

DUF1220 Homo Sapiens and Neanderthal fractal periods architectures breakthrough

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« *The mathematician does not study pure mathematics because it is useful ; he studies it because he delights in it and he delights in it because it is beautiful* »

Henri Poincare (1854 – 1912) french mathematician and physicist ¹

Probably, such a quote could also apply to the biomathematic study of the human genome...

ABSTRACT :

DUF1220 proteins regions show the largest Homosapiens lineage-specific increase in copy number of any protein-coding region in the human genome and map principally to 1q21.1, and partially also in 1p. DUF1220 deletions and reciprocal duplications have been associated with microcephaly and macrocephaly, respectively. In Colorado University Dr Sikela team established that human genome sequences encoding DUF1220, show a dramatically elevated copy number in the human lineage and variation in DUF1220 copy number has been linked to both brain size in humans and brain evolution among primates. Remarkably, dosage variations involving DUF1220 sequences have now been linked to human brain expansion, autism severity, total IQ, and cognitive and mathematical aptitude scores.

We analyzed in chromosome 1q a large region of 218 contiguous DUF1220 as well as in the chromosome 1p five other regions of DUF1220 smaller, then a total of 245 DUF1220 proteins. We supplemented by analyzing 16 RNAs of NBPF genes containing these DUF1220 and also 3 representative NBPF genes from Neanderthal genome. Finally the method is extended analysing the long 1q21 region from 7 other close primates like Neanderthal, great apes : chimp, gorilla, orangutan and monkeys : macaque, marmoset, vervet. This remarkable property is confirmed by comparing these primates to other mammals such as mice, rabbit, cow, dolphin and Elephant.

We then show four classes of multi-periodic fractal structures for all 19 DUF1220 regions and 19 NBPF genes studied cases. The analysis of these spectra of fractal periods² reveals a simple linear interdependence, hierarchization and unification between the numerical sequences of each of these 4 spectra and the sequences of Fibonacci and Lucas. Given the evidence of this numerical relationship, we suggest that this discovery may be one of the major causes of a cognitive development of man superior to that of the great primates.

INTRODUCTION :

To date, the exact function of the DUF1220 protein is not known. Meanwhile, DUF1220 proteins regions show the largest Homosapiens lineage-specific increase in copy number of any protein-coding region in the human genome and map principally to 1q21.1, and partially also in 1p. DUF1220 deletions and reciprocal duplications have been associated with microcephaly and macrocephaly, respectively. In Colorado University Dr Sikela team established that human

1 Please visit https://en.wikipedia.org/wiki/Henri_Poincar%C3%A9

2 This scientific paper belongs to a series of 6 articles demonstrating the existence of global numerical structures on the scale of whole human chromosomes and genomes. The method of analysis of fractal periods used here will be completely studied in: "Humans and Primates Chromosomes4 Fractal CODES: periodic stationary waveforms characterizing and differentiating Neanderthal and Sapiens whole chromosomes DNA sequences". The four other articles will be: "Global and long range fractal differences between sapiens and neanderthal genomes" and "The Human Genome Optimum : a numerical universal law controlling all LOH chromosomal deletions involved in human cancers " and « Sapiens mtDNA circular long-range numerical meta-structures are highly correlated with mtDNA diseases mutations » and « Fractal Chaos » : from Artificial Intelligence Neural Networks to Human Chromosomes DNA sequences Hidden Codes: Self-similarity and Scale Invariance....

genome sequences encoding DUF1220, show a dramatically elevated copy number in the human lineage and variation in DUF1220 copy number has been linked to both brain size in humans and brain evolution among primates (1, 2). Attempts to link genetic and I.Q have been proposed from the 1970s (3). Now, particularly, dosage variations involving DUF1220 sequences have now been linked to human brain expansion, autism severity, total IQ, and cognitive and mathematical aptitude scores (4).

There are many more copies of DUF1220 encoded in the human genome compared to the genome of any other species (Table1). Humans have approximately 270 haploid copies, far more than great apes (90–125 copies), monkeys (25–40 copies), and especially prosimians and non-primate mammals (1–9 copies)

Dr Sikela Lab. demonstrates the hypothesis that increasing copy number of sequences encoding DUF1220 protein domains is a major contributor to the evolutionary increase in brain size, neuron number, and cognitive capacity that is associated with the primate order. They propose that this relationship is restricted to the anthropoid sub-order of primates (5, 6, 7, 8).

Table 1 below illustrates the distribution of DUF1220 and NBPF gene populations in different mammalian species: antropoids, prosimians, and other mammals. The NBPF genes that often contain these DUF1220 proteins also appear to play an important role.

Indeed, thanks to the CRISPR technology (Clustered regularly interspaced short palindromic repeats), it is now possible to modify locally the genomes, and more particularly the human genome (9).

Despite the precise function of these DUF1220 proteins is not yet known, however, it is already possible to imagine the potential, the risk and the ethical stake of genetic manipulations of this region using the CRISPR technology. Especially since it has been established that this region is extremely fragile, difficult to sequence, and often causes severe cerebral disorders.

On the other hand, the fractal and global structures of the human genome were demonstrated (10).

In such a context, apart from ethical questions, can a local technology as powerful as CRISPR be applied, ignoring its possible effect on the possible global and long-range equilibria at the chromosome or even the entire genome?

For more than 25 years, we have been looking for possible global, even digital, structures that would organize DNA, genes, chromosomes, and even whole genomes (11, 12, 13, 14).

	Genome	PDE4DIP	Total DUF1220	NBPF Genes
EUARCHOTANGLIRES				
Anthropoids	Human	2	272	23
	Chimp	3	125	19
	Gorilla	3	99	15
	Orangutan	4	92	11
	Gibbon	3	53	10
	Macaque	1	35	10
	Marmoset	1	31	11
Prosimians	Mouse Lemur	1	2	1
	Bushbaby	1	3	2
	Tarsier	1	1	0
	Rabbit	1	8	3
	Pika	1	1	0
	Mouse	1	1	0
	Rat	1	1	0
	Guinea Pig	1	1	1
	Squirrel	1	1	1
	Tree Shrew	1	4	3
	LAURASIATHERIA			
	Cow	1	7	3
	Dolphin	1	4	1
	Pig	1	3	1
	Horse	1	8	3
	Dog	1	3	1
	Panda	1	2	1
	Cat	1	3	2
	Megabat	1	1	0
	Microbat	1	1	0
	Hedgehog	1	1	0
	Shrew	1	1	0
XENARTHRA				
	Armadillo	1	1	0
	Sloth	1	1	0
AFROTHERIA				
	Elephant	1	1	2
	Hyrax	1	1	0
	Tenrec	1	1	0
METATHERIA				
	Opossum	1	1	0
	Wallaby	1	1	0
PROTOTHERIA				

Table 1 : source : Table 1 from (6) Keeney, J. G., Dumas, L., & Sikela, J. M. (2014). The case for DUF1220 domain dosage as a primary contributor to anthropoid brain expansion. *Frontiers in Human Neuroscience*, 8, 427. <http://doi.org/10.3389/fnhum.2014.00427>

We will analyze here several major sequences containing these proteins DUF1220 according to an original approach highlighting sorts of "fractal periodicities". (15), this method of numerical analysis of chromosomal DNA sequences demonstrates the evidence of "fractal periods" and "resonance periods" characterizing each of the 24 human chromosomes as well as any partial or complete sequence of any chromosome. For example, as illustrated in Figure 1 below, these resonances make it possible to differentiate the respective genomes of Neanderthal and Sapiens on the global scale of the 1q21.1 DUF1220 main rich region. Here a resonance of 12 nucleotides is common to both Sapiens and Neanderthal regions, however, the respective shapes of these resonance curves are radically different.

Comparing Sapiens and Neanderthal 1q21.1 DUF1220 rich regions

The main resonance period = 12

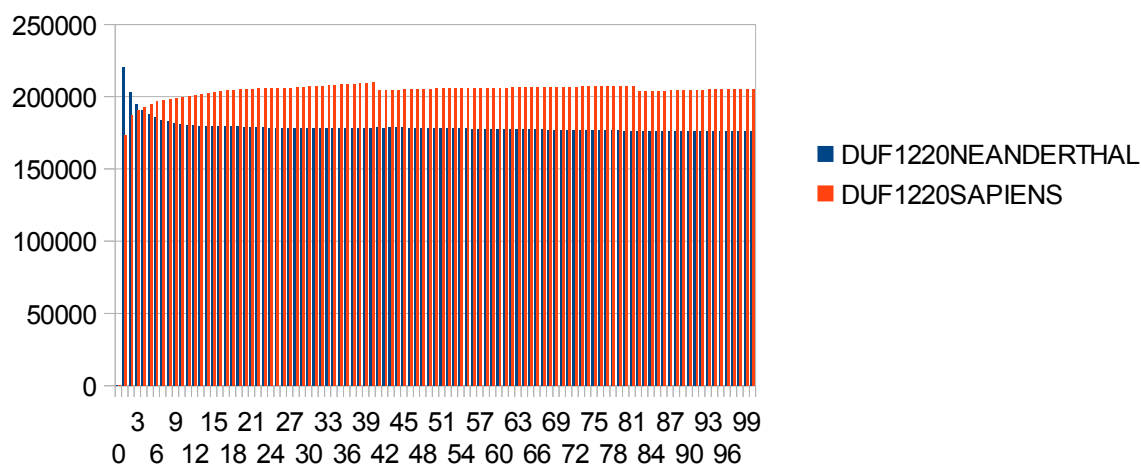


Figure 1: The 2 respective Neanderthal and Sapiens 1q21.1 DUF1220 region6 have a "resonance" of 12 bp, however, these two radically different resonance curves illustrate a major differentiation of the 2 human species on the GLOBAL scale.

METHODS :

Analysed whole human genomes :

We have completely and systematically analyzed the DUF1220 protein rich regions in many genomes and more specifically in each of the following 2 reference genomes:

Neanderthal reference genome :

-Neanderthal genome (2014) ref (16)
<http://www.nature.com/nature/journal/v505/n7481/full/nature12886.html>

Sapiens HG38 (2013) human reference genome ref (17)
 - Sapiens HG38 (2013) genome <https://www.ncbi.nlm.nih.gov/grc/human>

Analysed DUF1220 regions in Sapiens HG38 chromosome1 :

The main links to regions of DUF1220 are available by this link :
http://genome.ucsc.edu/cgi-bin/hgTracks?hgtgroup_map_close=0&hgtgroup_genes_close=0&hgtgroup_phenDis_close=0&hgtgroup_rna_close=0&hgtgroup_expression_close=0&hgtgroup_regulation_close=0&hgtgroup_compGeno_close=0&hgtgroup_varRep_close=0&hgtgroup_rep_close=0&hgsid=573629553_vMKvaa3cdohKVHtDV1yCaoEhuia9&position=DUF1220&hgt.positionInput=DUF1220&hgt.jump=go&hgt.suggestTrack=knownGene&db=hg38&c=chr4&l=0&r=190214555&pix=800&dinkL=2.0&dinkR=2.0

For more details, please visit complementary materials (part I).

Computing Fractal Periods and Resonances Summary :

We introduce here a method of global analysis of the roughness or fractal texture of the DNA sequences at the chromosome scale. To do this, we generalize the method of numerical analysis of the "Master Code of Biology" (15). Thus, we restructure the sequence into different generic sequences based on "meta codons" no longer triplets of 3 nucleotides but values ranging from 17 to 377 nucleotides, ie 360 simulations. This method of analysis will then reveal, in most cases, discrete waves or interferences, most often dissonances. However, sometimes there will emerge kinds of resonances where all scales of analysis appear to be in symbiosis.

The discrete interferences fields resulting from the analysis of an entire chromosome are therefore a three-dimensional space:

Dim y (vertical) restructuring in meta codons of lengths 17 to 377 nucleotides

Dim x (horizontal) derived mobile1 such that $1/2 \ 1/3 \ 1/4 \ \dots \ 1/n$

Dim z cumulated populations from the "Master code" operators (14).

The + 1 / -1 derivatives will be of type increase, ie +1 if derivative increasing and will be of type decrease, ie -1 if derived decreasing.

In this context we will explore these 3d spaces in 2 forms:

-Horizontal, meta codons dimension: curves for a given meta codon dimension, see in the example "resonances" below (see Figure 4).

-Vertically, spectral differentiation: discrete series d2-d1 is +1 if increase and -1 if decrease (see Figures 2 and 3 below).

We represent in top the +1 and in low the -1, (see the examples below).

Example of three-dimensional interference fields (Neanderthal chromosome 1q21.1 DUF1220 rich region6).

Dim x	d1	d2	.../...	d100		
Dim y	0	1	2	3	4	5
	5	318499	377103	401874	416629	424005
	6	369260	440557	364717	405943	357653
	7	389780	351783	332589	318646	310074
	8	253290	289225	304361	258865	273966
	9	275885	243343	226178	259486	245390
	10	188558	208306	214670	218930	222246
	11	208279	180867	204098	187607	203513
	12	220206	203013	194628	190435	187589
.../...	377					

Horizontal scan example : 5 318499 377103 401874 416639 424005 .../...

(see Figure 4)

Vertical scan example : 1 if $d_2 > d_1$ and -1 if $d_2 < d_1$ then : 1 1 -1 1 -1 1 -1 -1 .../...

(see Figures 2 and 3)

Table2 : Basic data involved in genomic DNA sequences fractal periods analysis.

DUF1220 region6 from Neanderthal 1q21.1

computing PERIODS by Fractal "increase/decrease" textures

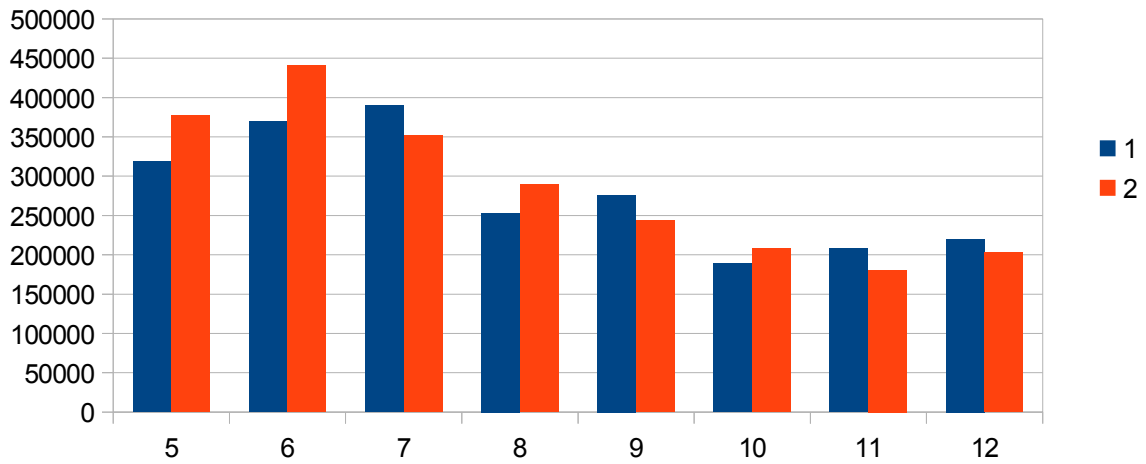


Figure 2 : zoom on vertical scan method from DUF1220 rich region6 Neanderthal 1q21.1.

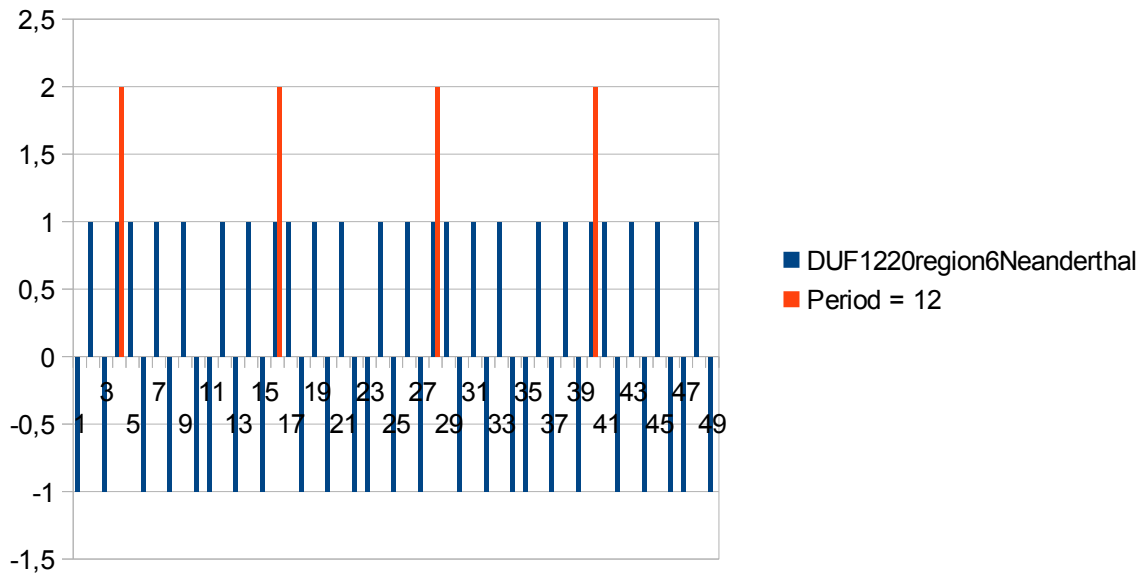


Figure 3 : zoom on vertical scan method revealing main Period = 12 from DUF1220 rich region6 Neanderthal 1q21.1.

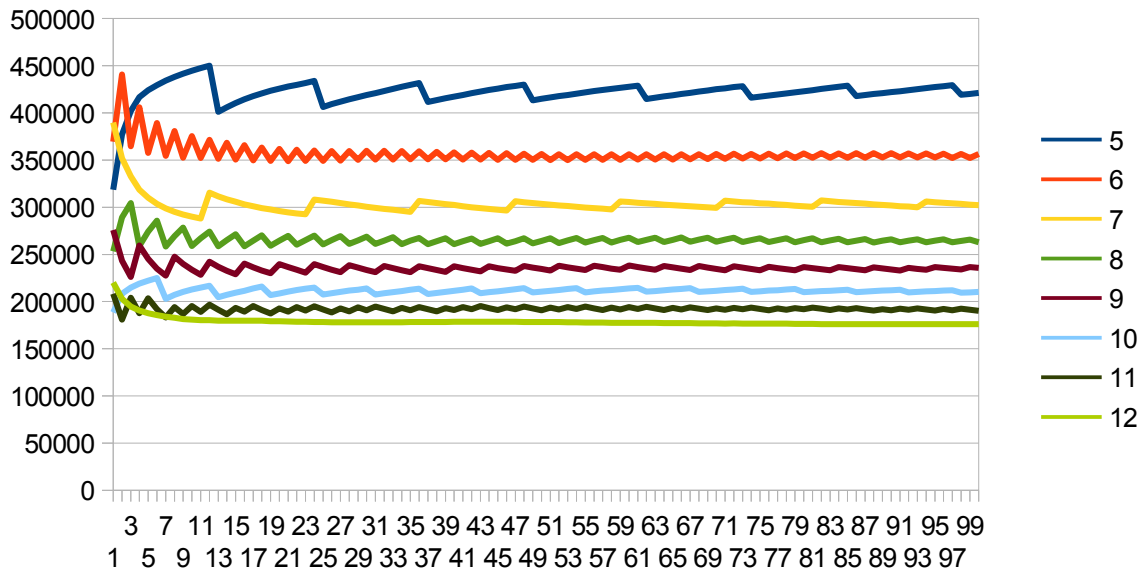


Figure 4: zoom on horizontal scan method revealing Resonances Periods = 5 7 12 from DUF1220 rich region6 Neanderthal 1q21.1.

These two independent methods lead in all the cases analyzed to the same period value: here, for example, the main period "horizontal scan" is a resonance of 12bp (FIG. 3) and the first 3 "vertical scan" periods are the periods 7 and 12 (FIG. 4).

RESULTS :

The study of the long region6 of more than 5 million base pairs and containing 218 DUF1220 will reveal the spectrum of the following periods:

First remark : there are various possible interferences between Fibonacci/Lucas sub-spectrums :

Main resonances periods:

5 7 12 19 31 50 81 DUF1220 resonances and periods

5 8 13 21 34 55 89 Fibonacci

0 1 1 2 3 5 8 Fibonacci

5 7 12 19 31 50 81 DUF1220 resonances and periods

2 1 3 4 7 11 18 29 47 Lucas

3 6 9 15 24 39 63... = 3 x (1 2 3 5 8 13..) = 3 times Fibonacci

5 7 12 19 31 50 81

1 3 4 7 11 Lucas

4 4 8 12 20 = 4 x (1 1 2 3 5...) = 4 times Fibonacci

5 7 12 19 31 50 81

3 4 7 11 18 Lucas

2 3 5 8 13 Fibonacci

etc...

Second remark : There are main resonances periods like 5 7 12 19 31 50... but also secondary resonances periods like : 17 (5+12), 24 (5+19), 26 (7+19), 57 (7+50), 69 (50+19), etc...

Main resonances :

5 7 12 19 31 50 81 .../...

Harmonic resonances :

17 24 26 36 38 43 48 55 62 74 91 93 98 .../...

Finally, we could propose the following rule :

The rule is :

"The distance between the waves flow periods sequence from DUF1220 region (5 7 12 19 31 50...) and a fibonacci similar sequence (5 8 13 21 34 55...) is ALSO another shifted fibonacci sequence (0 1 1 2 3 5...) !"

A corollary is:

The waves spectrum associated with DUF1220 region (5 7 12 19...) is analog with the INTERFERENCE subtraction between TWO fibonacci waves spectrum shifted (ie 5 8 13 21 34... and 0 1 1 2 3 5 8 13 ...)

DUF1220 region in Human HG38 chromosome1

DUF1220 resonances spectrum is analog with INTERFERENCE between a Fibonacci and a 5 steps shifted Fibonacci Spectrums

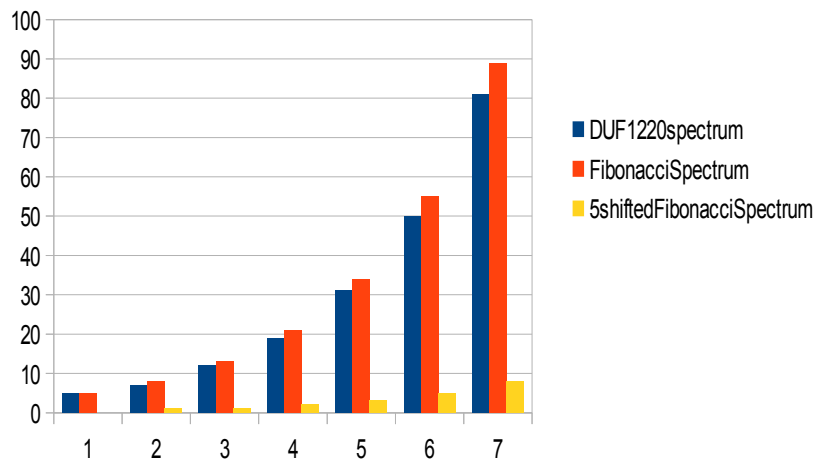


Figure 5 : Split of the 5 7 12 19... spectrum in the interference between 2 Fibonacci/Lucas sub-spectrums.

DUF1220spect	5	7	12	19	31	50	81
FibonacciSpec	5	8	13	21	34	55	89
5shiftedFibona	0	1	1	2	3	5	8

We now study the 16 cases of NBPF genes containing DUF1220 proteins in Homosapiens (HG38), which we will then complete with 3 other representative analogues in Neanderthal.

Recall:

Lucas: 2 1 3 7 11 18 29 47 ...

Fibonacci: 0 1 1 2 3 5 8 13 21 34 ...

NBPF genes	Resonance Periods	Fibonacci/Lucas Preiods	Shifted sequences	Hyper-resonance class
Test1 NBPF1	7 9 16 25 41	5 8 13 21 34	2 1 3 4 7	B
Test2 NBPF14	7 9 16 25 41	5 8 13 21 34	2 1 3 4 7	B
Test3 NBPF12	7 9 16 25 41	5 8 13 21 34	2 1 3 4 7	B

Test4 NBPF20	7 9 16 25 41	5 8 13 21 34	2 1 3 4 7	B
Test5 NBPF4	9 11 20 31 51	8 8 16 24 40 = 8x(1 1 2 3 5)	1 3 4 7 11	C
Neanderthal NBPF4	9 11 20 31 51	8 8 16 24 40 = 8x(1 1 2 3 5)	1 3 4 7 11	C
Test6 NBPF10	7 9 16 25 41	5 8 13 21 34	2 1 3 4 7	B
Test7 NBPF6	9 11 20 31 51	8 8 16 24 40 = 8x(1 1 2 3 5)	1 3 4 7 11	C
Test8 NBPF9	9 11 20 31 51	8 8 16 24 40 = 8x(1 1 2 3 5)	1 3 4 7 11	C
Neanderthal NBPF9	9 11 20 31 51	8 8 16 24 40 = 8x(1 1 2 3 5)	1 3 4 7 11	C
Test9 NBPF9	7 9 16 25 41	5 8 13 21 34	2 1 3 4 7	B
Test10 NBPF9	7 9 16 25 41	5 8 13 21 34	2 1 3 4 7	B
Test11 NBPF6	9 11 20 31 51	8 8 16 24 40 = 8x(1 1 2 3 5)	1 3 4 7 11	C
Test12 NBPF15	5 7 12 19 31	8 13 21 34	1 1 2 3	A
Neanderthal NBPF15	5 7 12 19 31	8 13 21 34	1 1 2 3	A
Test13 NBPF15	5 7 12 19 31	8 13 21 34	1 1 2 3	A
Test14 NBPF3	7 9 16 25 41	5 8 13 21 34	2 1 3 4 7	B
Test15 NBPF3	7 9 16 25 41	5 8 13 21 34	2 1 3 4 7	B
Test16 NBPF3	7 9 16 25 41	5 8 13 21 34	2 1 3 4 7	B

Table3 : The spectrums related to 19 cases of NBPF genes reveals 3 classes of spectrums, all could be splitted in Fibonacci/Lucas sub-spectrums.

Finally, we study the 19 cases of DUF1220 regions, including: the six regions from chromosome1 in Homosapiens, then we concentrate on the long region6 of 1q21.1 in Neanderthal, then in the large apes primates, then in Other primates, and finally in other mammals of which the very small number of DUF1220 is known (see Table 1).

Recall :

suite de lucas 2 1 3 7 11 18 29 47

suite de Fibonacci 0 1 1 2 3 5 8 13 21 34

DUF1220 regions	Number of DUF1220	Resonance Periods	Fibonacci/Lucas Periods	Shifted sequences	Hyper-resonance class
Anthropoids Primates					
Region1 1:16564024 16587759	7	9 11 20 31 51	8 8 16 24 40 = 8x(1 1 2 3 5)	1 3 4 7 11	C
Region2 1:21472881 21483305	5	7 9 16 25 41	5 8 13 21 34	2 1 3 4 7	B
Region3 1:108232266 108239862	4	7 9 16 25 41	5 8 13 21 34	2 1 3 4 7	B
Region4 108454483 108462078	4	7 9 16 25 41	5 8 13 21 34	2 1 3 4 7	B
Region5 1:120809849 120840512	7	7 9 16 25 41	5 8 13 21 34	2 1 3 4 7	B
Region6 1:144423094- 149554657	218	5 7 12 19 31 50 81	5 8 13 21 34 55 89	0 1 1 2 3 5 8	A
Region6		5 7 12 19 31 50 81	5 8 13 21 34 55 89	0 1 1 2 3 5 8	A

NEANDERTHAL 1:141527445-146659008					
Chimp region6 1:111091664-116223227		5 7 12 19 31 50 81	5 8 13 21 34 55 89	0 1 1 2 3 5 8	A
Gorilla region6 1:124329600-129461163		5 7 12 19 31 50 81	5 8 13 21 34 55 89	0 1 1 2 3 5 8	A
Orangutan region6 1:102601348-107732911		5 7 12 19 31 50 81	5 8 13 21 34 55 89	0 1 1 2 3 5 8	A
Olive Baboon Region6 1:119609055-124740618		5 7 12 19 31	8 13 21 34	1 1 2 3	A
Macaque region6 1:120005413-125136976		5 7 12 19 31 50 81	5 8 13 21 34 55 89	0 1 1 2 3 5 8	A
Marmoset region6 18:1-5131564		9 11 20 31 51	8 8 16 24 40 = 8x(1 1 2 3 5)	1 3 4 7 11	C
Vervet Region6 1:1-1280666		7 9 16 25 41	5 8 13 21 34	2 1 3 4 7	B
Prosimians					
Mice Region6 3:94635287-99766850		7 9 16 25 41	5 8 13 21 34	2 1 3 4 7	B
Rabbit Region6 13:40672536-45804099		11 13 24 37	2 1 3 4	9 12 21 33 3 x (3 4 7 11)	D
Laurasiatheria					
Cow Region6 3:19523691-24655254		5 7 12 19 31 50 81	5 8 13 21 34 55 89	0 1 1 2 3 5 8	A
Dolphin region6 GeneScaffold_2231:20869 5:327249		9 11 20 31 51	8 8 16 24 40 = 8x(1 1 2 3 5)	1 3 4 7 11	C
Afrotheria					
Elephant region6 scaffold_127:1-2319825		5 7 12 19 31 50 81	5 8 13 21 34 55 89	0 1 1 2 3 5 8	A

Table 4: The spectrums related to 19 cases of DUF1220 regions from Sapiens, Neanderthal, primates and other mammals reveals 4 classes of spectrums, all could be splited in Fibonacci/Lucas sub-spectrums.

Note: Most of the detailed results, such as the following, will be available in the complementary materials (Part II and Part III).

Here are the details of the periods, resonances and dissonances for the 2 long regions6 of 218 DUF1220 in Sapiens (HG38) and in Neanderthal.

REGION6 sapiens HG38 vs Neanderthal

Recall Resonances :

Main resonances : 5 7 12 19 31 50 81 .../...

Harmonic resonances : 17 24 26 36 38 43 48 55 62 69 74 91 93 98 100.../...

Below we illustrate the main resonances and most harmonic resonances. Each of these periods is highlighted by comparing it with the two neighboring numbers, which, in turn, produce dissonances: for example: 18 19 20. The full details of this analysis can be found in complementary materials (Part II).

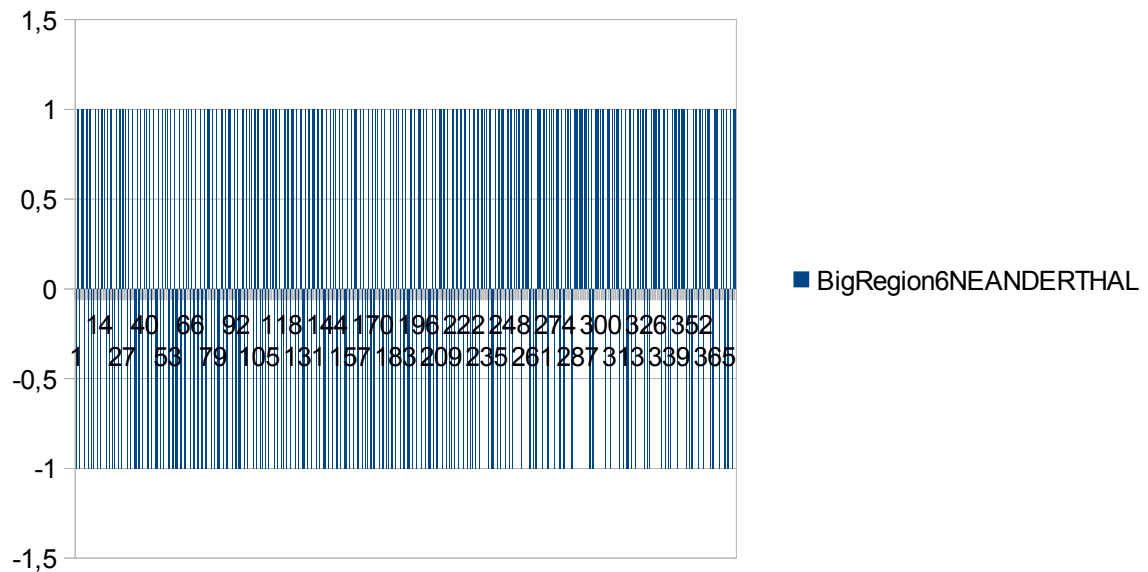


Figure 6: NEANDERTHAL - In this figure we could locate all main periods 7 12 19 31...



Figure 7 : SAPIENS HG38 - In this figure we could locate all main periods 7 12 19 31...

SAPIENS HG38 long region6 of 218 DUF1220

Main periods resonances

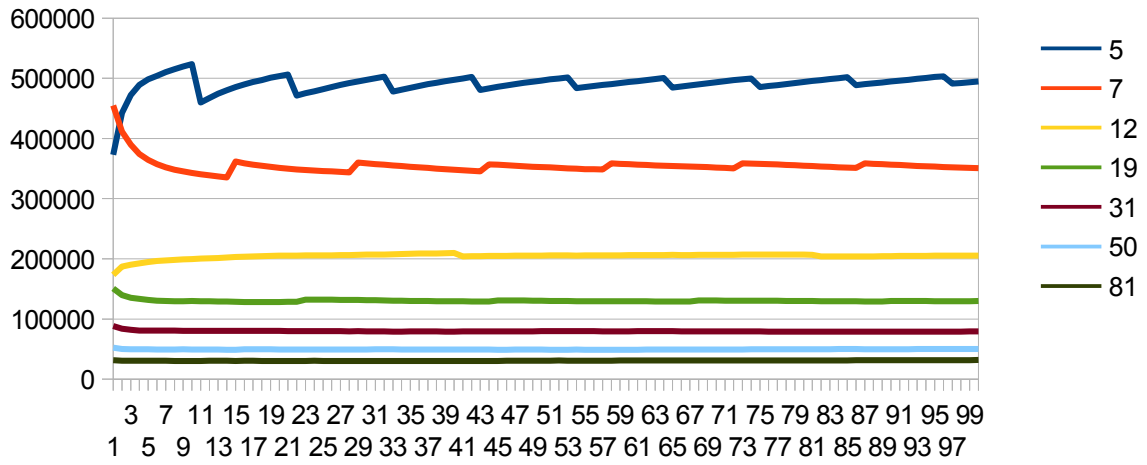


Figure 8 : SAPIENS HG38 - In this figure we could locate RESONANCES for all main periods 5 7 12 19 31 50 81

SAPIENS HG38 long region6 of 218 DUF1220

Dissonances from a 1 period shift

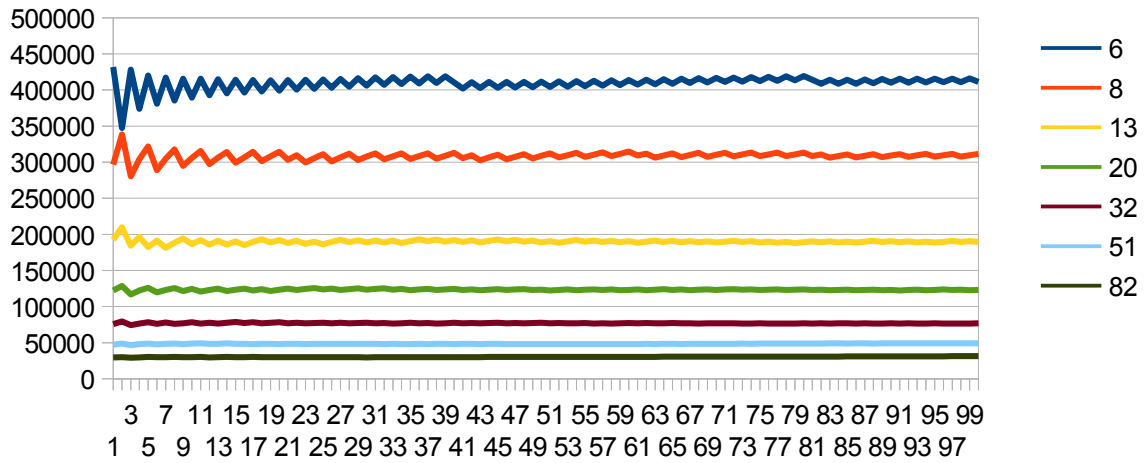


Figure 9 : SAPIENS HG38 - In this figure we could locate DISSONANCES shifting by 1 period all main periods 5 7 12 19 31 50 81

NEANDERTHAL Long Region6 of 218 DUF1220

main resonances

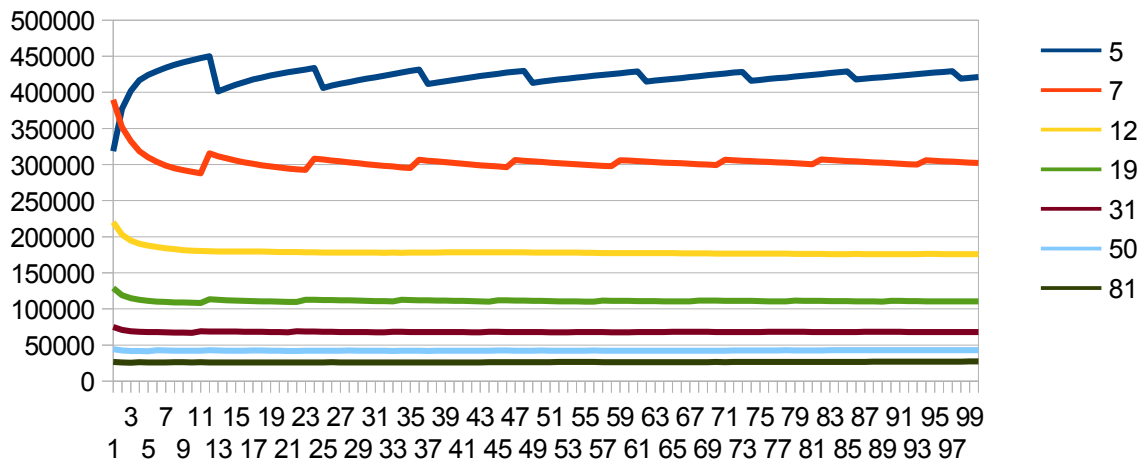


Figure 10 : NEANDERTHAL - In this figure we could locate RESONANCES for all main periods 5 7 12 19 31 50 81

NEANDERTHAL long region6 of 218 DUF1220

Dissonances from a 1 period shift

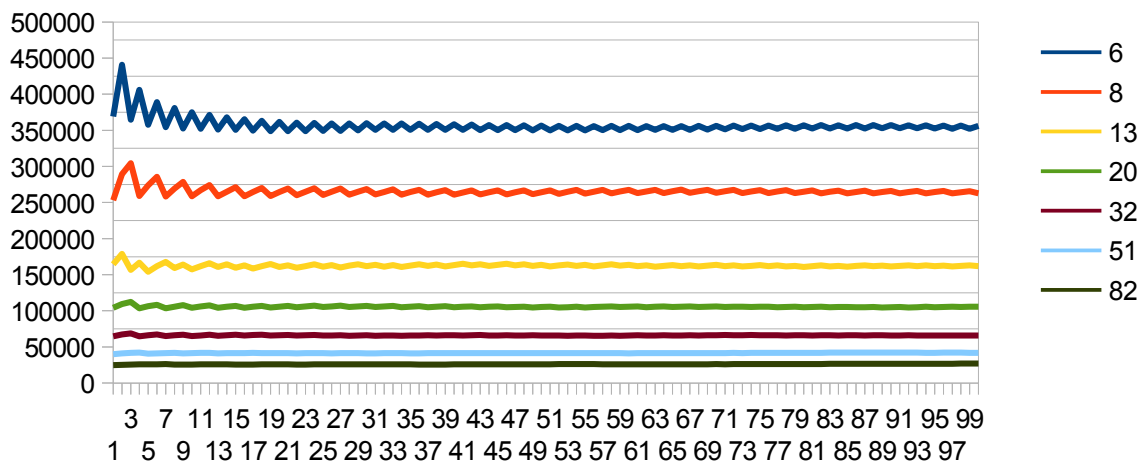


Figure 11 : NEANDERTHAL - In this figure we could locate DISSONANCES shifting by 1 period all main periods 5 7 12 19 31 50 81

Sapiens HG38 long region6 with 218 DUF1220

harmonic periods

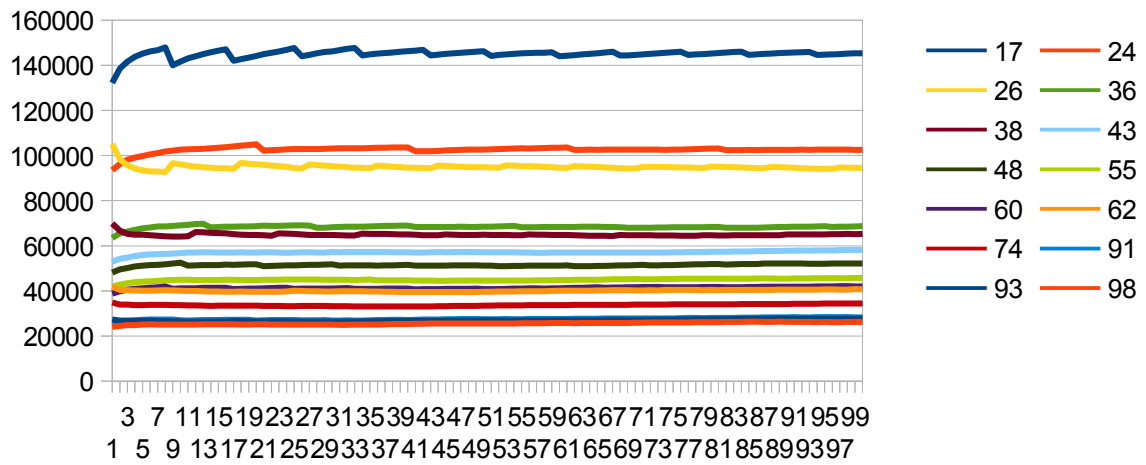


Figure 12 : SAPIENS HG38 - This figure show RESONANCES for all harmonic periods 17 24 26 36 38...

Neanderthal region6 of 218 DUF1220

Harmonics periods

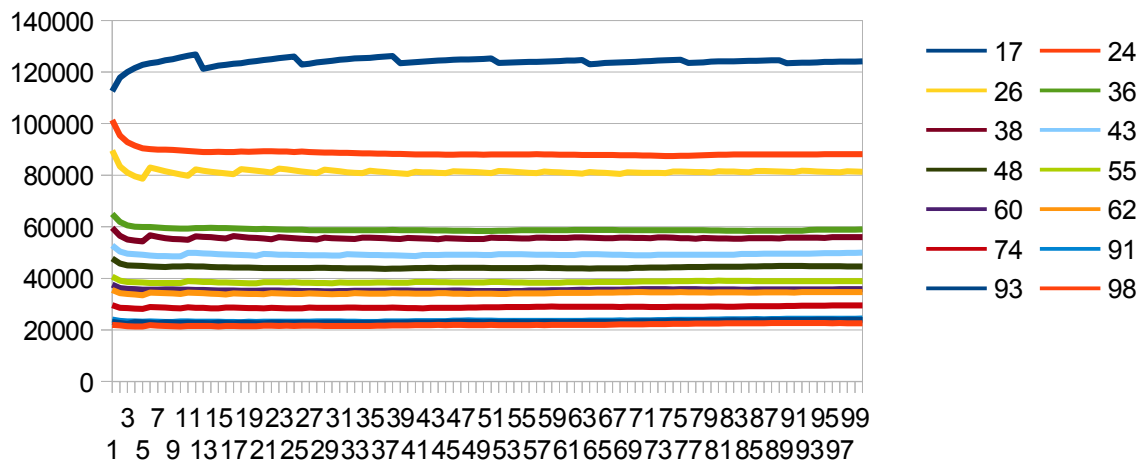


Figure 13 : NEANDERTHAL - This figure show RESONANCES for all harmonic periods 17 24 26 36 38...

Although Sapiens (17) has a much higher DNA sequencing quality than Neanderthal (16), it should be noted that the results for Neanderthal appear to be more compact than Sapiens. This may be due to the fact that the Neanderthal genomic sample comes from a single (or very small) number of individuals. On the contrary, the genome of Sapiens is a kind of consensus genome coming from a large number of individuals.

DISCUSSION :

We will discuss more precisely some remarkable points of this digital exploration of the regions DUF1220: Convergence, hierarchization and unification around the numbers of Fibonacci and Lucas of the 4 classes of digital spectra of the regions DUF1220 and the NBPF genes.

The fourfold correlation between different mammalian species, brain evolution, populations of DUF1220 and our numerical classification.

The study of the protein DUF1220.

Dynamic analysis of the long region of 218 DUF1220.

-2- Convergence, hierarchization and unification around the numbers of Fibonacci and Lucas of the 4 classes of digital spectra of DUF1220 regions and NBPF genes.

The study of 19 cases of NBPF genes on the one hand and of 19 regions DUF1220 on the other hand, 38 distinct analyzes appear to us UNIFIED around a single common generic law that can be stated thus:

A / The analysis of each of the regions containing DUF1220 proteins is characterized by a spectrum of numerical periods consisting of a sequence of integers.

B / These numerical spectra are grouped in only 4 characteristic classes.

C / each of these numerical classes can always be written in the form of a simple linear combination between 2 sequences of Fibonacci or Lucas.

D / It emerges a hierarchy allowing to classify these 4 classes among themselves.

Consequently, we can affirm that all the regions containing DUF1220 proteins can be CLASSIFIED, HIERARCHISEE and UNIFIED around a single law linking the numerical spectra of these regions DUF1220 and the sequences of Fibonacci and Lucas.

Let us now go over the rules outlined above.

The table below summarizes the properties of each of these 4 classes.

Let us recall the values of the two suites of Fibonacci and Lucas:

Fibonacci: 0 1 1 2 3 5 8 13 21 34 ...

Lucas: 2 1 3 4 7 11 18 29 47 ...

Class reference	Hierarchy	Basic initial fractal periods spectrum... ==>	==> Interfering with Fibonacci or Lucas pattern ... ==>	==> Result of the numerical interference... reveals another Fibonacci or Lucas pattern	Number of DUF1220 cases
A	High = 1	5 7 12 19 31 50 81	+ 0 1 1 2 3 5 8	= 5 8 13 21 34 55 89	12
B	Medium = 2	7 9 16 25 41	- 2 1 3 4 7	= 5 8 13 21 34	16
C	Medium = 3	9 11 20 31 51	- 1 3 4 7 11	= 8 8 16 24 40 = 8x(1 1 2 3 5)	9
D	Low = 4	11 13 24 37	- 2 1 3 4	= 9 12 21 33 = 3x(3 4 7 11)	1

Table 5: Summary of the 4 classes of spectrums unifying all 28 cases analysed.

About the HIERARCHY of the 4 classes:

First, we note this remarkable fact: each of the 4 digital spectra always starts with a sequence of 2 consecutive odd numbers (example 5 7).

In the second place, these 4 sequences of odd numbers can be hierarchized with respect to the ratio Phi (where Phi is the number of gold = 1.618033 ...).

$$5 \div 3 = 1.666666667 \quad 7 \div 5 = 1.4 \quad 9 \div 7 = 1.285714286 \quad 11 \div 9 = 1.222222222 \quad 13 \div 11 = 1.181818182$$

It will be noted that the best ratio would be the ratio 3/5, where 3 and 5 are numbers of Fibonacci. Although we have not met this ratio among the 38 cases studied, we will specify that the analysis of the large hybrid region fusing the 2 region1 and region2 in 1p has indeed led to a Fibonacci type spectrum, 5 8 13 ... See the figures below.

Fusion Region1 and Region2: chr1p: 16564024-21483305

Evidence of a Fibonacci sequence 3 5... 8 13 21...

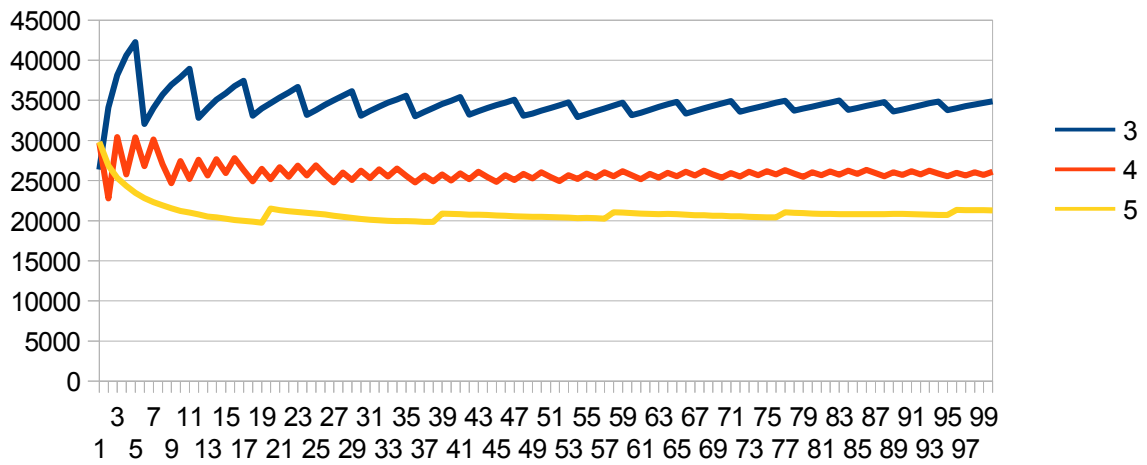


Figure 14: example of Fibonacci spectrum related to the mixed region1 and region2 : here 3 5 Resonances.

Fusion region1 and region2

evidence of a resonance = 8, from Fibonacci 3 5 8 13...

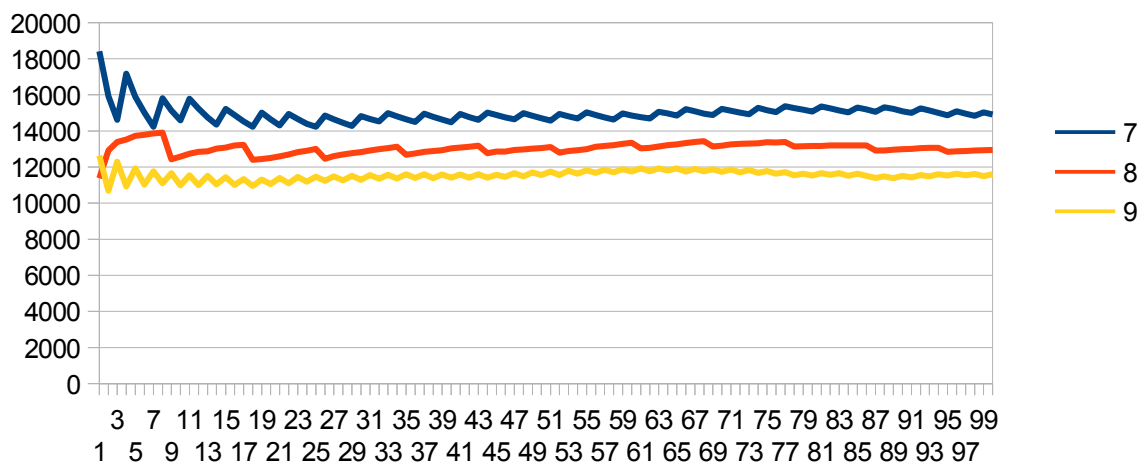


Figure 15: example of Fibonacci spectrum related to the mixed region1 and region2 : here 8 Resonance.

On the other hand, the case of class A, formed by the spectrum 5 7 12 19 31 ... is a very rich case, indeed, on the one hand, it is the first which immediately follows the ideal case of a Spectrum of Fibonacci as illustrated above, but above all, the decomposition of this spectrum causes several interferences of the Fibonacci or Lucas type to emerge, for example:

Four Fibonacci/Lucas interferences for Class A Main spectral resonances periods:

case 1 :

5 7 12 19 31 50 81 DUF1220 resonances and periods

interference between :

5 8 13 21 34 55 89 Fibonacci

0 1 1 2 3 5 8 Fibonacci

case 2 :

5 7 12 19 31 50 81 DUF1220 resonances and periods

interference between :

2 1 3 4 7 11 18 29 47 Lucas

3 6 9 15 24 39 63... = 3 x (1 2 3 5 8 13...) = 3 times Fibonacci

case 3 :

5 7 12 19 31 50 81 DUF1220 resonances and periods

interference between :

1 3 4 7 11 Lucas

4 4 8 12 20 = 2 x 1 1 2 3 5 = 2 times Fibonacci

case 4 :

5 7 12 19 31 50 81 DUF1220 resonances and periods

interference between :

3 4 7 11 18 = Lucas

2 3 5 8 13 = Fibonacci

.../..

-2- The fourfold correlation between different mammalian species, brain evolution, populations of DUF1220 and our numerical classification.

Weighting of the 4 classes A B C D:

The distance of the successive ratios 7/5 9/7 11/9 and 13/11 is calculated to the ideal ratio of 1 / Phi = 0.6180339887.

We thus obtain: 0.7142857143 0.7777777778 0.8181818182 0.8461538462

Then: 0.09625172555 0.1597437891 0.2001478295 0.2281198575

Of which we calculate the inverse: 1 / 0.09625172555 0.1597437891 0.2001478295 0.2281198575

= 10.38942413 6.26002429 4.996306992 4.383660462

Which we relativise in order to compare these values to the order of magnitude of the numbers of DUF1220 and the numbers of NBTF.

Finally, by weighting by a coefficient = 10:

10 x 10.38942413 6.26002429 4.996306992 4.383660462 = 103.8942413 62.6002429 49.96306992 43.83660462

Are finally: A: 104 B: 63 C: 50 D: 44

Species	Total DUF1220	Spectra class	εNBPF genes
Neanderthal	272	104	23
Sapiens	272	104	23
chimp	125	104	15
Gorilla	99	104	11
Orangutan	92	104	10
Olive Baboon	53	104	10
Macaque	35	104	10
Marmoset	31	50	11
Vervet	3	63	2
Mice	1	63	0
Rabbit	8	44	3
Cow	7	104	3
Dolphin	4	50	1
Elephant	1	104	2

Table 6 : Summary of DUF1220 numbers, NBPF genes numbers, and computed normalized spectral classes.

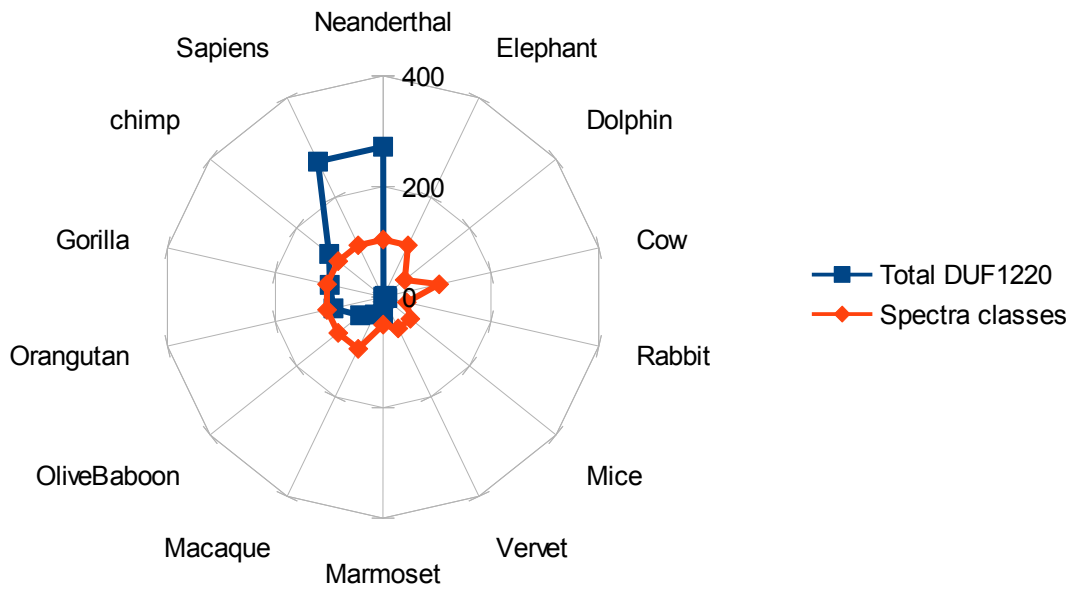


Figure 16 : Comparing graphical correlations between DUF1220 numbers and computed normalized spectral classes.

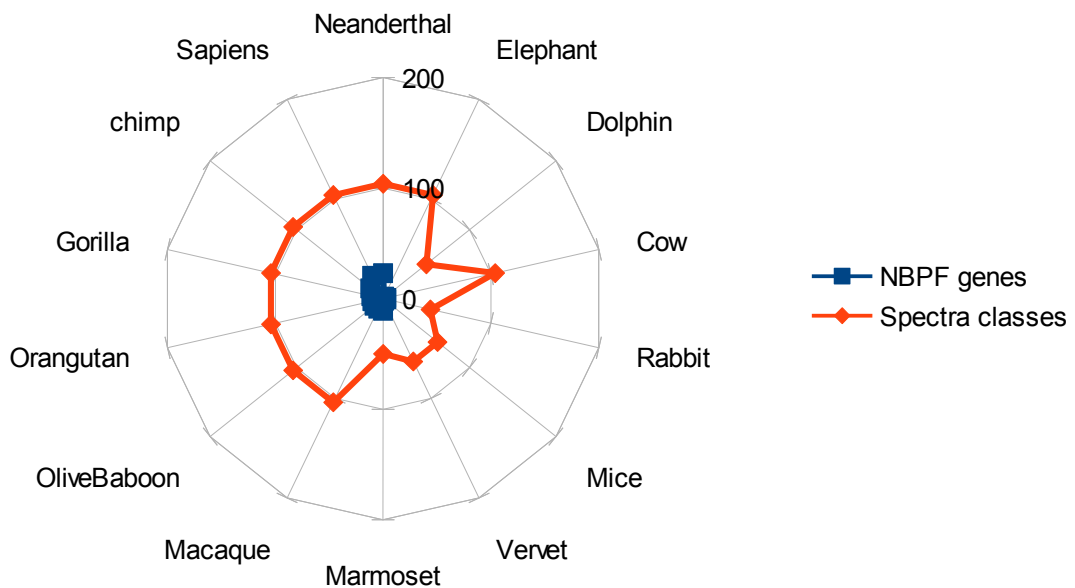


Figure 17 : Comparing graphical correlations between NBPF genes numbers and computed normalized spectral classes.

-3- The study of the protein DUF1220.

We are interested in the DUF1220 protein itself as well as the gaps separating the 218 successive occurrences in the long region6 of 1q21.1.

Here is the sequence of the first of the 118 occurrences DUF1220 of the long region6 of 1q21.1:

chr1:144,423,094-144,423,901 808 bp

[http://genome.ucsc.edu/cgi-bin/hgTracks?](http://genome.ucsc.edu/cgi-bin/hgTracks?db=hg38&lastVirtModeType=default&lastVirtModeExtraState=&virtModeType=default&virtMode=0&nonVirtPosition=&position=chr1%3A144423094-144423901&hgside=573629553_vMKvaa3cdohKVHtDV1yCaoEhuia9)

[db=hg38&lastVirtModeType=default&lastVirtModeExtraState=&virtModeType=default&virtMode=0&nonVirtPosition=&position=chr1%3A144423094-144423901&hgside=573629553_vMKvaa3cdohKVHtDV1yCaoEhuia9](http://genome.ucsc.edu/cgi-bin/hgTracks?db=hg38&lastVirtModeType=default&lastVirtModeExtraState=&virtModeType=default&virtMode=0&nonVirtPosition=&position=chr1%3A144423094-144423901&hgside=573629553_vMKvaa3cdohKVHtDV1yCaoEhuia9)

>hg38_dna range=chr1:144423094-144423901 5'pad=0 3'pad=0 strand=+ repeatMasking=none

```
AAGGGCGAAGCTGATATGCTCTTCCTCAAATGAGTAAAACACACTTCTGT
AGTGCTGGAATGAGTCAGGTTGTTCAAAGTACATTGACGGAGTCGAATAA
CATCTATCCAGTGAGTCCGTGAAGACTTCAGGCTCTTCCACTTCCATCAG
CACGCCGTAGAGCCTGGAAAAGGAGACAAAACCTAAAGAAGCAGCCAGGGA
AAATCAGACACCACAGAGCCCCACTAGATTTTCAGAAGTAATATAAGGAAG
TGGTTAGAAAAGAAAAGGATAGATTTCATTAATGAGGTAAAAAAGAAAAA
TTTATTGCCTTTTATGTTGGGATAGAACAGGGCCAGGTAGAAAACAATGAA
AGAGAAAGACAGAGAGAGAGACAGAGACAGAGACAGAGAGAAAAGTGAG
CTAGTGAATTGCCAGGTGACATACTGGTAAGGGAGTAAAAGGACACTCT
GAGTTAGTGCCCTCATGACACACAGCAAACCTGTGATCACAAAAGAGTGA
GCTCAATAGTTTTCCATAAAAATATGCTCAAAATTTGATGCAGTGGCCATC
AGAGTACAGCTTTTGAAGTATGGTCAACCTATGGTACGTTAGTAAATGAT
AAGGGGAGGAAGAAATGGAACCTAAACATCTACTGCAATGAAAACCAAC
AGCAATGACAGTAGGAGTAATTCAGCCTTCGTTGAAAACATGACATCAA
CACACTCTGGTTTCCCTGAATCTGTTGCCCTCCAGGTGTTAACACAGAATT
AAGCATCCACAATTGCTGAAAGTTACCTGGGGCATGGTGGGTTGTCATCT
TCCCCTT
```

We analyzed this DNA sequence using the "Master Code of DNA" method described in (15).

Here is a summary of the main results:

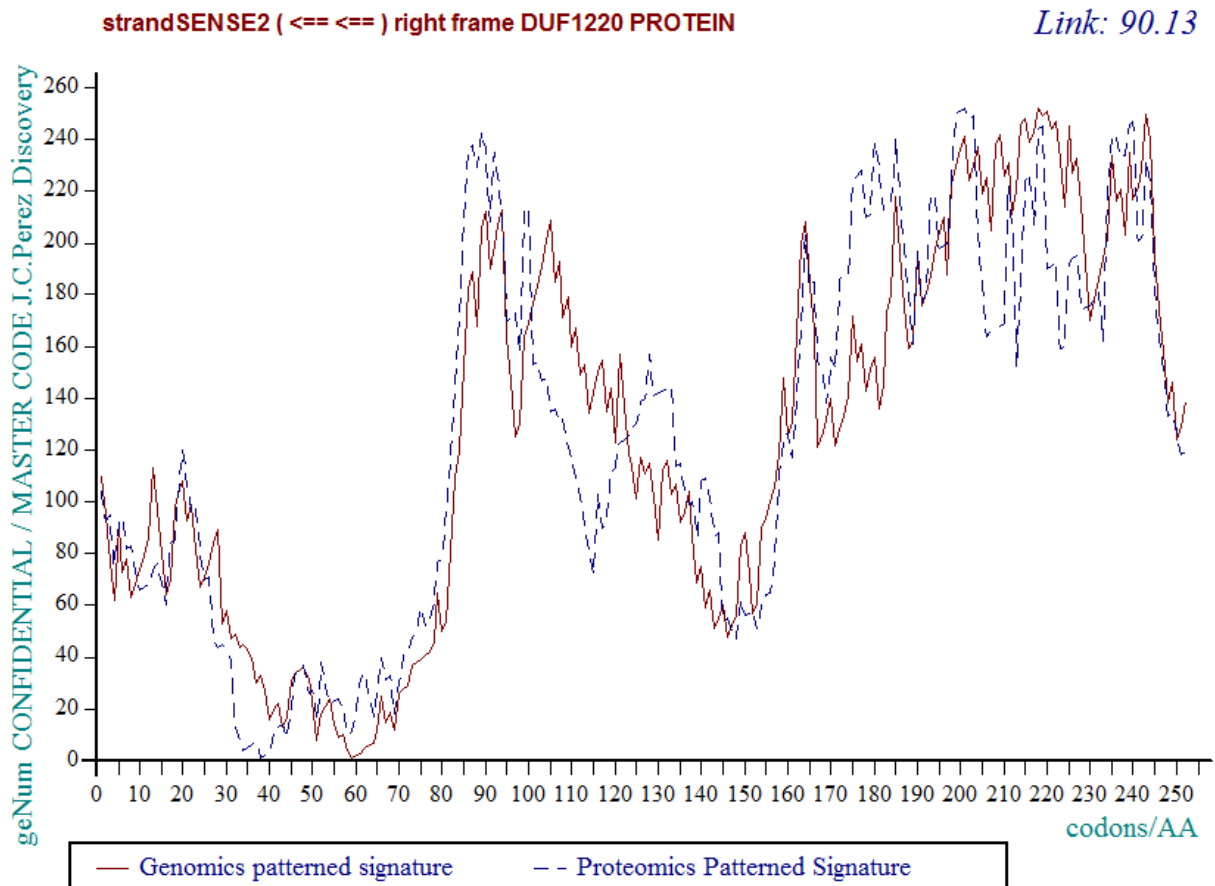


Figure 18: Master Code unifying Genomics and Proteomics patterns for the first DUF1220 protein from the long region6 of 218 DUF1220.

```
===== Strand2 =====
ANALYSING GLOBAL GENOMICS/PROTEOMICS COUPLING RATIO PERCENTAGE...
_____ UNIVERSALIS GENETIC CODE (Global Unified Genetic Code) _____
_____
```

GENOMICS/PROTEOMICS Global Coupling percentage: **90.12953** <==== (a)

=== Strand 2 =====

MAJOR GENOMICS SITES...

15 FIRST + Major sites: **59** 60 61 58 62 63 64 51 56 57 65 69 43 55 67 <==== (b)

15 LAST - Minorsites: **218** 220 243 219 215 222 214 225 221 217 209 201 244 216 208

MAJOR PROTEOMICS SITES...

15 FIRST Major sites: 38 39 40 34 35 36 37 33 44 58 **59** 41 42 43 32 <==== (c)

15 LAST Minor sites: 201 200 199 203 202 240 239 219 **218** 89 236 235 185 180 87

===== VECTPIM2...

GENOMICS teeth of saw PERCENT CODE...

INCREASE /\ DECREASE: **0.623015873** 0.376984127 <==== (d)

PROTEOMICS teeth of saw PERCENT CODE...

INCREASE /\ DECREASE: **0.6111111111** 0.3888888889

PERIODS ANALYSER SUMMARY:

TOPS. PERIODS: 3 7 11 15 19 23 27 31 35 43 47 51 55 59 63 67 71 74 79 83 85 95 .../... <==== (e)

PERIODS: 4 4 4 4 4 4 4 8 4 4 4 4 4 3 5 4 2 10 5 3 4 4 5 4 3 <==== (f)

AVERAGE PERIODS: 4.285714286

GAUSS PERIODS: VALUE / NB TIMES <==== (g)

PERIOD..... 4 19

PERIOD..... 3 3

PERIOD..... 5 3

PERIOD..... 2 1

PERIOD..... 8 1

PERIOD..... 10 1

Suggested PERIOD: 4

The three figures below and remarks (a) to (d) will enable the reader to grasp the potential of this method whose two strong points are unification between the genomics and proteomics images and On the other hand, a characterization of the fractal texture of the sequence and the demonstration of PERIODS. It is these periods which constitute the elementary brick of our spectral analysis, the object of this article.

Comments:

a) As shown in the figure above, one observes that - for one of the 3 codon reading frames and for one of the reading directions of the sequence - there is a very strong correlation (> 90%) Between the master code image of the double-stranded DNA sequence and the master code of the virtual (or potential) amino acid translation of this same double strand. Here it may seem natural since it is a protein (DUF1220) but the same phenomena are universal throughout the genome, even for non-coding regions! This means that the master code produces a UNIFICATION between the 2 languages of the living being DNA and amino acids. In (15), we show that the third language, the RNA, plays the role of a kind of "neutral element", like the "zero" of mathematics. See the figure opposite (<https://www.omicsonline.org/articles-images/2153-0637-5-131-g002.html>) extracted from Figure 2 in (15).

b) c) It can be seen here that the extreme sites (lowest and highest in the figure) most often have local couplings on the scale of their address of triplets codons. For proteins, we have established that this corresponds to "active sites". For chromosomes, we have established that this corresponds to the points of fragility (breakpoints) of the chromosomes.

d) The "sawtooth" textures (see visual example in FIG. 22) are counted here, differentiating the increase and the decreasing slope. We observe that this ratio is very close to 1 / Phi (Phi = 1.618 the golden ratio). As shown in the image on the left, <https://www.omicsonline.org/articles-images/2153-0637-5-131-g003.html> extracted from Fig. 3 in (15) This ratio behaves as an attractor for genomic images of the master code of DNA.

e) f) g) These numerical values illustrate the periodic phenomena of fractal roughness of the textures of the genomics images of the master code. Here we see the sawtooth peaks (e), the corresponding periods (f), and the Gaussian distribution of these periods (g). The probable period is here = 4. Let 4 triplets codons, or ... $3 \times 4 = 12$ nucleotides ... **This value 12 is precisely the one that we also found in the analysis of the resonances and periods of this great region6 of 218 DUF1220 !**

DUF1220 protein DNA sequence

Master Code of DNA Periods

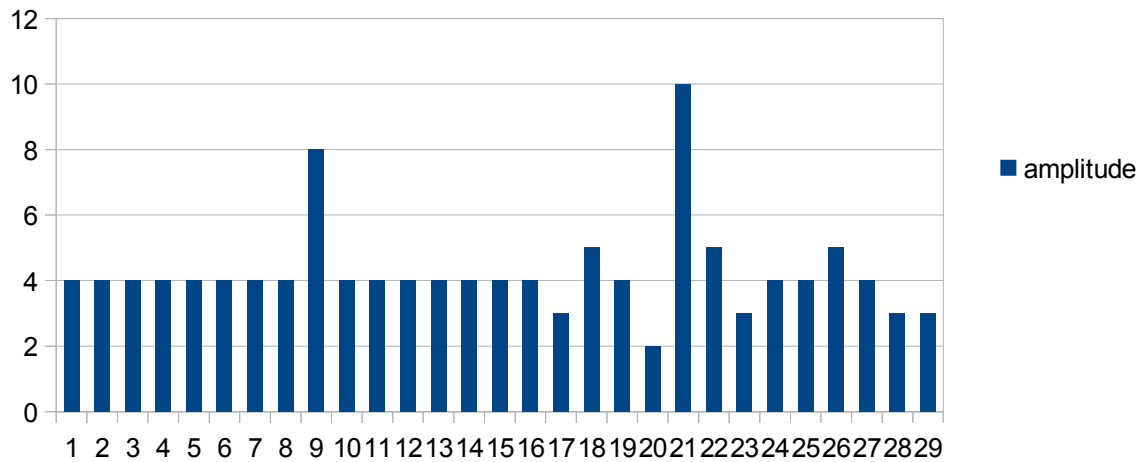


Figure 19 : Master Code waves amplitudes for the first DUF1220 protein from the long region6.

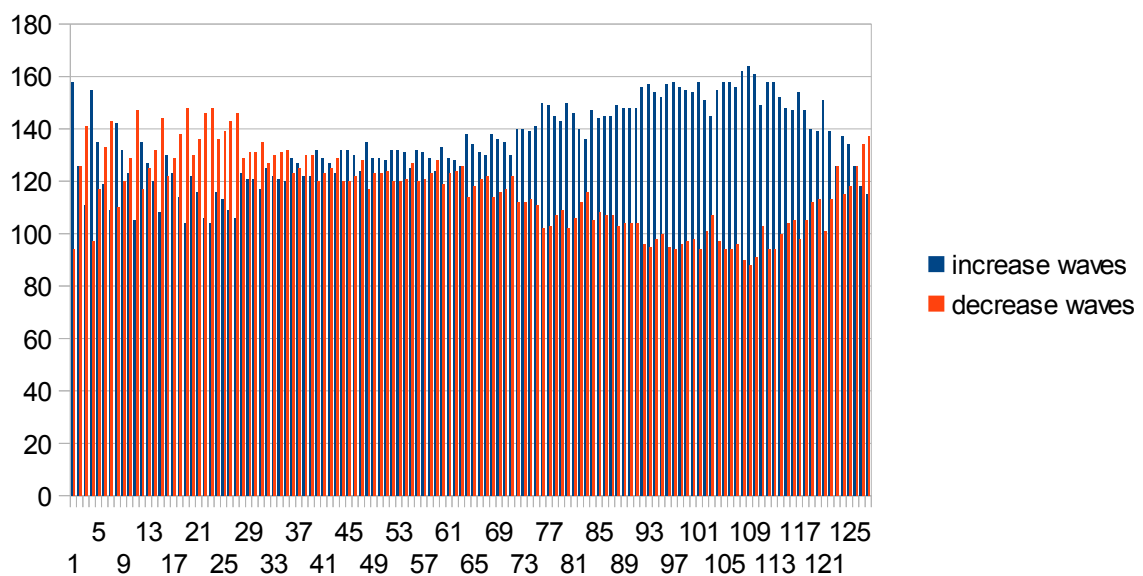


Figure 20 : Master Code waves fractal textures for the first DUF1220 protein from the long region6.

We then wanted to analyze in the same way the "gap" separating 2 consecutive proteins DUF1220.

For example, DUF1220 is the first protein of 218 DUF1220 and INTERDUF1220, the gap separating this first DUF1220 from the second DUF1220:

[DUF1220 at chr1:144423094-144423901 start](#)
[DUF1220 at chr1:144424700-144425551](#)

INTERDUF1220 in : [chr1 : 144423902-144424699](#)
 chr1:144,423,094-144,423,901 808 bp.

http://genome.ucsc.edu/cgi-bin/hgTracks?db=hg38&lastVirtModeType=default&lastVirtModeExtraState=&virtModeType=default&virtMode=0&nonVirtPosition=&position=chr1%3A144423094-144423901&hgside=573629553_vMKvaa3cdohKVHtDV1yCaoEhuia9
 >hg38_dna range=chr1:144423094-144423901 5'pad=0 3'pad=0 strand=+ repeatMasking=none

DUF1220
 chr1:144423094-144423901
 INTERDUF1220
 chr1 : 144423902-144424699
 Here their respective compositions in bases T C A G:
 DUF1220: 179 T, 292 A, 149 T, 188 A.
 INTERDUF1220: 179 T, 292 A, 149 T, 188 A.

A detailed analysis will then make us discover this strange fact: the gap separating the first 2 proteins DUF1220 of the sequence region6 of 218 DUF1220 is, itself, a new protein DUF1220! Or, more precisely, the exact sequence capable of coding for a protein DUF1220, because, in fact, just in front of the gene of a protein is most often found a so-called "promoter" sequence ...

The consequence is that a more exhaustive analysis of this region of 218 DUF1220 may expose - perhaps - a number even greater than 218 proteins DUF1220! At the start of the long region6, there are therefore 3 occurrences of the protein DUF1220 attached and consecutive. This long region6 would therefore include not 218, but at least 219 DUF1220 proteins. The entirety of this region must be studied in more detail6. It will also be necessary and above all to carry out this same type of analysis on individual genomes!

Incidentally, the ratios TA and CG at DUF1220 and INTERDUF1220 also show that:

Accumulation DUF1220 = TA = 471

Cumulative DUF1220 = CG = 337

That is, $337 \div 471 = 0.7154989384 = 2 - "e"$.

Where "e" is the Euler constant ([https://en.wikipedia.org/wiki/E_\(mathematical_constant\)](https://en.wikipedia.org/wiki/E_(mathematical_constant))) $e = 2.71828$.

Indeed, the error is very low: $0.7154989384 \div 0.71828 = 0.9961281651$

We then carried out the same analyzes on the following 2 gaps. It appears then that they are, on the one hand different from DUF1220 and, on the other hand different from each other.

INTER2DUF1220 second gap
[DUF1220 at chr1:144424700-144425551](#)
[DUF1220 at chr1:144426288-144427081](#)

144425552-144426287
 >hg38_dna range=chr1:144425552-144426287 5'pad=0 3'pad=0 strand=+ repeatMasking=none

strandSENSE2 (<== <==) regular reading frame SECOND GAP DUF1220

Link: 94.06

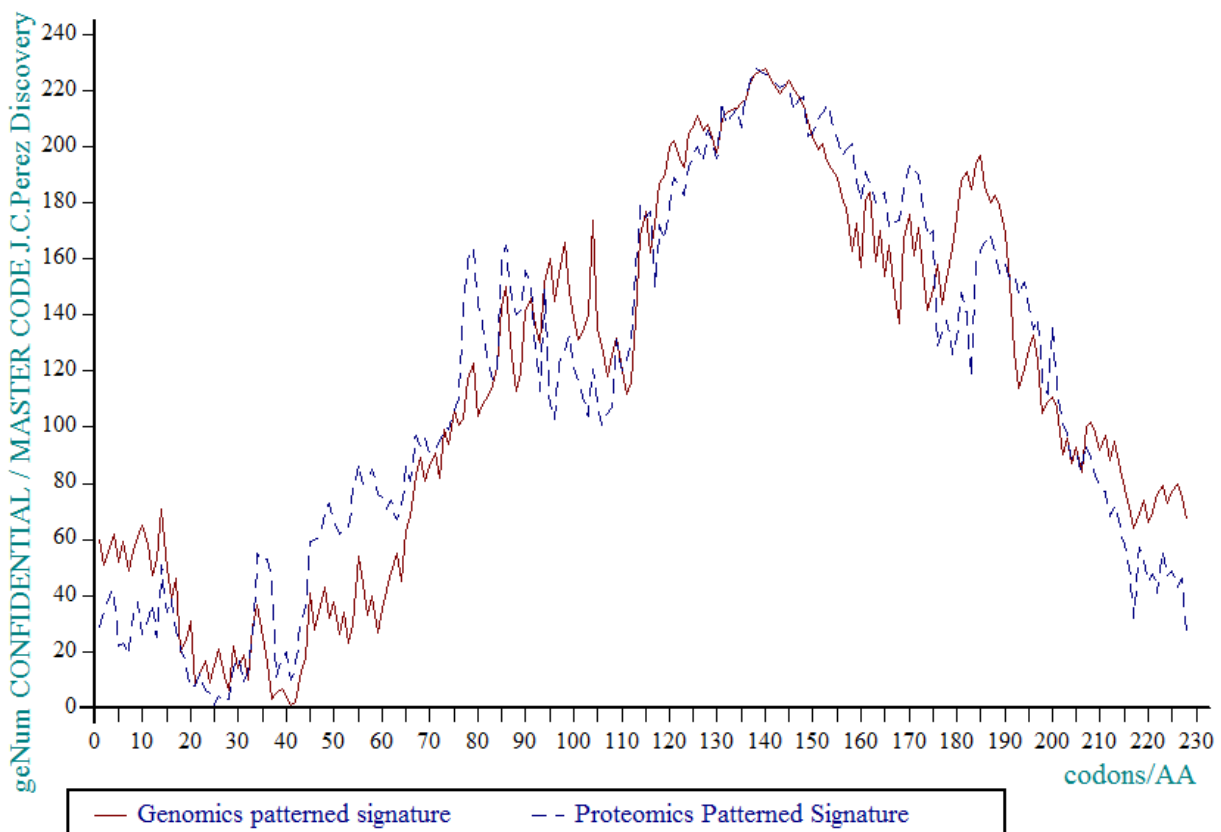


Figure 21: Master Code unifying Genomics and Proteomics patterns for the second GAP separating DUF1220 proteins from the long region6 of 218 DUF1220.

INTER3DUF1220

[DUF1220 at chr1:144426288-144427081](#)

[DUF1220 at chr1:144427831-144428634](#)

144427080-144427830

>hg38_dna range=chr1:144424701-144425552 5'pad=0 3'pad=0 strand=+ repeatMasking=none

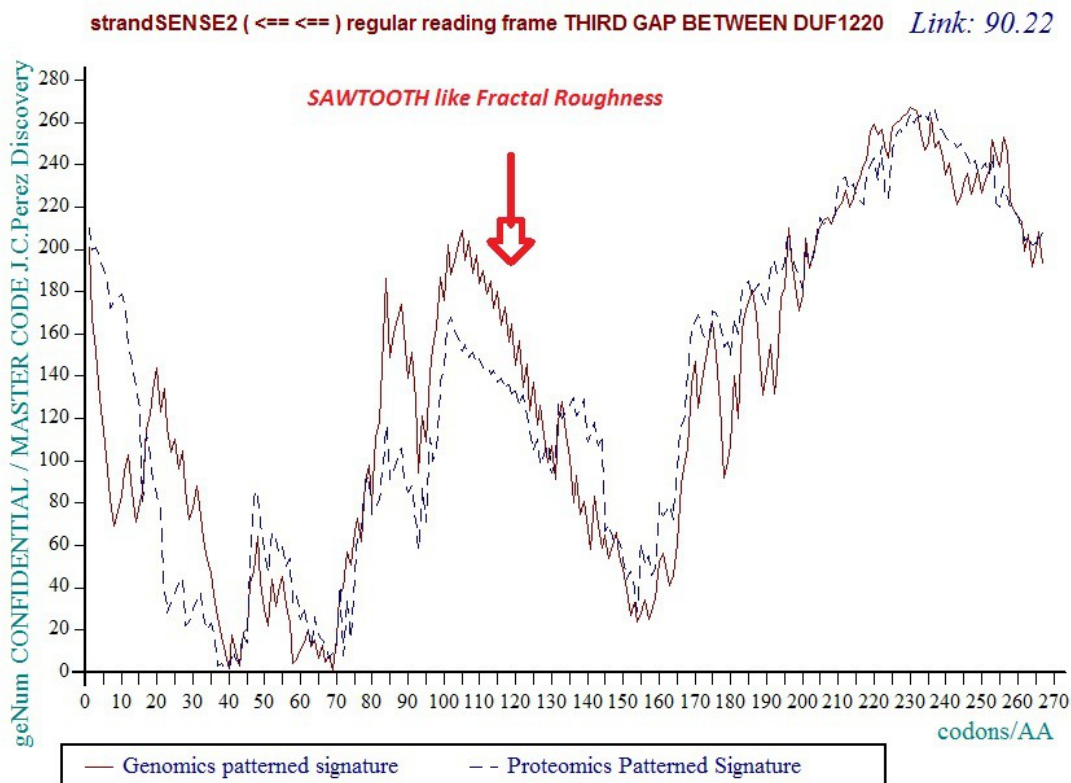


Figure 22: Master Code unifying Genomics and Proteomics patterns for the third GAP separating DUF1220 proteins from the long region6 of 218 DUF1220.

In this figure the reader observes the "saw teeth" typical of the phenomenon of fractal roughness, at the origin of the periods and resonances.

-4- Dynamic analysis of the long region of 218 DUF1220.

We will now consider a possible dynamic, perhaps "threshold effects" that could result from the number of successive DUF1220. For this, in the long region of 218 DUF1220, we have successively analyzed the periodic spectra:

Of the first 5 DUF1220,

Of the first 10 DUF1220,

Of the first 20 DUF1220,

-of the first 50 DUF1220,

Here is an overview of these results, the reader will find the complete study in complementary materials (Part IV).

Reminder of the sequence of 218 DUF1220:

chr1q

http://www.ensembl.org/Homo_sapiens/Location/Overview?r=1%3A144423094-149554657

Cas2 : Analyse des 10 premiers DUF1220 :

[DUF1220 at chr1:144423094-144423901 start](#)

[DUF1220 at chr1:144424700-144425551](#)

[DUF1220 at chr1:144426288-144427081](#)

[DUF1220 at chr1:144427831-144428634](#)

[DUF1220 at chr1:144429713-144433807](#)

[DUF1220 at chr1:144435163-144435809](#)

[DUF1220 at chr1:145291607-145336848](#)

[DUF1220 at chr1:145293214-145294055](#)

[DUF1220 at chr1:145294792-145295601](#)

[DUF1220 at chr1:145296351-145297173](#)

1: 144423094-145297173

http://www.ensembl.org/Homo_sapiens/Location/View?r=1%3A144423094-145297173

DUF1220by10

Chromosome 1: 144,423,094-145,297,173

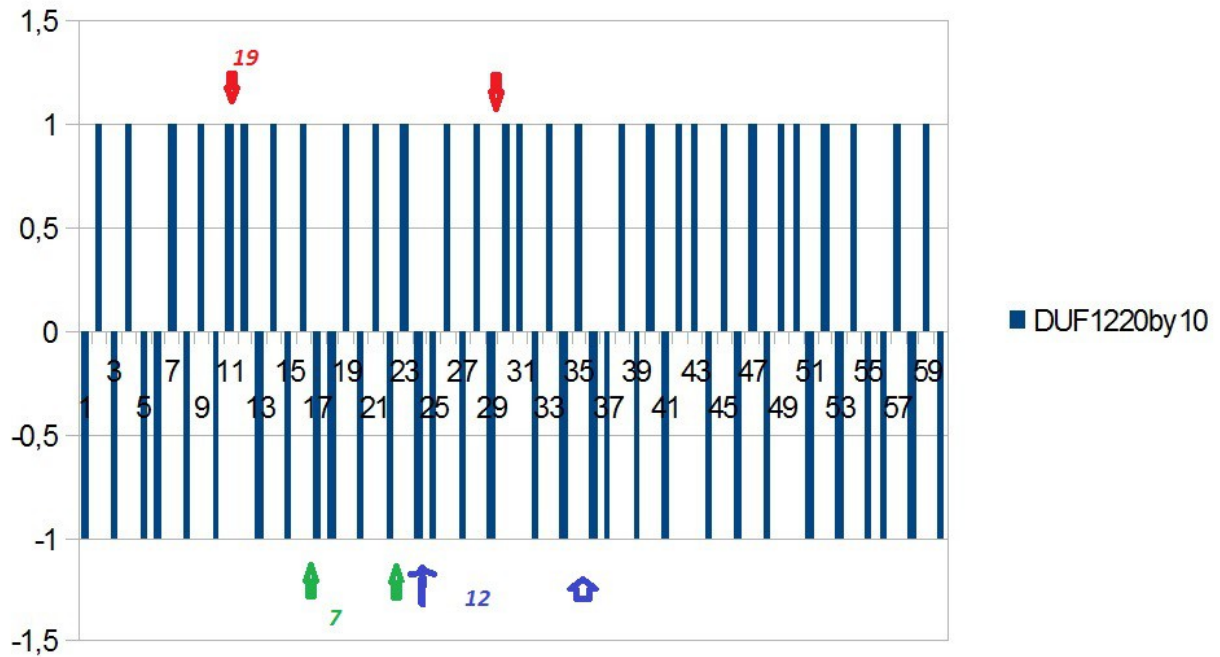


Figure 23 : « bar-codes » likes related to the 5 7 12 19 31 spectrum of the 10 first DUF1220 proteins within the long region6 of 218 DUF1220.

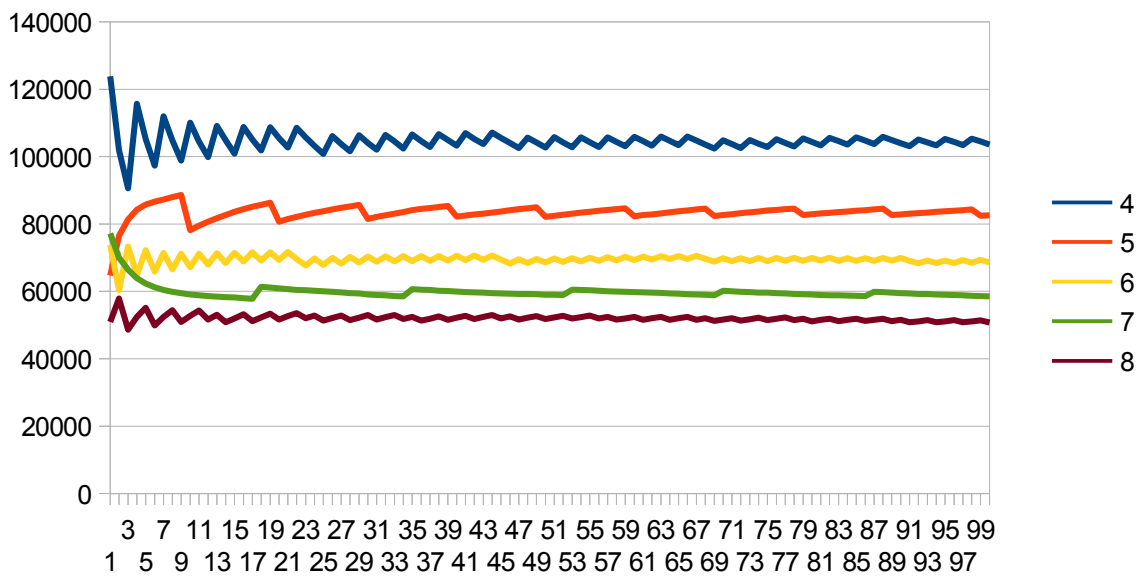


Figure 24 : Evidence of 5 7 resonances periods in the 5 7 12 19 31 spectrum of the 10 first DUF1220 proteins within the long region6 of 218 DUF1220.

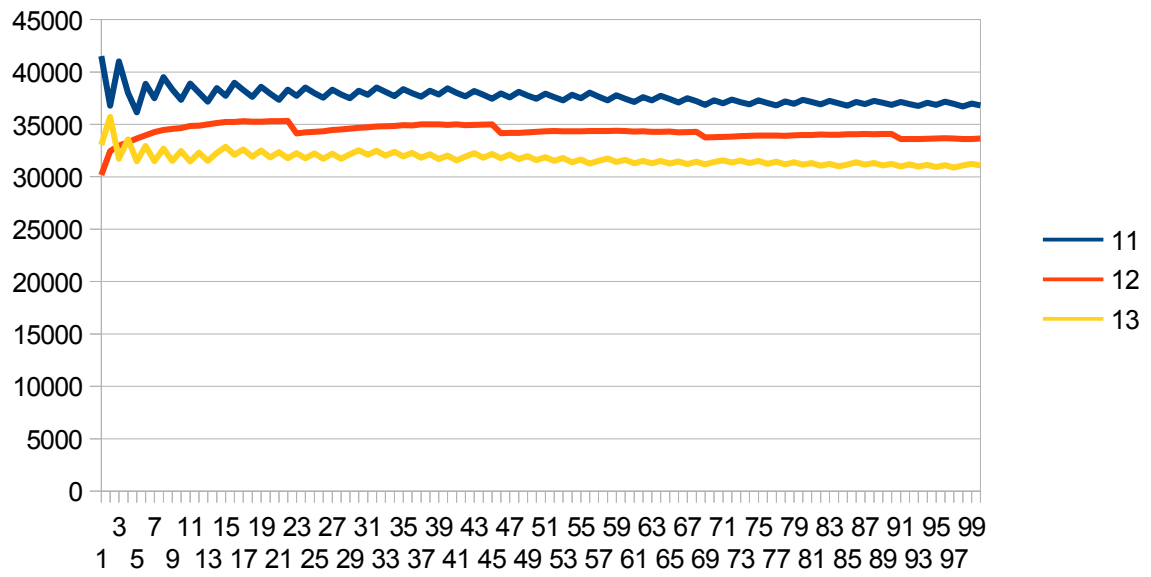


Figure 25: Evidence of 12 resonance period in the 5 7 12 19 31 spectrum of the 10 first DUF1220 proteins within the long region6 of 218 DUF1220.

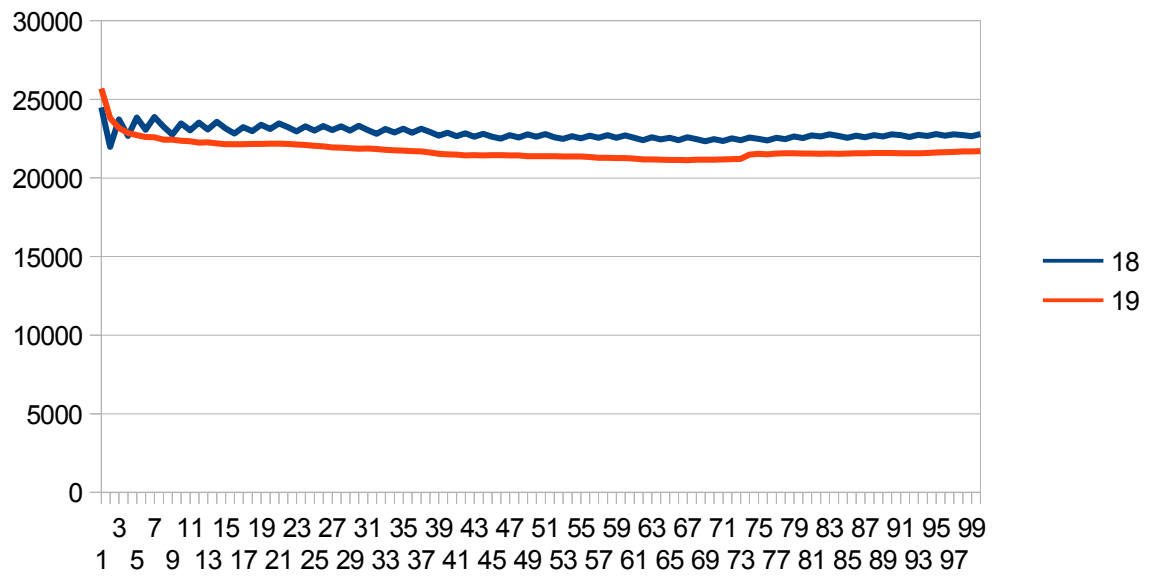


Figure 26: Evidence of 19 resonance period in the 5 7 12 19 31 spectrum of the 10 first DUF1220 proteins within the long region6 of 218 DUF1220.

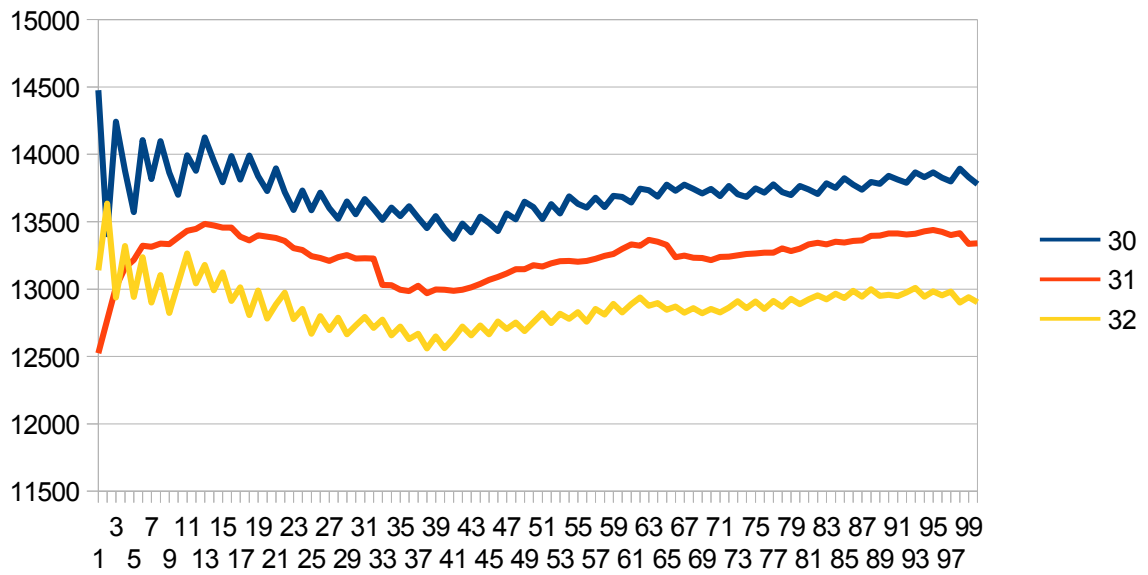


Figure 27 : Evidence of 31 resonance period in the 5 7 12 19 31 spectrum of the 10 first DUF1220 proteins within the long region6 of 218 DUF1220.

CONCLUSIONS :



Figure 28: Electrical Resonances (https://en.m.wikipedia.org/wiki/Electrical_resonance) and Oscilltors like « fork-tuning » vs Nikola Tesla...
 source <https://teslaresearch.jimdo.com/invention-of-radio/>

<http://images.google.fr/imgres?imgurl=https%3A%2F%2Fimage.jimcdn.com%2Fapp%2Fcms%2Fimage%2Ftransf%2Fdimension%3D670x10000%3Aformat%3Djpg%2Fpath%2Fs40c423127565d23a%2Fimage%2Fifcc75f8f6dddebc3%2Fversion%2F1401406283%2Fimage.jpg&imgrefurl=http%3A%2F%2Fteslaresearch.jimdo.com%2Finvention-of-radio%2F&h=410&w=670&tbnid=O94YNF-rjJHx0M%3A&vet=1&docid=pwag3J9p0SxInM&itg=1&ei=SluIWOGZI4eqU5KZm-gP&tbnm=isch&iact=rc&uact=3&dur=1756&page=0&start=0&ndsp=47&ved=0ahUKEwjh5vqX6tzRAhUH1ROKHZLMBv0QMwhAKCEwIQ&bih=882&biw=1821>

In this long contig of more than 5 million bases of the region 1q21.1, comprising 218 DUF1220, What does this potential of main resonances mean?

Main resonances periods:

5 7 12 19 31 50 81 DUF1220 resonances and periods

+ 0 1 1 2 3 5 8 Fibonacci

= 5 8 13 21 34 55 89 Fibonacci

5 7 12 19 31 50 81 DUF1220 resonances and periods

- 2 1 3 4 7 11 18 29 47 Lucas

= 3 6 9 15 24 39 63... = 3 x (1 2 3 5 8 13..) = 3 times Fibonacci

This means, according to our intuition, that this region of spectrum (5 7 12 19 31 50 81) represents the first part of a kind of potential "resonator".

Then, "interference" with an external spectrum of Fibonacci in addition (+ 0 1 1 2 3 5 8) or with a Lucas spectrum in subtraction (-2 1 3 4 7 11 18 29 47) will produce a "resonance" Of type Fibonacci (= 5 8 13 21 34 55 89) or else (3 x 1 2 3 5 8 13 ..) ...

Certainly, this second part of the resonator coming from an external source would remain to be determined ...

Thus, in a kind of "key-lock" system, this 1q21.1 region would then act as a kind of "receiver", the "lock"!

But a receiver of what type "transmitter", the "key"?

The profoundly bipolar character of this phenomenon remains indivisible.

Can one imagine how the perception of the image of a nautilus or the musical resonance of Bach or the subtle aesthetic of a mathematical equation could constitute the beginning of the process constituting this "key"?

Certainly the genome when studied as a mathematical object with the tools of mathematical topology can offer a medium of resonance via the subtle topologies of the ribbon of Moebius or the bottle of Klein as demonstrated by the studies of Diego Lucio Rapoport (18).

Indeed, as demonstrated by V.olkmar Weiss (19), the proportions of Phi and the number of gold in the electro-encephalogram (EEG) are discovered on the scale of experimental measurement.

During our Artificial Intelligence research at IBM, based on our model "Fractal Chaos" (20, 21, 22), we had demonstrated the numerical hyper-sensitivity of an artificial neural network positioned in the vicinity of Phi and Subjected to perturbations of the Fibonacci number type (23, 24).

The fractal architecture (25, 26), the mathematics (27) and Phi the golden number are omnipresent in Nature, in humans, in DNA, and even on the atomic scale (28) ... It is a serious mistake to fall into these simplistic theses of an omnipresence of the golden number in the adn as well as an omnipresence of waves in the adn ...

The reality that we have discovered for more than 25 years of biomathematic exploration of dna is much more subtle:

Phi the Golden ratio (29, 30, 31, 32, 33) and the numbers of Fibonacci never appear in the same form according to the scale and level of genetic information studied:

In 1991 (11) we discover proportions of fibonacci structuring the proportions of bases TCAG inside the sequences of the genes ... but not in the junk dna non coding.

In 1997 (14, 15) we discovered that a numerical law of projection of the atomic masses of the base and amine acids, a law based on pi and phi, unifies the 3 languages of the genetics that are DNA, RNA, amino acids.

In 2009 (34, 35) we demonstrate that the fractal texture of the above unified genomic and proteomic images is manifested in the form of periodic waves.

Finally, from 2010 (36, 37) we publish various articles demonstrating that the golden ratio controls and finely adjusts the proportions of triplets codons to the scale of the entire human genome.

This multi-level diversity of Phi is as astonishing as it is radiant ...

For example, in front of the tetrad formed by the four discoveries presented in this article on the one hand, in (38) on the other hand, and finally in (39) we can only remain remarkable:

In this paper, we show that there is a sort of HGO (human genome optimum) unifying the entire human genome. This HGO will then allow the discovery of a universal law guiding all the LOH deletions implied in the cancers.

In "Humans and Primates Chromosomes4 Fractal CODES: periodic stationary waveforms characterizing and differentiating Neanderthal and Sapiens whole chromosomes DNA sequences" (39) we show a sort of hierarchy classifying the 24 human chromosomes. One of them, the chromosome4 would be a kind of leader, "lighthouse" ... and this lighthouse vibrates to the proportions of Phi, the numbers of lucas and fibonacci.

Finally, in this article we discover more strange still: Phi and the numbers of fibonacci and lucas no longer appear explicitly. They hide behind a subtle interference, hiding behind a spectrum of numerical periods in the appearance of any numbers.

Our intuition is that there exists a link, "dialogues" between these three heterogeneous but subtle mechanisms ...

We suggest in this scenario Key lock or transmitter receiver, a probable link between the chromosome4 of which (39) will show that it behaves like a kind of resonance emitter of fibonacci and lucas ...

And this famous region 1p21.1 with more than 200 DUF1220 would then behave like a kind of "resonance box", the resonator.

Finally, in "Global and long range fractal differences between sapiens and neanderthal genomes" (40), we will demonstrate how the law discovered here seems to apply sometimes even to the scale of an entire chromosome such as chromosomes 10 and 11, The image of chromosome 10 of Sapiens BUILD34 below, controlled by a spectrum 12 19 31 ...

HomoSapiens (Build34) whole chromosome10

Evidence of a spectral resonances set = periods 12, 19, 31

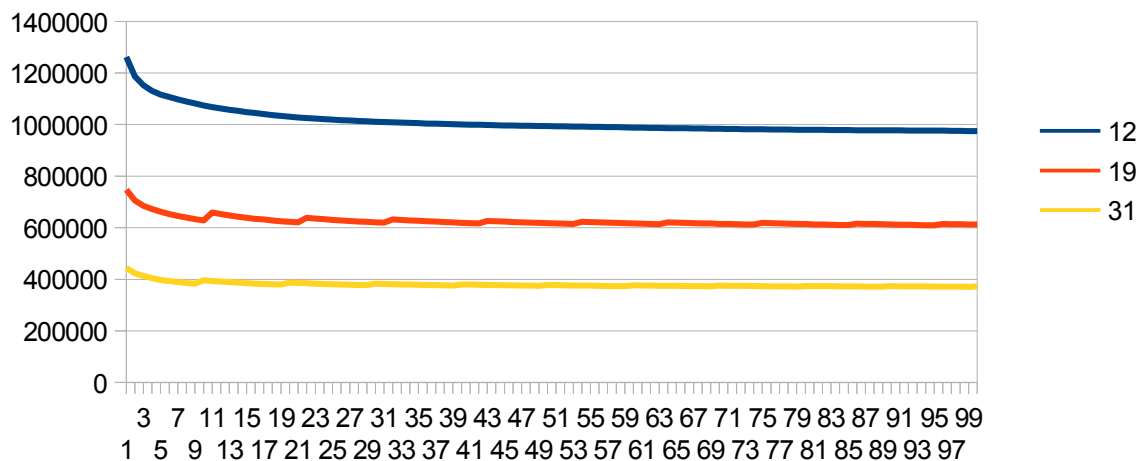


Figure 29: A 5 7 12 19 31 spectrum unifying the whole SAPIENS (BUILD34) chromosome10.

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