

# Random organic molecules

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ABSTRACT. This is an introduction to organic chemistry, life soups and early life, and habitable planets, by insisting on the randomness of the various phenomena at play, and on the underlying mathematics and physics. We first provide a detailed introduction to chemistry, organic chemistry and molecular biology, with a randomness approach to many topics, and with some cosmological background explanations included too. Then we go on the study of life soups that can appear, under favorable circumstances, their cooking and self-cooking, and the origins of life on Earth. Finally, we discuss habitable planets, and various speculations that can be made, on extraterrestrial forms of life.

## Preface

It is hard to talk about the origins of life, especially if you are a scientist. As with quantum mechanics, elementary particles, black holes, Big Bang, dark matter and many more, the legend goes that scientists understand such things. To which scientists can only answer, if indeed asked, that they don't understand, in fact, nothing much.

And in what regards life, things are tremendously more complicated, because biology is to chemistry what chemistry is to physics, and is also what physics is to mathematics, that is, an exceptional increase of complexity, in everything that happens, leaving no chance to our poor human mind to have something properly understood.

Speaking legends, another one, a bit more advanced, has it that supercomputers, or perhaps supercomputers of the future, will certainly understand such things. In answer, supercomputers are pretty good at basic, computational mathematics, level 1, and certainly useful, but rather clueless at hard problems in physics, level 2. As for chemistry, level 3, and then biology, level 4, supercomputers are certainly useful here too, but only for extremely modest questions, and overall, they look here more like a cow eating some grass, with little to no relation to sharks or tigers jumping on their prey.

Anyway. To summarize, life was invented by God, and with this being the only correct scientific explanation, and which is widely agreed upon, among decent scientists. This being said, after so many centuries of research, we have a bit of an idea of how life works, and how it appeared, and this can be certainly the subject of a story to tell.

You probably know a bit about all this, origins of life, from school, but decided, now that you are student, to do studies in something else than chemistry and biology. In this case, the present book might be for you. We will discuss here chemistry, organic chemistry, and then life soups and early life, at a more advanced level than the school one, and by insisting on the randomness of the various phenomena at play, and on the underlying mathematics and physics. The book is organized in 4 parts, as follows:

I. We will first provide a basic introduction to chemistry, with a randomness approach to many things, and with some cosmological background explanations included too.

II. We will discuss then the basics of organic chemistry and molecular biology, again by insisting on the randomness of the various processes that can be at play.

III. Then we will go on the study of life soups that can appear, under favorable circumstances, their cooking and self-cooking, and the origins of life on Earth.

IV. Finally, we will discuss habitable planets, with due astronomy preliminaries, and various speculations that can be made, on the extraterrestrial forms of life.

In the hope that you will find this book useful. Again, what we will be doing here is rather the topic of organic chemistry, and molecular biology, and this book will stand for what it is worth, namely an introduction to this, written for students in mathematics, or physics, or computer science, or engineering, wishing to learn more about this.

Many thanks go to my various scientific colleagues, for many things learned from them, over the time, and with a special mention to internet too, which is such a good place for learning new things, away from your usual occupations. Thanks as well to my cats, for some help with the physics, and for support on some philosophical questions too.

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Part I

**Basic chemistry**

*Ave Maria! Jungfrau mild  
Erhore einer Jungfrau Flehen  
Aus diesem Felsen starr und wild  
Soll mein Gebet zu dir hinwehen*

CHAPTER 1

**Physics, atoms**

1a.

1b.

1c.

1d.

**1e. Exercises**

Exercises:

EXERCISE 1.1.

EXERCISE 1.2.

EXERCISE 1.3.

EXERCISE 1.4.

EXERCISE 1.5.

EXERCISE 1.6.

EXERCISE 1.7.

EXERCISE 1.8.

Bonus exercise.



## CHAPTER 2

### Chemistry, molecules

2a.

2b.

2c.

2d.

#### 2e. Exercises

Exercises:

EXERCISE 2.1.

EXERCISE 2.2.

EXERCISE 2.3.

EXERCISE 2.4.

EXERCISE 2.5.

EXERCISE 2.6.

EXERCISE 2.7.

EXERCISE 2.8.

Bonus exercise.



## CHAPTER 3

### Acids and bases

**3a.**

**3b.**

**3c.**

**3d.**

**3e. Exercises**

Exercises:

EXERCISE 3.1.

EXERCISE 3.2.

EXERCISE 3.3.

EXERCISE 3.4.

EXERCISE 3.5.

EXERCISE 3.6.

EXERCISE 3.7.

EXERCISE 3.8.

Bonus exercise.





## CHAPTER 4

### Random chemistry

4a.

4b.

4c.

4d.

4e. Exercises

Exercises:

EXERCISE 4.1.

EXERCISE 4.2.

EXERCISE 4.3.

EXERCISE 4.4.

EXERCISE 4.5.

EXERCISE 4.6.

EXERCISE 4.7.

EXERCISE 4.8.

Bonus exercise.



Part II

Organic molecules

*I see skies of blue, and clouds of white  
The bright blessed day, the dark sacred night  
And I think to myself  
What a wonderful world*

CHAPTER 5

**Hydrogen and carbon**

5a.

5b.

5c.

5d.

**5e. Exercises**

Exercises:

EXERCISE 5.1.

EXERCISE 5.2.

EXERCISE 5.3.

EXERCISE 5.4.

EXERCISE 5.5.

EXERCISE 5.6.

EXERCISE 5.7.

EXERCISE 5.8.

Bonus exercise.



CHAPTER 6

**Organic chemistry**

**6a.**

**6b.**

**6c.**

**6d.**

**6e. Exercises**

Exercises:

EXERCISE 6.1.

EXERCISE 6.2.

EXERCISE 6.3.

EXERCISE 6.4.

EXERCISE 6.5.

EXERCISE 6.6.

EXERCISE 6.7.

EXERCISE 6.8.

Bonus exercise.





## CHAPTER 7

### Small molecules

7a.

7b.

7c.

7d.

#### 7e. Exercises

Exercises:

EXERCISE 7.1.

EXERCISE 7.2.

EXERCISE 7.3.

EXERCISE 7.4.

EXERCISE 7.5.

EXERCISE 7.6.

EXERCISE 7.7.

EXERCISE 7.8.

Bonus exercise.



## CHAPTER 8

### Big molecules

8a.

8b.

8c.

8d.

8e. Exercises

Exercises:

EXERCISE 8.1.

EXERCISE 8.2.

EXERCISE 8.3.

EXERCISE 8.4.

EXERCISE 8.5.

EXERCISE 8.6.

EXERCISE 8.7.

EXERCISE 8.8.

Bonus exercise.



## Part III

# Soups, early life

*Little darling  
It feels like years since it's been here  
Here comes the sun, here comes the sun  
And I say, it's alright*

CHAPTER 9

**Stars and planets**

**9a.**

**9b.**

**9c.**

**9d.**

**9e. Exercises**

Exercises:

EXERCISE 9.1.

EXERCISE 9.2.

EXERCISE 9.3.

EXERCISE 9.4.

EXERCISE 9.5.

EXERCISE 9.6.

EXERCISE 9.7.

EXERCISE 9.8.

Bonus exercise.





## CHAPTER 10

### Life soups

10a.

10b.

10c.

10d.

10e. Exercises

Exercises:

EXERCISE 10.1.

EXERCISE 10.2.

EXERCISE 10.3.

EXERCISE 10.4.

EXERCISE 10.5.

EXERCISE 10.6.

EXERCISE 10.7.

EXERCISE 10.8.

Bonus exercise.



## CHAPTER 11

### Cooking

11a.

11b.

11c.

11d.

11e. Exercises

Exercises:

EXERCISE 11.1.

EXERCISE 11.2.

EXERCISE 11.3.

EXERCISE 11.4.

EXERCISE 11.5.

EXERCISE 11.6.

EXERCISE 11.7.

EXERCISE 11.8.

Bonus exercise.



## CHAPTER 12

### Early life

12a.

12b.

12c.

12d.

12e. Exercises

Exercises:

EXERCISE 12.1.

EXERCISE 12.2.

EXERCISE 12.3.

EXERCISE 12.4.

EXERCISE 12.5.

EXERCISE 12.6.

EXERCISE 12.7.

EXERCISE 12.8.

Bonus exercise.



## Part IV

# Habitable planets

*You know the day destroys the night  
Night divides the day  
Tried to run, tried to hide  
Break on through to the other side*



CHAPTER 13

**Stars, again**

**13a.**

**13b.**

**13c.**

**13d.**

**13e. Exercises**

Exercises:

EXERCISE 13.1.

EXERCISE 13.2.

EXERCISE 13.3.

EXERCISE 13.4.

EXERCISE 13.5.

EXERCISE 13.6.

EXERCISE 13.7.

EXERCISE 13.8.

Bonus exercise.



CHAPTER 14

**Solar system**

14a.

14b.

14c.

14d.

14e. Exercises

Exercises:

EXERCISE 14.1.

EXERCISE 14.2.

EXERCISE 14.3.

EXERCISE 14.4.

EXERCISE 14.5.

EXERCISE 14.6.

EXERCISE 14.7.

EXERCISE 14.8.

Bonus exercise.



CHAPTER 15

**Some astronomy**

**15a.**

**15b.**

**15c.**

**15d.**

**15e. Exercises**

Exercises:

EXERCISE 15.1.

EXERCISE 15.2.

EXERCISE 15.3.

EXERCISE 15.4.

EXERCISE 15.5.

EXERCISE 15.6.

EXERCISE 15.7.

EXERCISE 15.8.

Bonus exercise.



## CHAPTER 16

### **Mars attacks**

**16a.**

**16b.**

**16c.**

**16d.**

**16e. Exercises**

Congratulations for having read this book, and no exercises for this final chapter.





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