International Journal of Multidisciplinary and Current Research ISSN: 2321-3124
Research Article Available at: http://ijmcr.com

Harmonic Principles in Endocrinology

Fabio Borziani

Laboratorio Privato di Biochimica F. Pacini, Reggio Calabria, Italy, phone number: +39.388.4944048.

Accepted 05 July 2016, Available online 11 July 2016, **Vol.4 (July/Aug 2016 issue)**

Abstract

Since ancient times models have studied to describe the "Harmony of the World". In the most diverse historical periods, research into the regularity between parameters of natural phenomena has undoubtedly been a key feature of doing science. The astronomer Johannes Kepler, one of the first scientists of the modern era, sought harmony, understood as a musical correlation expressed by mathematical regularities, in the planets of the solar system. He calculated the "notes" of each planet and organized them into harmonic configurations tuned to the musical system of just intonation. By referring to the numerical properties at the heart of just intonation, a musical tuning in which the frequencies of notes are related by ratios of small whole numbers, this study explores the harmonic relationships in terms of the numerical ratios between the molecular masses of pairs of hormones secreted by the same endocrine glands. By also making use of specific correspondences, indicated by the writer Rodney Collin, between endocrine glands of the human body and planets of the solar system (thymus/Venus, adrenal cortex/Earth, adrenal medulla/Mars, endocrine pancreas/main-belt asteroids, neurohypophysis/Jupiter, adenohypophysis/Saturn and testicle/Uranus), harmonic relationships are explored in numerical ratios between the molecular masses of pairs of hormones secreted by different glands and of pairs of hormones and hormone receptors. The analysis of these relationships shows their statistical significance in relation to just intonation. This suggests an opportunity for further research of harmonic principles in other areas of science.

Keywords: *Harmony, hormone, Kepler, endocrinology.*

Introduction

The German music theorist Rudolf Haase (1920-2013) wrote: «Our conclusion is not only that Kepler's harmonic world image is correct in every detail, but also that further pursuit and elaboration of his methods and perspectives permit a truly all-encompassing worldview to emerge, whose existence can no longer be doubted. It concerns principally a different perspective on the world and the use of different categories for its interpretation» [1].

For the whole of his life, German astronomer Johannes Kepler (1571-1630) was captivated by an idea that dominated his entire work as a researcher, that harmony was an expression of a perfect hidden order in the universe created by God. In 1619, he published "Harmonices Mundi", an extensive study of the harmonic relationships referred to the planets of the solar system [2]. Kepler was the first to approach the subject with scientific responsibility and accuracy in an attempt, successful according to several commentators, to understand and find proof of the legendary "Music of the Spheres".

The English writer Rodney Collin (1909-1956) published in 1953 "The Theory of Celestial Influence", an impressive work that begins with the words: «In every age men have tried to assemble all the knowledge and experience of their day into a single whole which would explain their relation to the universe and their possibilities in it» [3]. In his "model of the universe", Collin proposed a particular relationship between the endocrine glands of the human body and the planets of the solar system observed in relative progressive distances from their respective centres, the heart in the human body and the Sun in the solar system.

The relations proposed in this research between thymus/Venus, adrenal cortex/Earth, adrenal medulla/Mars, endocrine pancreas/main-belt asteroids, neurohypophysis/Jupiter, adenohypophysis/Saturn and testicle/Uranus originate from a possible correspondence between the glands and planets theorized by Collin.

The same methodology as employed by Kepler in his search for harmonic relationships is used in this study with respect to the molecular masses of hormones and their receptors.

Materials and Methods

The molecular mass of a chemical compound consists of the sum of the atomic masses of all the atoms that compose it and is numerically expressed in atomic mass units (u).

Table 1 Data for the various hormones and hormone receptors considered

Molecule	Molecular mass (u)	Associated planet	Perihelion (AU)	Molecular mass / Perihelion (p)	Aphelion (AU)	Molecular mass / Aphelion (a)
Thymulin	858.8533	Venus	0.7184	1195.5085	0.7282	1179.4195
DHEA	288.4244	Earth	0.9833	293.3229	1.0167	283.6868
Aldosterone	360.4440	Earth	0.9833	366.5656	1.0167	354.5235
Cortisol	362.4599	Earth	0.9833	368.6158	1.0167	356.5062
MCR	107146.3201	Earth	0.9833	108966.0532	1.0167	105386.3678
GCR	86215.21583	Earth	0.9833	87679.4629	1.0167	84799.0713
Norepinephrine	169.1778	Mars	1.3813	122.4772	1.6660	101.5473
Epinephrine	183.2044	Mars	1.3813	132.6319	1.6660	109.9666
Glucagon	3482.7473	Asteroids	-	-	-	-
Insulin	5807.5702	Asteroids	-	-	-	-
Amylin	3903.2766	Asteroids	-	-	-	-
PP	4181.7109	Asteroids	-	-	-	-
SST-28	1637.8782	Asteroids	-	-	-	-
SST-14	3148.5558	Asteroids	-	-	-	-
Ghrelin	3244.6649	Asteroids	-	-	-	-
Oxytocin	1007.1873	Jupiter	4.9516	203.4064	5.4552	184.6288
Vasopressin	1084.2316	Jupiter	4.9516	218.9659	5.4552	198.7519
ACTH	4541.0658	Saturn	9.0206	503.4106	10.0535	451.6900
β-Lipotropin	9805.8171	Saturn	9.0206	1087.0471	10.0535	975.3635
GH	22124.7557	Saturn	9.0206	2452.6922	10.0535	2200.7018
Prolactin	22891.878	Saturn	9.0206	2537.7334	10.0535	2277.0058
Testosterone	288.4244	Uranus	18.2861	15.7729	20.0965	14.3520
AR	100786.0208	Uranus	18.2861	5511.6193	20.0965	5015.1032

DHEA, dehydroepiandrosterone; MCR, mineralocorticoid receptor; GCR, glucocorticoid receptor; PP, pancreatic polipeptide; SST-28, somatostatin of 28 amino acids; SST-14, somatostatin of 14 amino acids; ACTH, corticotropin; GH, growth hormone; AR, androgen receptor

Table 2 Data for the various musical intervals considered

Interval	Example of notes	Fraction	Quotient	Lower limit	Upper limit
Unison	C-C	1/2	1.0000	0.9934	1.0000
Chromatic semitone	C-C#	24/25	0.9600	0.9534	0.9666
Diatonic semitone (I)	E-F	15/16	0.9375	0.9309	0.9441
Diatonic semitone (II)	C-D*b*	25/27	0.9259	0.9193	0.9325
Minor second	D-E	9/10	0.9000	0.8934	0.9066
Major second	C-D	8/9	0.8889	0.8823	0.8955
Minor third	C-E*b*	5/6	0.8333	0.8267	0.8399
Major third	C-E	4/5	0.8000	0.7934	0.8066
Fourth	C-F	3/4	0.7500	0.7434	0.7566
Augmented fourth	C-F#	32/45	0.7111	0.7045	0.7177
Fifth	C-G	2/3	0.6667	0.6601	0.6733
Augmented fifth	C-G#	16/25	0.6400	0.6334	0.6466
Minor sixth	C-A*b*	5/8	0.6250	0.6184	0.6316
Major sixth	C-A	3/5	0.6000	0.5934	0.6066
Minor seventh	C-B*b*	5/9	0.5556	0.5490	0.5622
Major seventh	C-B	8/15	0.5333	0.5267	0.5399
Octave	C-C'	1/2	0.5000	0.5000	0.5066

The molecular mass values of hormones and hormone receptors considered in this study were obtained from the online databases of PubChem [4] and UniProt [5].

Kepler was the first scientist to realize that the planets of the solar system follow elliptical orbits around the Sun. The elliptical orbit of each planet can be described by its perihelion, the minimum distance from the Sun, and its aphelion, the maximum distance from the Sun, and the two values can be expressed in astronomical units (AU).

One AU represents the semi-major axis of the elliptical orbit of the Earth around the Sun, i.e. the approximate mean distance between the two bodies. The values of perihelia and aphelia of the planets considered in this study were obtained from the online database of Wolfram [6].

For each hormone, Table 1 shows the molecular mass, the perihelion and aphelion of the planet considered in relation to the gland which synthesizes the hormone and the "transformed values" (p) and (a), obtained from the ratio of the molecular mass to the perihelion and aphelion respectively.

The use of measures related to planetary perihelia and aphelia originates from the studies of Kepler, who, for his harmonic research, considered the angular velocities of the planets at their perihelia and aphelia. These angular velocities, which represent the maximum and minimum speeds of the planets, were considered in relation to each other in the search for possible mathematical-musical correlations. Musical intervals resulting from the ratios between the values of the maximum and minimum angular velocities of each planet and from the relationship between the maximum and minimum angular velocities of pairs of planets, in the opinion of Kepler were a method of generation of the musical scaffolding at the base of the different musical notes "played" by each planet and organized in two harmonic configurations representing a major scale and a minor scale, both tuned according to the musical system of just intonation.

Just intonation was conceived by the Greek mathematician Archytas in the fourth century BC and found practical application with the advent of tonal music and the subsequent theory formulated by Gioseffo Zarlino in 1558, which relates to the harmonic series as a musical tuning in which the frequencies of notes are related by ratios of small whole numbers.

Table 2 shows the musical intervals of just intonation in terms of the fractions that determine them and the corresponding quotients with lower and upper limits obtained by subtracting and adding 0.0066.

The decision to apply a tolerance value of 0.0066 to the theoretical ratio of each musical interval comes from a need to assess whether the ratios between the molecular masses of the hormones and hormone receptors fall within the "harmony range" of each musical interval, or otherwise prove to be outside this range and therefore inharmonious.

By summing together the "harmony ranges" defined for each of the musical intervals in Table 2, the value of 0.2075 is obtained. This means that by dividing any two of these numbers chosen at random, in the event that the result is between 0.5 and 1, there is a 41.5% probability that the ratio corresponds to one of the musical intervals defined by just intonation.

In order for the ratio of a pair of values to always be within the range from 0.5 to 1, it is necessary to multiply or divide the second term of the division by powers of two. Considering these values just as sound frequencies, the mathematical operation allows you to raise or lower the frequency of the second sound until it is within the same octave as the first. The same mathematical process was also used by Kepler in his harmonic research regarding the angular velocities of the planets in considering that multiplying or dividing a sound frequency by a power of 2 the corresponding note does not change, but simply moves it to a different octave. Thus, in "research in harmonic principles", what is interesting is the ratio between pairs of values in the moment in which they fall within the same octave.

With these considerations, the aim of this study is to assess whether the molecular masses of hormones and hormone receptors relate to the harmonic relationships of just intonation or not. The hypothesis tested is that the "harmonicity percentage" of the sample is equal to that of the theory (41.5%). If the *p*-value is less than 0.001, the null hypothesis can be rejected, indicating that the "harmonicity percentage" of the sample is significantly different from that of the theory.

Results and Discussion

Expressed below are the ratios between pairs of hormones and pairs of hormones and receptors, in order to highlight specific harmonic relationships, or rather the corresponding musical intervals, and the difference between the values obtained and theoretical ratios of the corresponding musical intervals (Δ).

First series: harmonic relationships between hormones secreted by the same glands

The endocrine glands considered that secrete more than one hormone are: adrenal cortex, adrenal medulla, endocrine pancreas, neurohypophysis and adenohypophysis.

Regarding the adrenal cortex, the three most important hormones are dehydroepiandrosterone (DHEA), secreted by the zona reticularis, aldosterone, produced by the zona glomerulosa, and cortisol, synthesized in the zona fasciculata. Three harmonic relationships between these three hormones are observed:

DHEA / Aldosterone = 288.4244 / 360.4440 = 0.8002
Major third = 0.8000 Δ = 0.0002

DHEA / Cortisol = 288.4244 / 362.4599 = 0.7957
Major third = 0.8000 Δ = 0.0043

Aldosterone / Cortisol = 360.4440 / 362.4599 = 0.9944
Unison = 1.0000 Δ = 0.0056

The two principal hormones secreted by the adrenal medulla are norepinephrine and epinephrine:

Norepinephrine / Epinephrine = 169.1778 / 183.2044 = 0.9234
Diatonic semitone (II) = 0.9259 Δ = 0.0025

The principal hormones produced by the endocrine pancreas are: glucagon, secreted by alpha cells, insulin

and amylin, secreted by beta cells, pancreatic polypeptide (PP), secreted by PP cells, somatostatin of 28 amino acids (SST-28) and somatostatin of 14 amino acids (SST-14), secreted by delta cells, and ghrelin, secreted by epsilon cells. Below are the ratios between the molecular masses of each of the pairs formed by these hormones.

Glucagon / Insulin = 3482.7473 / 5807.5702 = 0.5997
Major sixth = 0.6000 Δ = 0.0003

Glucagon / Amylin = 3482.7473 / 3903.2766 = 0.8923
Major second = 0.8889 Δ = 0.0034

Glucagon / PP = 3482.7473 / 4181.7109 = 0.8329
Minor third = 0.8333 Δ = 0.0004

Glucagon / SST-28 = 3482.7473 / (3148.5558 x 2^1) = 0.5531
Minor seventh = 0.5556 Δ = 0.0025

Glucagon / SST-14 = 3482.7473 / (1637.8782 x 2^2) = 0.5316
Major seventh = 0.5333 Δ = 0.0017

Glucagon / Ghrelin = 3482.7473 / (3244.6649 x 2^1) = 0.5367
Major seventh = 0.5333 Δ = 0.0034

Insulin / Amylin = 5807.5702 / (3903.2766 x 2^1) = 0.7439
Fourth = 0.7500 Δ = 0.0061

Insulin / PP = 5807.5702 / (4181.7109 x 2^1) = 0.6944
No harmonic relationship

Insulin / SST-28 = 5807.5702 / (3148.5558 x 2^1) = 0.9223
Diatonic semitone (II) = 0.9259 Δ = 0.0036

Insulin / SST-14 = 5807.5702 / (1637.8782 x 2^2) = 0.8864
Major second = 0.8889 Δ = 0.0025

Insulin / Ghrelin = 5807.5702 / (3244.6649 x 2^1) = 0.8949
Minor second = 0.9000 Δ = 0.0051

Amylin / PP = 3903.2766 / 4181.7109 = 0.9334
Diatonic semitone (I) = 0.9375 Δ = 0.0041

Amylin / SST-28 = 3903.2766 / (3148.5558 x 2^1) = 0.6199
Minor sixth = 0.6250 Δ = 0.0051

Amylin / SST-14 = 3903.2766 / (1637.8782 x 2^2) = 0.5958
Major sixth = 0.6000 Δ = 0.0042

Amylin / Ghrelin = 3903.2766 / (3244.6649 x 2^1) = 0.6015
Major sixth = 0.6000 Δ = 0.0015

PP / SST-28 = 4181.7109 / (3148.5558 x 2^1) = 0.6641
Fifth = 0.6667 Δ = 0.0026

PP / SST-14 = 4181.7109 / (1637.8782 x 2^2) = 0.6383
Augmented fifth = 0.6400 Δ = 0.0017

PP / Ghrelin = 4181.7109 / (3244.6649 x 2^1) = 0.6444
Augmented fifth = 0.6400 Δ = 0.0044

SST-28 / SST-14 = 3148.5558 / (1637.8782 x 2^1) = 0.9612
Chromatic semitone = 0.9600 Δ = 0.0012

SST-28 / Ghrelin = 3148.5558 / 3244.6649 = 0.9704
No harmonic relationship

SST-14 / Ghrelin = 1637.8782 / 3244.6649 = 0.5048
Octave = 0.5000 Δ = 0.0048

The two principal hormones secreted by the neurohypophysis are oxytocin and vasopressin:

Oxytocin / Vasopressin = 1007.1873 / 1084.2316 = 0.9289
Diatonic semitone (II) = 0.9259 Δ = 0.0030

Unlike the hormones considered thus far, important hormones secreted by the adenohypophysis, thyrotropin (TSH), luteinizing hormone (LH) and follicle-stimulating hormone (FSH), have structures with various glycosylated residues. The presence of glycosylated variants determines the impossibility of calculating univocal molecular masses for these hormones. Therefore, regarding the hormones produced by the adenohypophysis, it is possible to consider within this study the two principal peptides derived from proopiomelanocortin, corticotropin (ACTH) and β-lipotropin, together with the growth hormone (GH) and prolactin:

ACTH / β-Lipotropin = 4541.0658 / (9805.8171 / 2^1) = 0.9262
Diatonic semitone (II) = 0.9259 Δ = 0.0003

ACTH / GH = 4541.0658 / (22124.7557 / 2^2) = 0.8210
No harmonic relationship

ACTH / Prolactin = 4541.0658 / (22891.8780 / 2^2) = 0.7935
Major third = 0.8000 Δ = 0.0065

β-Lipotropin / GH = 9805.8171 / (22124.7557 / 2^1) = 0.8864
Major second = 0.8889 Δ = 0.0025

β-Lipotropin / Prolactin = 9805.8171 / (22891.8780 / 2^1) = 0.8567
No harmonic relationship

GH / Prolactin = 22124.7557 / 22891.8780 = 0.9665
Chromatic semitone = 0.9600 Δ = 0.0065

Of the 32 ratios examined, 28 correspond to the musical intervals considered, resulting in a "harmonicity percentage" of 87.5% compared to the theoretical 41.5%. The standard error is 0.087, that of the t-test is 5.28, with a *p*-value <0.001, therefore the null hypothesis is rejected in favour of the alternative hypothesis.

Second series: harmonic relationships between hormones secreted by different glands

For his research in harmonic principles about the planets of the solar system, Kepler related the angular velocities of adjacent planets at their respective points of minimum distance from the Sun, perihelion, and maximum distance from the Sun, aphelion. According to the definition of the German astronomer, a so-called divergent relationship compares the maximum velocity of the inner planet with the minimum velocity of the outer one, or the velocity of the first planet at its perihelion and that of the second at its aphelion, while a convergent relationship compares the minimum velocity of the inner planet with the maximum velocity of the outer one, or the velocity of the first planet at its aphelion and that of the second at its perihelion.

Using a similar methodology, the values of the molecular masses of hormones can be "transformed" by dividing them by the perihelia and aphelia of the planets considered in relation to the glands that secrete these hormones, as shown in Table 2. By way of example, between the two hormones of the adrenal medulla, norepinephrine and epinephrine, associated with Mars, and the two hormones of the neurohypophysis, oxytocin and vasopressin, associated with Jupiter, pairs of divergent and convergent relationships can be calculated, similarly to how Kepler himself did.

The value of epinephrine (p), obtained by dividing the molecular mass of epinephrine (183.2044) by the perihelion of Mars (1.3813) is related to the value of vasopressin (a), obtained by dividing the molecular mass of vasopressin (1084.2316) by the aphelion of Jupiter (5.4552) in order to express the divergent relationship between the two hormones:

Epinephrine (p) / Vasopressin (a) = (183.2044 / 1.3813) / (1084.2316 / 5.4552) = 0.6673
Fifth = 0.6667 Δ = 0.0006

To obtain the convergent relationship between the same two hormones, the value of epinephrine (a), obtained by dividing the molecular mass of epinephrine (183.2044) by the aphelion of Mars (1.6660), is related to the value of vasopressin (p), obtained by dividing the molecular mass of vasopressin (1084.2316) by the perihelion of Jupiter (4.9516):

Epinephrine (a) / Vasopressin (p) = (183.2044 / 1.6660) / (1084.2316 / 4.9516) = 0.5022
Octave = 0.5000 Δ = 0.0022

The same mathematical operations give the divergent and convergent relationships of norepinephrine and oxytocin:

Norepinephrine (p) / Oxytocin (a) = (169.1778 / 1.3813) / (1007.1873 / 5.4552) = 0.6634
Fifth = 0.6667 Δ = 0.0033

Norepinephrine (a) / Oxytocin (p) = (169.1778 / 1.6660) / (1007.1873 / 4.9516 / 2^1) = 0.9985
Unison = 1.000 Δ = 0.0015

It is interesting to note that in the divergent relationships between epinephrine/norepinephrine and vasopressin/oxytocin the intervals expressed are two fifths, while in convergent relationships, again between epinephrine/norepinephrine and vasopressin/oxytocin, the intervals that occur are an octave and a unison.

Similarly, the harmonic relationships between the hormones secreted by the glands associated with the planets from Venus to Saturn can be studied: thymulin (thymus/Venus), DHEA, cortisol and aldosterone (adrenal cortex/Earth), epinephrine (adrenal medulla/Mars), vasopressin (neurohypophysis/Jupiter), GH and prolactin (adenohypophysis/Saturn).

By following the methodology described above and by taking epinephrine (p) as a reference with which to calculate the harmonic relationships with the other hormones, the first group of relationships to be taken into consideration concerns the thymulin (p), DHEA (a), aldosterone (a), cortisol (a), epinephrine (p), vasopressin (a), GH (p) and prolactin (p):

Epinephrine (p) / Thymulin (p) = 132.6319 / (1195.5085 / 2^3) = 0.8875
Major second = 0.8889 Δ = 0.0014

Epinephrine (p) / DHEA (a) = 132.6319 / (283.6868 / 2^1) = 0.9351
Diatonic semitone (I) = 0.9375 Δ = 0.0024

Epinephrine (p) / Aldosterone (a) = 132.6319 / (354.5235 / 2^1) = 0.7482
Fourth = 0.7500 Δ = 0.0018

Epinephrine (p) / Cortisol (a) = 132.6319 / (356.5062 / 2^1) = 0.7441
Fourth = 0.7500 Δ = 0.0059

Epinephrine (p) / Vasopressin (a) = 132.6319 / 198.7519 = 0.6673
Fifth = 0.6667 Δ = 0.0006

Epinephrine (p) / GH (p) = 132.6319 / (2452.6922 / 2^4) = 0.8652
No harmonic relationship

Epinephrine (p) / Prolactin (p) = 132.6319 / (2537.7334 / 2^4) = 0.8362
Minor third = 0.8333 Δ = 0.0029

The second group of relationships to be calculated in reference to epinephrine (a) concerns thymulin (a), DHEA

(p), aldosterone (p), cortisol (p), epinephrine (a), vasopressin (p), GH (a) and prolactin (a):

Epinephrine (a) / Thymulin (a) = 109.9666 / (1179.4195 / 2^3) = 0.7459
Fourth = 0.7500 Δ = 0.0041

Epinephrine (a) / DHEA (p) = 109.9666 / (293.3229 / 2^1) = 0.7498
Fourth = 0.7500 Δ = 0.0002

Epinephrine (a) / Aldosterone (p) = 109.9666 / (366.5656 / 2^1) = 0.6000
Major sixth = 0.6000 Δ = 0.0000

Epinephrine (a) / Cortisol (p) = 109.9666 / (368.6158 / 2^1) = 0.5966
Major sixth = 0.6000 Δ = 0.0034

Epinephrine (a) / Vasopressin (p) = 109.9666 / 218.9659 = 0.5022
Octave = 0.5000 Δ = 0.0022

Epinephrine (a) / GH (a) = 109.9666 / (2200.7018 / 2^4) = 0.7995
Major third = 0.8000 Δ = 0.0005

Epinephrine (a) / Prolactin (a) = 109.9666 / (2277.0058 / 2^4) = 0.7727
No harmonic relationship

Similarly, the harmonic relationships between the hormones secreted by the glands associated with the planets from Mars to Uranus can be studied: norepinephrine (adrenal medulla/Mars), oxytocin (neurohypophysis/Jupiter), ACTH and β-Lipotropin (adenohypophysis/Saturn), testosterone (testicle/Uranus).

The first group of relationships to be calculated in reference to norepinephrine (p) concerns norepinephrine (p), oxytocin (a), ACTH (p), β-lipotropin (p) and testosterone (a):

Norepinephrine (p) / Oxytocin (a) = 122.4772 / 184.6288 = 0.6634
Fifth = 0.6667 Δ = 0.0033

Norepinephrine (p) / ACTH (p) = 122.4772 / (503.4106 / 2^2) = 0.9732
No harmonic relationship

Norepinephrine (p) / β-Lipotropin (p) = 122.4772 / (1087.0471 / 2^3) = 0.9014
Minor second = 0.9000 Δ = 0.0014

Norepinephrine (p) / Testosterone (a) = 122.4772 / (14.3520 x 2^4) = 0.5334
Major seventh = 0.5333 Δ = 0.0001

Finally, the second group of relationships to be calculated in reference to norepinephrine (a) concerns norepinephrine (a), oxytocin (p), ACTH (a), β-lipotropin (a) and testosterone (p):

Norepinephrine (a) / Oxytocin (p) = 101.5473 / (203.4064 / 2^1) = 0.9985
Unison = 1.0000 Δ = 0.0015

Norepinephrine (a) / ACTH (a) = 101.5473 / (451.6900 / 2^2) = 0.8993
Minor second = 0.9000 Δ = 0.0007

Norepinephrine (a) / β-Lipotropin (a) = 101.5473 / (975.3635 / 2^3) = 0.8329
Minor third = 0.8333 Δ = 0.0004

Norepinephrine (a) / Testosterone (p) = 101.5473 / (15.7729 x 2^3) = 0.8048
Major third = 0.8000 Δ = 0.0048

Of the 22 ratios examined, 19 correspond to the musical intervals considered, resulting in a "harmonicity percentage" of 86.4% compared to the theoretical 41.5%. The standard error is 0.105, that of the t-test is 4.27, with a *p*-value <0.001, therefore the null hypothesis is rejected in favour of the alternative hypothesis.

Third series: harmonic relationships between hormones and hormone receptors

Due to the presence of glycosylated variants in the structure of most of the hormone receptors, as already considered in relation to the adenohypophysis hormones, TSH, LH and FSH, it is possible to know the molecular masses only of steroid hormone receptors, which consist of long chains of amino acids without glycosylated residues.

The harmonic relationships between the mineralocorticoid receptor (MCR) and aldosterone, the glucocorticoid receptor (GCR) and cortisol and the androgen receptor (AR) and testosterone can be considered. As previously, double relationships are calculated between hormone and receptor, in reference to the values of the perihelion and aphelion of the planet associated to the gland that secretes the hormone, the Earth for aldosterone and cortisol and Uranus for testosterone.

MCR (a) / Aldosterone (p) = 105386.3678 / (366.5656 x 2^9) = 0.5615
Minor seventh = 0.5556 Δ = 0.0059

MCR (p) / Aldosterone (a) = 108966.0532 / (354.5235 x 2^9) = 0.6003
Major sixth = 0.6000 Δ = 0.0003

GCR (a) / Cortisol (p) = 84799.0713 / (368.6158 x 2^8) = 0.8986

Minor second = 0.9000 Δ = 0.0014

GCR (p) / Cortisol (a) = 87679.4629 / (356.5062 x 2^8) = 0.9607
Chromatic semitone = 0.9600 Δ = 0.0007

AR (a) / Testosterone (p) = 5015.1032 / (15.7729 x 2^9) = 0.6210
Minor sixth = 0.6250 Δ = 0.0040

AR (p) / Testosterone (a) = 5511.6193 / (14.3520 x 2^9) = 0.7501
Fourth = 0.7500 Δ = 0.0001

Of the 6 ratios examined, all 6 correspond to the musical intervals considered, resulting in a "harmonicity percentage" of 100% compared to the theoretical 41.5%. The standard error is 0.201, that of the t-test is 2.91, with a *p*-value <0.001, therefore the null hypothesis is rejected in favour of the alternative hypothesis.

Conclusions

Using Collin's idea of correspondences between the endocrine glands in the human body and the planets of the solar system, and using the same methodology described by Kepler in his "Harmonices Mundi", a number of statistically significant and harmonic relationships between the molecular masses of hormones and hormone receptors has been identified.

It would be interesting to apply the same research methodology used by Kepler to other fields of scientific knowledge, as advocated by Haase: «And today, since we possess a new science of "research in harmonic principles", in which these traditions are united with modern scientific knowledge, the harmonic components of the world become more visible than ever. We might even suggest that the purely quantitative, scientific observation of nature is perhaps a side effect of *this* worldview.

In any event, this is how Kepler thought when he subordinated his scientific discoveries to harmonic laws. Since those times, the quantitative view of nature has predominated, and the thought of a harmony of the world appears more distant than ever, however urgently we need it. But this harmony can return to us, too; for it requires only another perspective on the world, the harmonic one, attainable at any time and perhaps more easily today than yesterday. Johannes Kepler sought and found the world harmony, and thereby became a pioneer of natural science. We modern people should turn to his *World Harmony* and learn to interpret the great achievements of natural science in its light, and thereby find our way back to the Harmony of the World.»

Acknowledgments

My thanks to Johannes Kepler for his genius and tenacity, to Rodney Collin for his hard work and generosity, to Chris Squire for his mood and most of all to all the Pythagoreans for their vision.

Conflicts of Interest

The author declares no conflict of interest.

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