

A POETIC ANTECEDENT OF CHRONOBIOLOGY

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SUMMARY

It is a well known fact that the poem "El Sueño" (The Sleep/the Dream), written by Sor Juana Inés de la Cruz, may be considered a scientific medical work according to criteria prevailing at the time in which it was written, in 1685, and first published, in 1692. This has been stated by Alfonso Méndez Plancarte in 1951, Emilio Carilla in 1972, Octavio Paz in 1982, Elías Trabulse in 1984 and by Héctor Pérez-Rincón in 1989.

Basically, four scientific criteria can be distinguished:

1. The poem gives us a fine clinic description of sleep, by which we are able to distinguish its various stages, that actually are known to have a proper electroencephalographic expression. A very careful comparison between the poem and current physiology of sleep was made in order to ascertain the aforementioned views. Up till now, we can consider this poem as the first clinical description of sleep stages carried out in the Western hemisphere.

2. It has been found that the onirical part of the poem describes the adventure of human intellect, which contemplates itself in an effort to acquire knowledge, in spite of the strong tomist influences found in the poem. This part is particularly interesting as recent publications tell us that memory consolidation processes which promote an adequate structure of knowledge precisely occur during this sleeping stage. The onirical content of the poem had been interpreted before in many other ways.

3. Chronobiological aspects are clearly represented and the mere clinical description of physiological sleep gives us a pleasant idea of chronobiology. We can also find in this poem specific segments that talk about work-rest alternation, and other rhythmic aspects of human body.

4. All those who have catalogued this poem as scientific highlight the continuous references concerning Galenic human physiology, which in those times and in most parts of the world were highly acknowledged. Particularly interesting for us is the poem's description of brain physiology, where soul faculties are named and described.

Our purpose is to show this particular facet of a woman considered to have the most privileged and advanced intelligence in Seventeenth Century Mexico.

Key words: Chronobiology, sleep, Sor Juana Inés de la Cruz, "El Sueño" poem.

RESUMEN

Es sabido que el poema "El Sueño" de Sor Juana Inés de la Cruz puede considerarse también como un trabajo médico-científico según los criterios de la época en la cual fue escrito en 1685 y publicado por primera vez en 1692, opinión que han compartido varias personalidades como Alfonso Méndez Plancarte en 1951, Octavio Paz en 1982, Elías Trabulse en 1984, y Héctor Pérez-Rincón en 1989.

Se pueden distinguir básicamente cuatro tipos de criterios científicos:

1. El poema ofrece una fina descripción clínica del sueño (dormir), en la que es posible distinguir las etapas de éste, fases que en la actualidad tienen además una connotación electroencefalográfica propia. Se hizo una comparación cuidadosa entre el poema y una fisiología actual del sueño para poder afirmar lo antes dicho. Hasta hoy consideramos que ésta es la primera descripción clínica de las etapas del sueño que se hizo en Occidente.

2. Se ha encontrado que en la parte onírica del poema se habla de una aventura del intelecto humano, que se contempla a sí mismo en un esfuerzo por adquirir conocimiento, independientemente de las fuertes influencias tomistas que se pueden encontrar en él. Esta parte es especialmente interesante puesto que diversas publicaciones de años recientes nos refieren que precisamente durante esta fase del sueño se consolidan los procesos de memorización que llevarán a una adecuada estructuración del conocimiento. La parte onírica ya se había interpretado antes de otras múltiples maneras.

3. Son muy claros los aspectos cronobiológicos representados particularmente en el poema, pues la sola descripción clínica del sueño fisiológico nos ofrece una grata idea de la cronobiología. Dentro del poema hay partes específicas en que se habla de la alternancia trabajo-reposo y en general de actividades rítmicas del cuerpo humano.

4. De forma específica, los estudiosos que han catalogado este poema como científico aluden a las continuas y nutridas referencias a la fisiología humana galénica, que por entonces prevalecía en gran parte del planeta. Particular interés nos merece su descripción de la fisiología cerebral, donde se nombran y describen las facultades del alma.

Es el propósito de los autores dar a conocer la especial faceta de esta mujer, que consideramos la inteligencia más avanzada y privilegiada del México del siglo XVII.

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In the Prologue to the 1951 edition of Alfonso Méndez Plancarte comprising the writings of Sor Juana Inés de la Cruz, it is stated: "[...]her topics so tedious on physiologies[...]" We could not expect less from this eminent researcher of our literature than to highlight the medical-scientific aspect of this poem written in 1685 and published for the first time in Madrid in 1692 (8, 15).

Octavio Paz in his book *Sor Juana, or The Traps of Faith* (*Sor Juana Inés de la Cruz o las Trampas de la Fe* [8]) published in 1982, makes an exquisite analysis of "El Sueño" (sleep/dream) by Sor Juana. This study, in addition to describing the literary beauty of the poem, which addresses aspects related to esoterism, philosophy, metaphysics, and theology, informs us of the relationship between the poem and the medical science prevailing at the time, a link which is our main interest. In fact, in the poem we can find concepts of anatomy and physiology: brain, cardio-pulmonar and gastric. All these medical ideas were operating in the Western world at that time.

Elías Trabulse included this complex poem among the Mexican scientific writings of the Seventeenth Century, and together with Paz, he emphasized its medical and physiological aspects (18).

In a memorable paper, our distinguished friend Héctor Pérez-Rincón mentions the existence of a humoral theory of sleep as a physiological activity, which is included in this poem (9).

Therefore, it is not strange to find chronobiological concepts within this literary work of art. The poet defines with all clarity the concepts related to chronobiology, and as these are contained in a work considered scientific, we may by all means affirm that Sor Juana was the first person to refer, in 1692, to these biological characteristics of man, even though the specific structures comprising biological clocks in mammals were not identified until 1972.

We have to bear in mind that Jean Jacques D'Ortus de Mairan, who is considered the first scientist to mention the subject of chronobiology, made his observations in the Seventeenth Century. In 1729, he made a report to L'Académie Royale des Sciences, in Paris, dealing with the behavior of some flowers which remained closed at night and opened during the day, and relating them to a biological rhythm (7, 10).

Our aim in this paper is to show this foremost finding in chronobiology. Although Sor Juana is widely known as a writer, excepting the studies of Méndez Plancarte, Paz, Trabulse and Pérez-Rincón, the scientific

relevance of her poem had not been previously mentioned. Furthermore, no one has related it yet to chronobiology.

Sor Juana most probably used the following works as references: Aristotle, on his *Brief Treatises on Natural History*, dedicates a chapter to the subjects of sleep and dreaming (1). It is not far-fetched to think that Sor Juana may have consulted Plato's *Republic*, in which a small commentary is devoted to these aspects (11). Hippocrates, on one of his treatises dealing with diet, mentions some sleep topics (6). We can find traces of Galen in some of the poem's descriptions of anatomy and physiology: cerebral, cardio-pulmonar, and gastric (5). She might have also read the beautiful scientific poem *De Rerum Natura*, written by Titus Lucretius Carus, in which the subject of sleep is treated from a scientific point of view (17). It is possible that Sor Juana picked up the concept of the atom and its properties from Aristotle and Lucretius, while they in turn took it from Democritus. Regarding the oniric contents, it is quite likely that the poet consulted *Scipio's Dream* by Cicero, a work where dreams are classified by their contents and characteristics (3). It is less likely that she may have read *The Interpretation of Dreams* by Artemidorus Daldianus, as its contents were unorthodox and the editions very rare, either Greek or in other languages (2). Moreover, a clear influence of Fray Luis de León and St. Thomas Aquinas is evident in Sor Juana's "Sleep/Dream" poem (8, 16), although it owes its inspiration to the writings of Athanasius Kircher, Sor Juana's coetaneous, particularly from such works as *Iter exstaticum* (8), in which an astronomical journey is narrated, and *Oedipus Aegyptiacus*, which contains abundant hermetical concepts. In medical treatises printed in Mexico during the Sixteenth and early Seventeenth centuries, no chronobiological aspects mentioned by Sor Juana are present (13, 14).

The whole poem is structured as a detailed clinical description of sleep, as it is understood now (4). She initiates her narration fully awake, vigilant, and finishes it by saying "the world illuminated and I myself awake", verse 975. Between two periods of complete wakefulness with focalized attention, it is possible to distinguish a period of disperse attention, somnolence, hypnagogic hallucinations, slow wave sleep, deep REM sleep -with its complex oniric content-, and finally wakefulness, taking the same path but on the opposite direction (4). It seems that regarding the oniric aspect of sleep, Sor Juana precludes what we presently know for certain: that some memory aspects and knowledge in general are structured during sleep (19).

Forthwith we will address the more relevant chronobiological aspects of the poem, with the ideas Sor Juana envisioned as the mechanisms ruling the

world, or “Nature”, as she proposes in a daring and modern fashion. It is necessary to make clear that within the poem no direct mention to God or Christ is made, and only on few occasions the Bible is mentioned. This boldness did not have an impact on the fastidious minds of the inquisitors. It may be possible that the scandal originated by the “Athenagoric Letter” obstaculized an analysis of the “Sleep-Dream” poem, a fact that may have been negative for the poet. Soon after the first edition of this work in 1692, Sor Juana died, the victim of an epidemic, inside her convent.

The specific chronobiological fragment of the poem is as follows:

- 151* Nearly past, the darkest hour of the night,
shadow marking midpoint to the dawn,
relieved of his diurnal tasks, man welcomes
relieved, fatigued, not only
by the cumbrous toll of
physical exertion, but also by the
pleasant toil of delectation (for any
action, overly repeated, may tire the
senses, even pleasure;
160 persistently, Nature lifts and lowers
one, and then the other, of her pans,
distributing her several chores-now
restful leisure, now gainful activity-
on the imbalanced balance with which she
rules the world's complex machinery);
being, then, the body
engaged by deep and welcome sleep, and,
if not ended what
might be thought the normal occupation
170 of the senses (work, after all, but well-beloved
work
-if labor may be savored), at least
this while suspended and surrendered to the
image
of the antipode to life, as sopor
(oblivion its weapon) furtively attacks
and indolently quells
the humble shepherd and the royal prince,

* (151. El conticinio casi ya pasando / iba, y la sombra dimidiaba, cuando / de las diurnas tareas fatigados / -y no sólo oprimidos / del afán poderoso / del corporal trabajo, más cansados / del deleite también (que también cansa / objeto continuado a los sentidos / aun siendo deleitoso: / que la Naturaleza siempre alterna / ya una, ya otra balanza, / distribuyendo varios ejercicios, / ya al ocio, ya al trabajo destinados, / en el fiel infiel con que gobierna / la aparatosa máquina del mundo)-; / así, pues, de profundo / sueño dulce los miembros ocupados, / quedaron los sentidos / del que ejercicio tienen ordinario / -trabajo, en fin pero trabajo amado, / si hay amable trabajo- / si privados no, al menos suspendidos, / y cediendo al retrato del contrario / de la vida, que -lentamente armado- / cobarde embiste y vence perezoso / con armas soñolientas, / desde el cayado humilde al cetro altivo, / sin que haya distintivo / que el sayal de la púrpura discierna:... (14).

marking no difference between
the silk of kings and peasant's woolen stuff...

In other words, in the absolute calmness of the night sleep falls. Once the darkest hour of the night is past, which is the most silent and calm part of the night, the body takes its deserved rest... “Nature that always alternates/ this balance, this other,/ distributing various exercises,/ aim to idleness or to labor...” This is the most formal reference to the rhythms that Nature uses to set the human body to work, alternating periods of labor and fatigue with those of calmness, rest and sleep. In this way, Nature drives the ostentatious machinery of the world. In this poem the loss of conscience is addressed, when the slow wave sleep is mentioned. At this point, the description of the senses ensues: the organs the body uses to be aware of the state of wakefulness, remain tired: “if not deprived, at least suspended,/ and yielding to the portrait of the opposite/ of life...” One may think here about the loss of muscular tone in the body, which is a characteristic of slow wave sleep (4).

If the above verses present us a detailed analysis not only of the clinical initiation of sleep but also of chronobiological propositions, the verses that will be analyzed forthwith state even more clearly the aspect of biological rhythms and Galenic physiology with which Sor Juana embroiders this beautiful scientific poem:

- [192* The soul, then, freed from
governing the senses -by which endeavor
and activity it
deems the day is well or poorly spent-
now, it seems, does but
administer -remote, if not completely
disconnected from the temporary
death of languid limbs and inert bones-
200 the gift of vegetative warmth, the mortal
shell in restful lassitude, cadaver,
yet with a soul imbued,
dead in life, but living still in death,
and, of life's continuation giving
silent indication,
the vital mainspring of the human clock:
its movement marked not by hands but

* [192. El alma, pues, suspensa / del exterior gobierno -en que ocupada / en material empleo, / o bien o mal da el día por gastado, / solamente dispensa / remota, si del todo separada / no a los de muerte temporal opresos / lánguidos miembros, sosegados huesos, / los gajes del calor vegetativo, / el cuerpo siendo, en sosegada calma, / un cadáver con alma, / muerto a la vida y a la muerte vivo, / de lo segundo dando tardas señas / el del reloj humano / vital volante que, si no con mano, / con arterial concierto, unas pequeñas / muestras, pulsando, manifiesta lento / de su bien regulado movimiento... (14)]

harmony of vein and artery, the
slow, pulsing, regulation of the heart.

The “soul”, inside the physiological sleep but prior to any oniric activity, and after having classified the day as well or badly spent, exempts the “fees of vegetative warmth”, the “languid members”, “temporarily oppressed with death”. We are faced with an alive dead body or a living body apparently dead, which corresponds to the slow wave sleep, comprising absolute lack of wakefulness, total muscular atony, manifested by languid members.

The poem makes a clear reference to the faculties of the soul when it states that the soul exempts the fees of vegetative warmth, which is a concept that along with the rest of the poem must be interpreted as having a special significance in relation to medical and theological treatises.

Very wisely the poem reasserts the conviction that the human body is ruled by well-regulated rhythms. Here becomes evident the firmness and clarity with which Sor Juana declares her view of the rhythmic activity the human body is endowed with, by means of a poem that traditionally has been classified as difficult to understand. We do not know of the existence of a previous scientific work containing a clear mention to the alternation that Nature offers regarding human activities, the human clock, the rhythms contained within the physiologic machine, the whole with its well-regulated movement. It is true that Sor Juana mentions the heart as the pacemaker, but she, in previous paragraphs, also affirms unquestionably the existence of a certain activity encompassing the whole body where the rhythm is kept by a clock. Therefore, the precise references to a rhythmic activity of the human body are expressed in verses 151 to 179. Later on, she will talk about a human clock, the heart, mentioning its rhythms and the regulation of functions; this is found in verses 192 to 209.

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