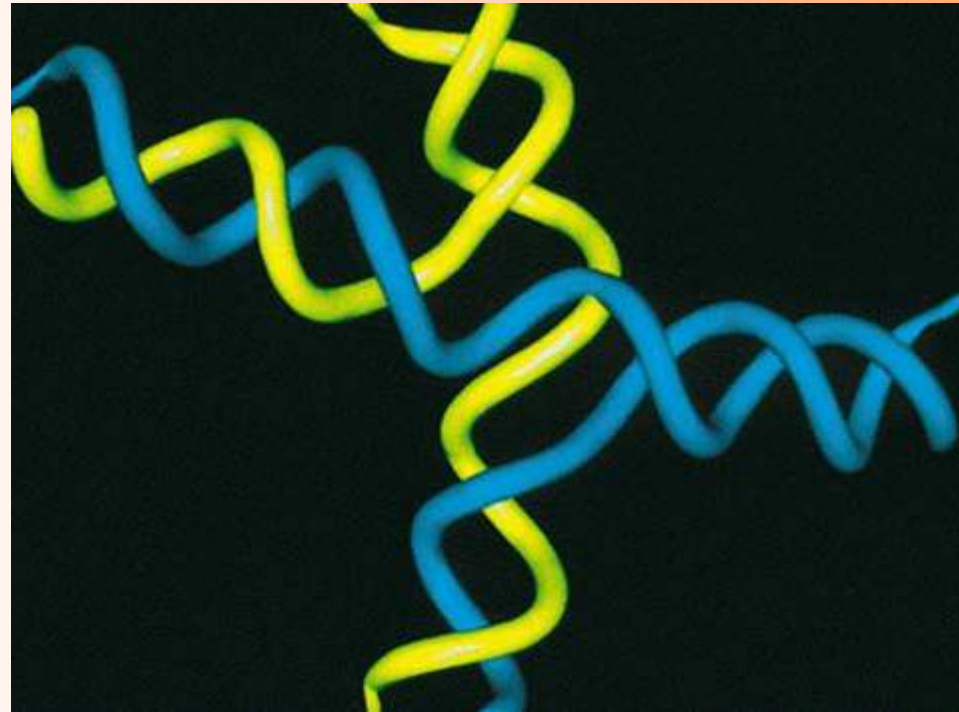
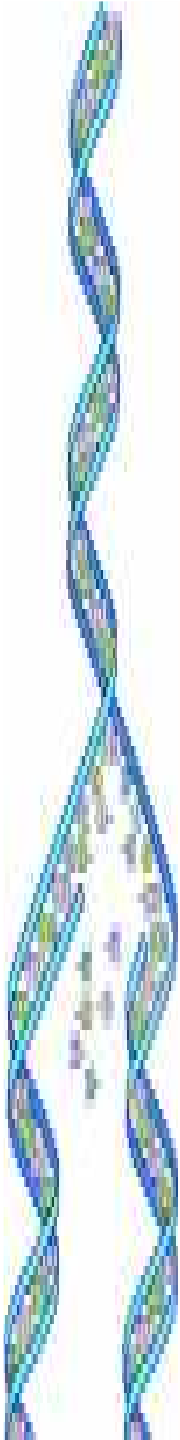


# Randomness of DNA Mutation and the Possibility of Guided Evolution

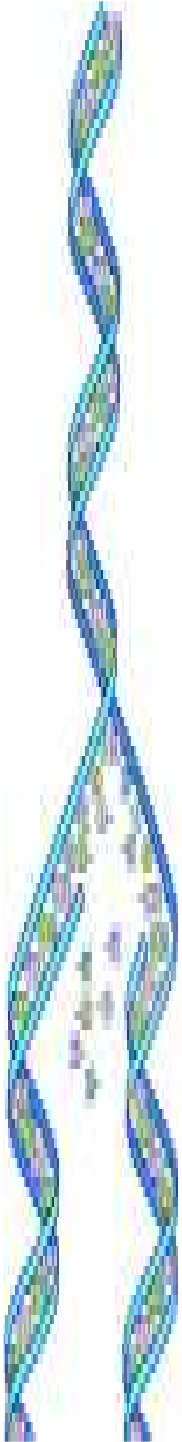


Daan van Schalkwijk  
TNO Quality of Life /  
University of Leiden



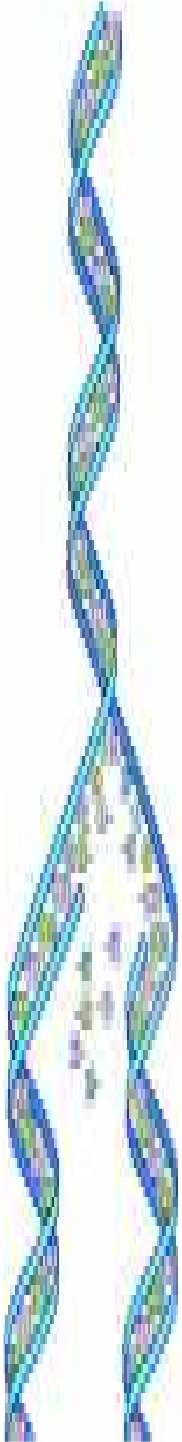
# Contents

- Introduction
- DNA mutation and repair
- Guided Randomness?
- Conclusion



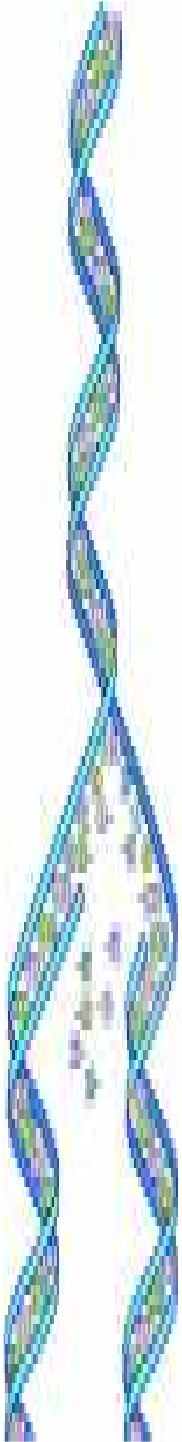
# Introduction

- Philosophy
- Modern world view based in part on enlightenment
  - World can be explained completely rationally
  - This is taken to imply no necessity for the supernatural
  - Laplace to Napoleon on the place of God in his theory of celestial mechanics:  
“I have no need of that hypothesis”



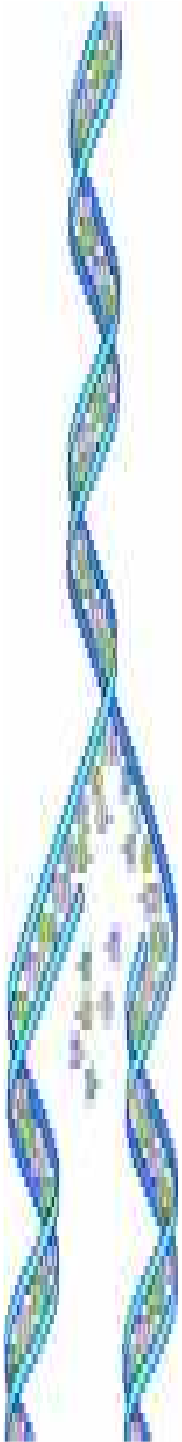
# Introduction

- But what is the starting point?
  - Do we want a satisfactory world view?
  - Or do we want to search for reality?
- In other words:
  - Our worldview or
  - The world?
- Correct order: the world → worldview
- Incorrect: our worldview → the world
- So keep listening to reality!



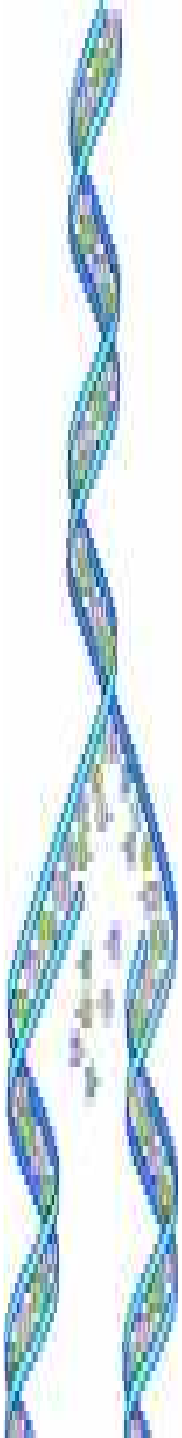
# Introduction

- Darwinism is the biological culmination of this line of thought:
  - A system that could explain living beings without **needing** anything but itself – intellectually speaking
  - Taking one principle to explain things scientifically can be illuminating
  - The answer to a single (range of) question(s) can never lead to a worldview, this needs the consideration of other phenomena we observe



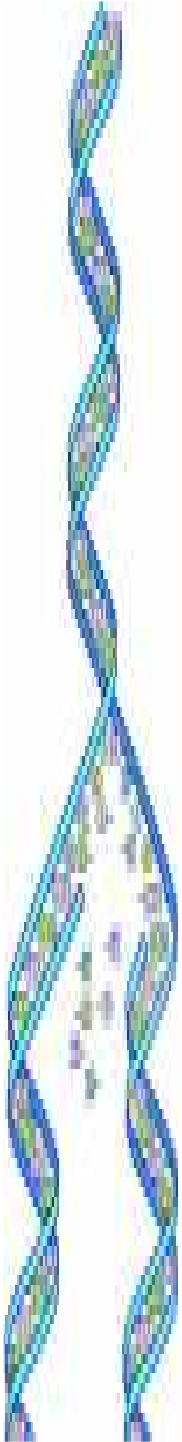
# Introduction

- Example: Dawkins
- If we don't know that God exists, is it possible? Well, no, since we already have an explanation for the existence of life: evolution as a consequence of natural selection.
- But what about:
  - Free Will
  - Existence of a Conscience
  - The 'being' of reality



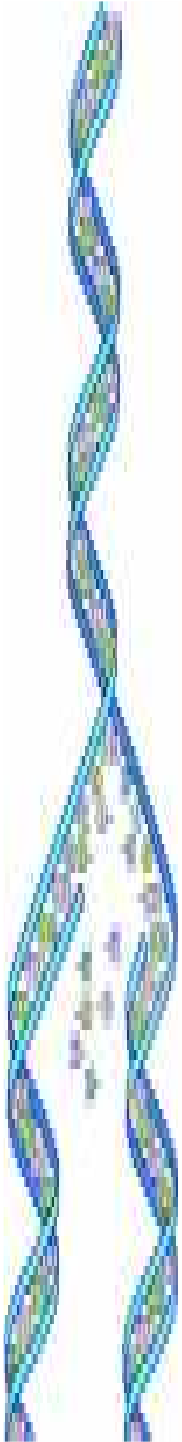
# Introduction

- Gandalf to Saruman:  
“He that breaks a thing to find out what it is has left the path of wisdom”
- Philosophy: Love of Wisdom
- Seeks for oneness in thinking
- Simultaneous answer to many questions and interrelation of questions



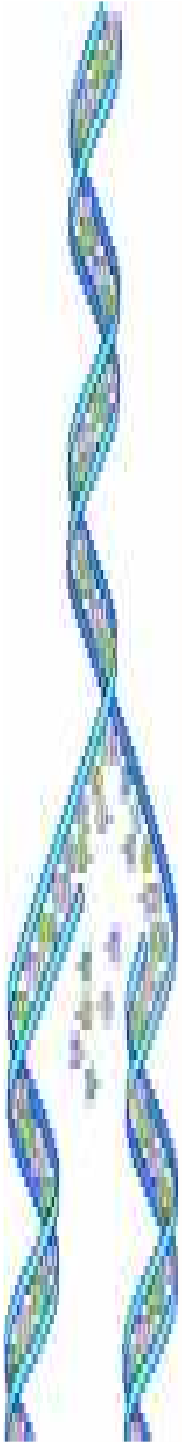
# Introduction

- The consequences – ‘bionieuws’ recently:
  - “Darwin has become a symbol for the strife between faith and science, for the death of God and the ‘demystification’ of our worldview. (...) There is no higher Being, nor a higher purpose, only a blind process of mutation and selection. Man is a short, coincidental and above all meaningless flash of light in the eternal darkness”
  - Chris Buskes in his book about the influence of Evolutionary theory



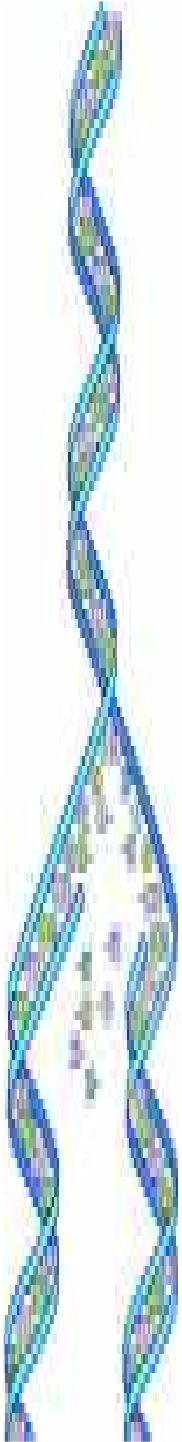
# Introduction

- Evolution theory has two pillars:
  - Random mutation
  - Natural selection
- So **not pure randomness!**  
Selection could lead to  
“extreme value distribution”
- Evolution biologists:  
focus on natural selection
- Biochemists: mutation process



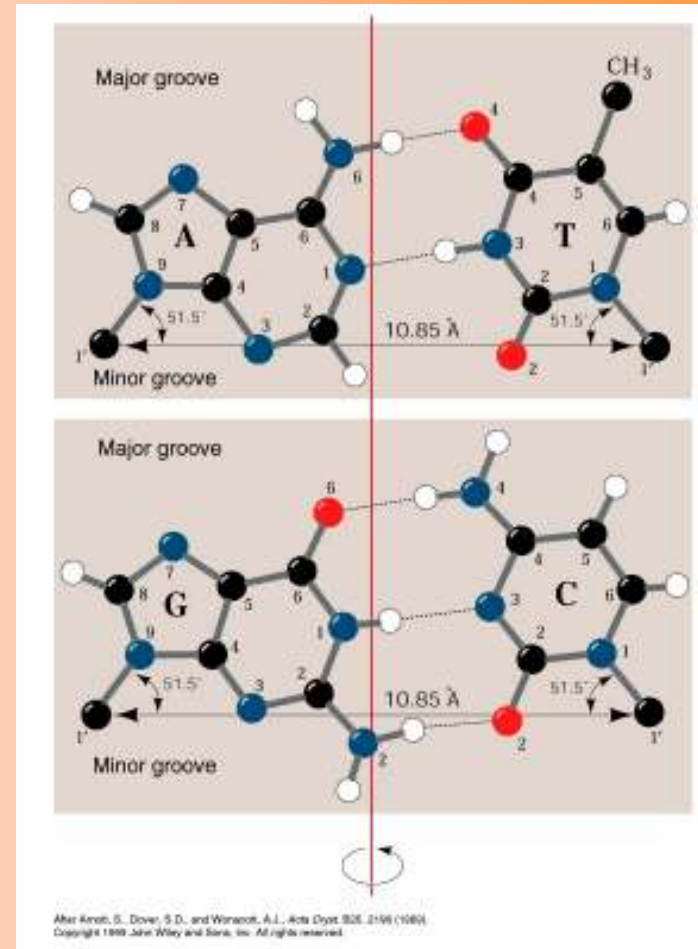
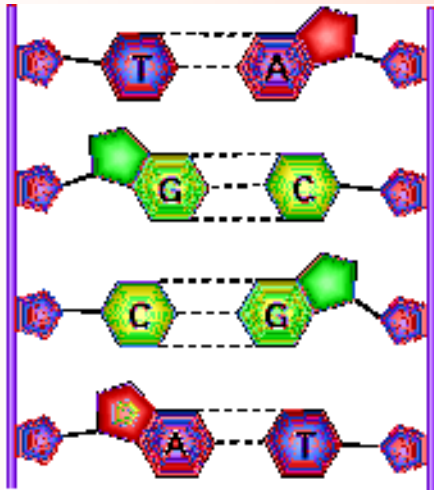
# Introduction

- Here: closer look at mutations
  - Are they really random?
  - If so, in what sense?
  - What does this say about the possibility of guidance?



# DNA mutation

- Four bases, specific pairing



# DNA mutation

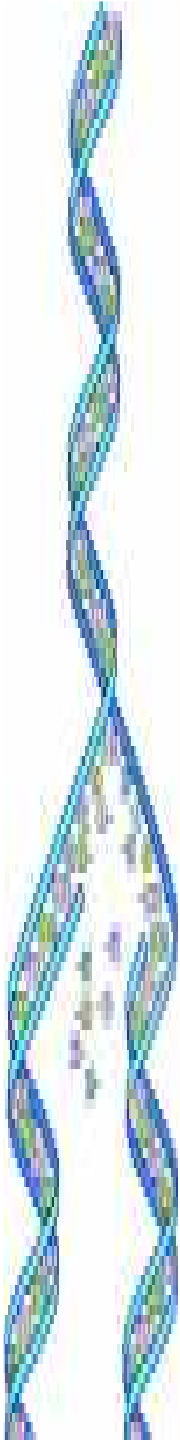
- Replication process

- External animation, see e.g.

- <http://science.nhmccd.edu/biol/bio1int.htm#dna>

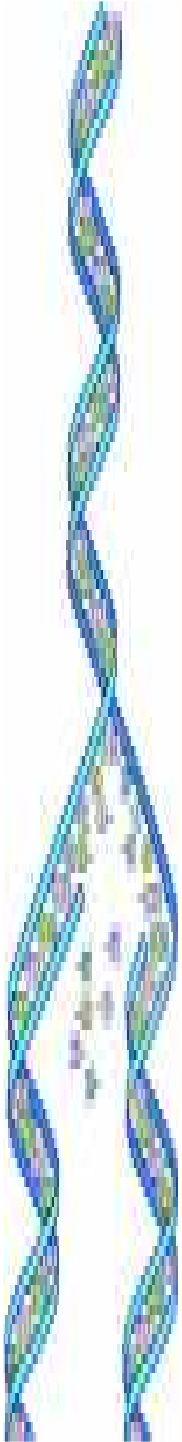
- more specifically, the first of:

- [http://highered.mcgraw-hill.com/sites/0072437316/student\\_view0/chapter14/animations.html](http://highered.mcgraw-hill.com/sites/0072437316/student_view0/chapter14/animations.html)



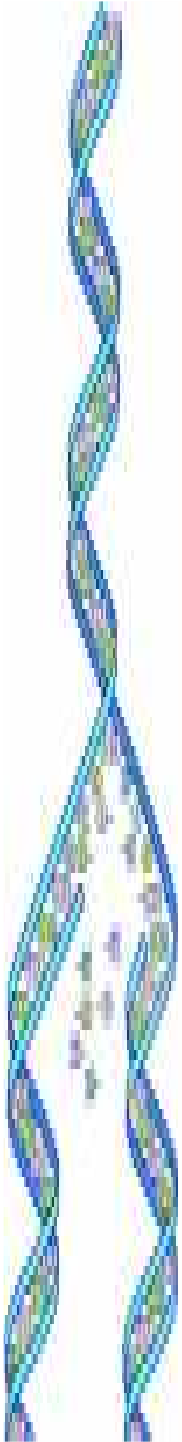
# DNA mutation

- Tautomeric shift
- Interaction with UV light / mutagen can induce this shift

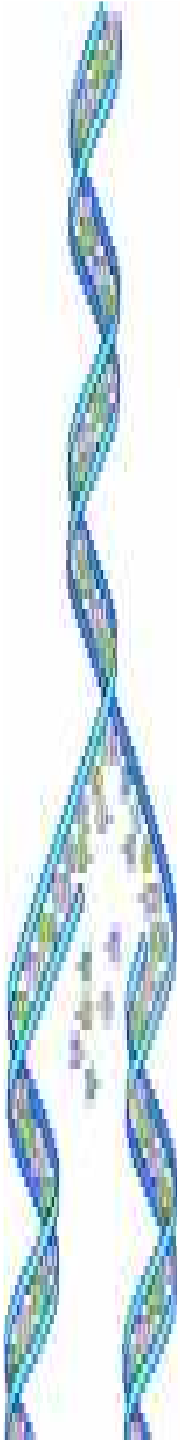
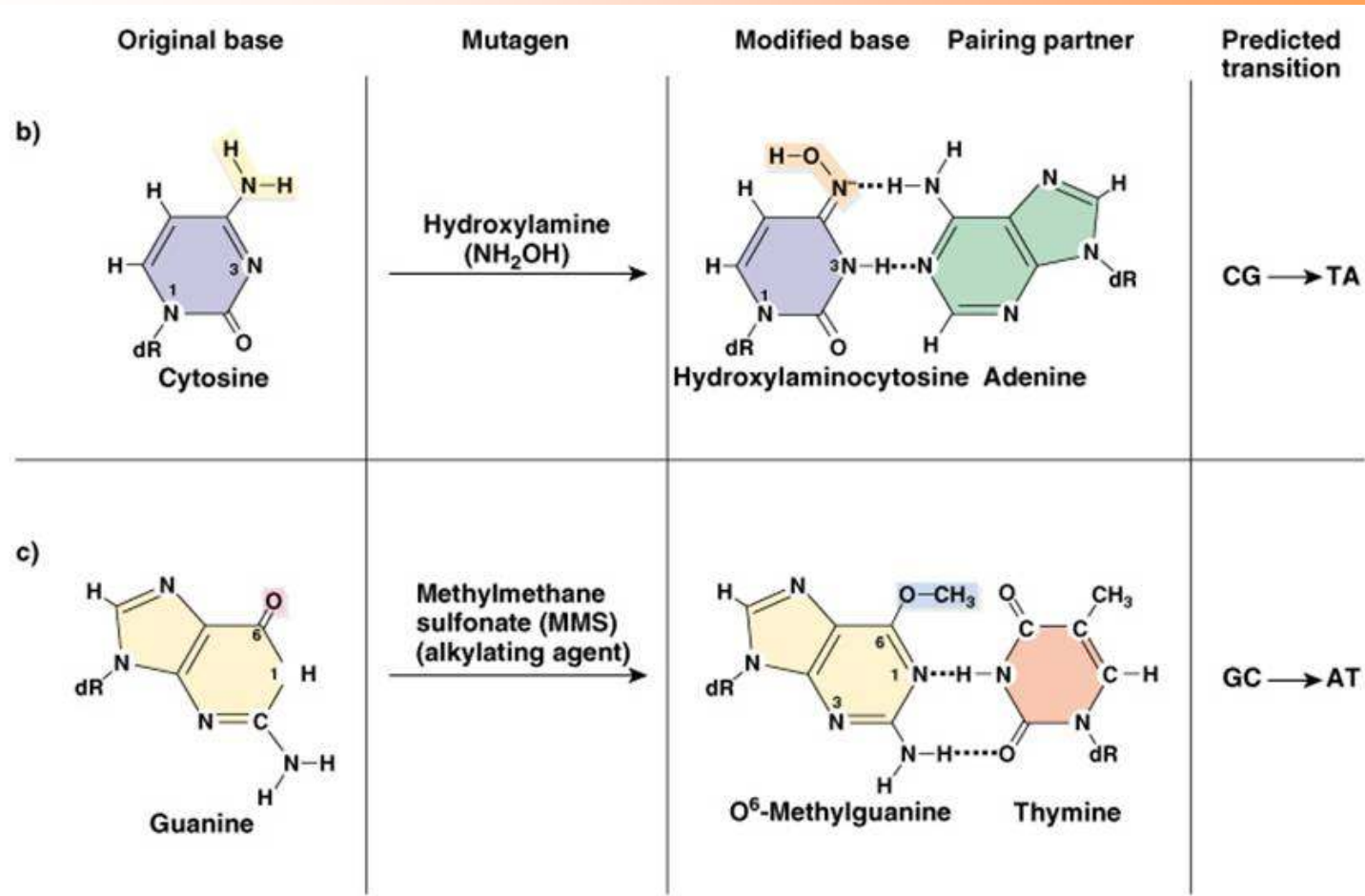


# DNA mutation

- Mechanism mutation induction
  - Bases can be in one of two states, the keto (mostly) or enol (sometimes) forms
  - The enol form pairs with another base than the keto form
  - The keto and enol forms are in a dynamic equilibrium: sometimes the keto spontaneously shifts to the enol form  
This transition is called 'tautomeric shift'



# DNA mutation

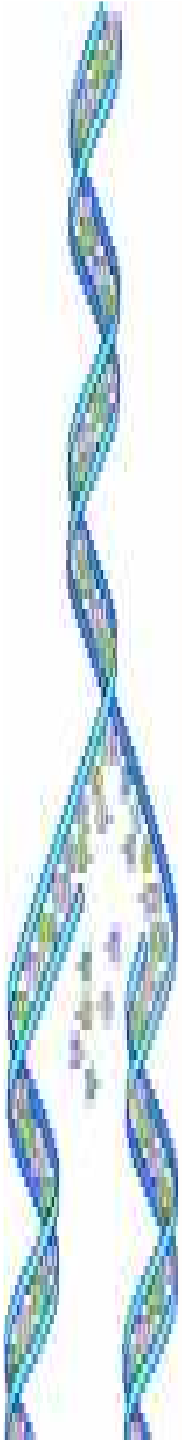


# DNA mutation

- Repair process

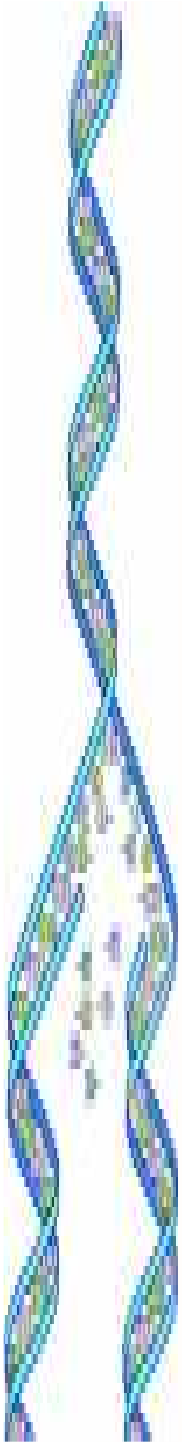
- External animation, see e.g.

- [http://www.nature.com/nrc/journal/v1/n1/animation/nrc1001-022a\\_swf\\_MEDIA1.html](http://www.nature.com/nrc/journal/v1/n1/animation/nrc1001-022a_swf_MEDIA1.html)



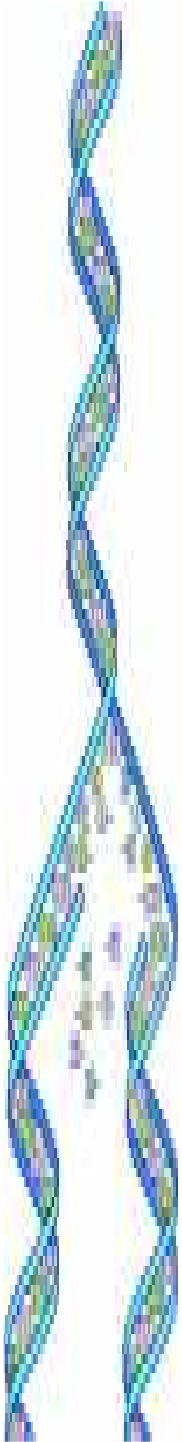
# DNA mutation

- Elements of randomness:
  - Tautomeric shift
  - Induction by UV light / mutagen
  - Recognition of transcription error
- These processes occur at a quantummechanical space scale!



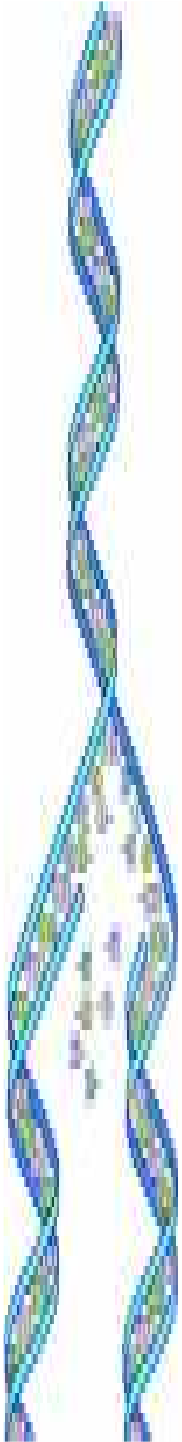
# DNA mutation

- How random is random?
- Quantummechanics:  
fundamental stochasticity
- i.e.: experimentally verified that science  
cannot predict the exact outcome!



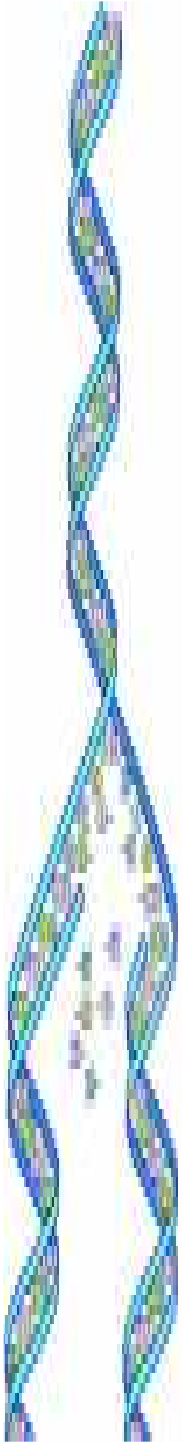
# Guided Randomness?

- Does 'fundamental stochasticity' from a natural sciences perspective imply the absence of guidance?
  - If guidance should be 'material': yes!
  - If guidance could be spiritual: no!
    - this lies outside the domain of the natural sciences



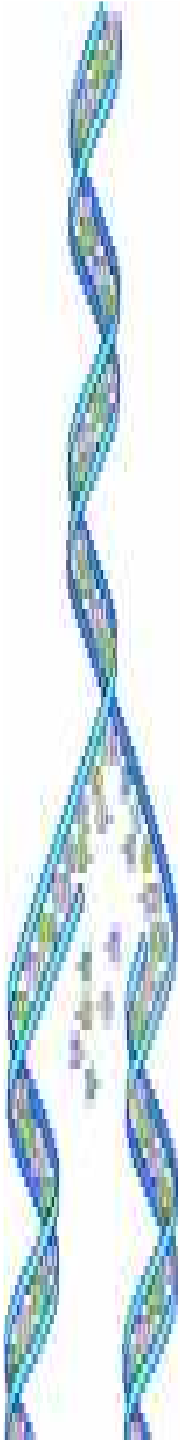
# Guided Randomness?

- Problem has two 'levels'
  - Material
  - Spiritual
- Are these incompatible?



# Guided Randomness?

- Two levels can give a different perspective:



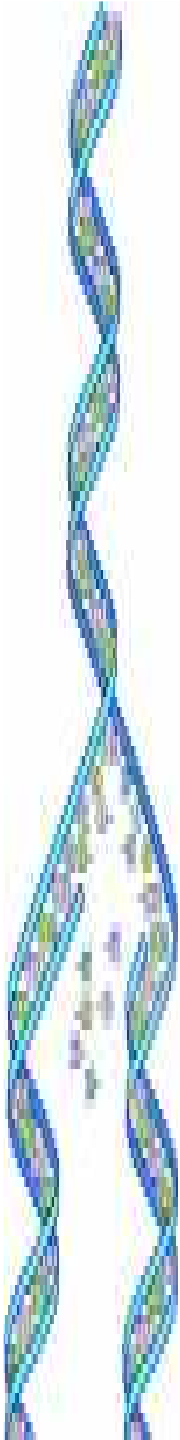


# Guided Randomness?

- But spiritual guidance could be present, without being detectable scientifically
- Idea: small difference in process, drastically different effects
- Thought experiment: horserace in wood
  - Branch falling from tree: stochastic event
  - Effect on horse-rider: victory or defeat!

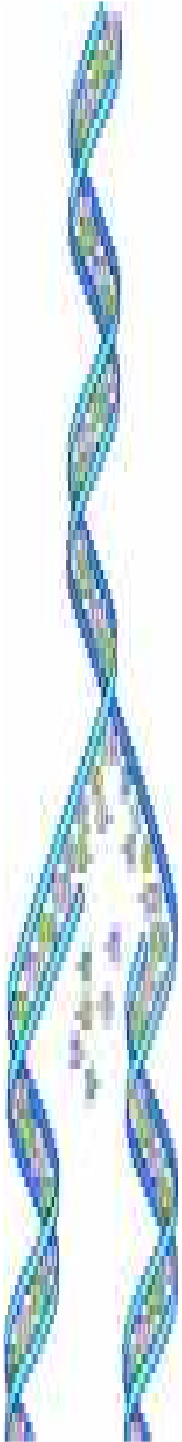
# Guided Randomness

- Thought experiment: horserace (animation)



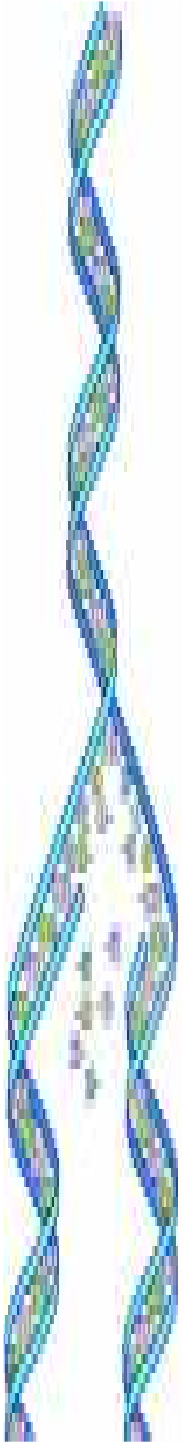
# Guided Randomness?

- Analogy with DNA mutation:
  - Replication is a fast process
  - Mutation induction depends on equilibrium state of base at replication



# Guided Randomness?

- Evolution biologists like to speak of the 'God of the gaps'
  - I.E. God is not 'needed' – there is only place for Him near unexplained events (gaps in the fossil records)
- But this argument would imply:  
God the **G.A.P.S.**  
Good All-Powerful Sustainer!



# Conclusions

- DNA mutation depends on quantummechanical processes  
→ is fundamentally stochastic
- This does not imply the absence of guidance, if spiritual guidance is not excluded beforehand
  - This falls outside the realm of the natural sciences
- The concept of God acting in nature:  
God the G.A.P.S.!

