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Discovering Thoughts, Inventing Future

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The Desire to Remain Childless and its Role in Female Partner Selection Criteria: An Evolutionary Psychology based Perspective

By Ana Vitória Moreira de Marchi Apolaro & Mauro Lantzman
Pontifical Catholic University of São Paulo

Abstract- The present article aims to investigate if there are differences – and which – between partner selection criteria of females in long term relationships that desire and that do not desire children with their current male partners. According to Evolutionary Psychology, these criteria are directly related to the type of parental investment practiced by the partner. The method consisted of virtual data collection of 288 answers to the research questionnaire aimed at cisgender, heterosexual and nulliparous women currently in a relationship, which evaluated the presence or absence of certain traits in their current male partners. Results showed significative differences between partner selection criteria of females that desired and that did not desire children in 14 male traits and no significative differences in the other 13 male traits presented. Traits containing significative differences were, whereas also culturally valued, mostly indicative of parental investment and genetic quality.

Keywords: evolutionary psychology; partner selection; women; parental investment.

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Ana Vitória Moreira de Marchi Apolaro [α] & Mauro Lantzman [σ]

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Keywords: evolutionary psychology; partner selection; women; parental investment.

I. Introduction

The present article aimed to investigate if there were differences – and which – between partner selection criteria of females in long term relationships that desired and that did not desire children with their current male partners. Data consisted of 288 answers to the research questionnaire aimed at cisgender, heterosexual and nulliparous women currently in a relationship, which evaluated the presence or absence of 23 certain traits in their current male partners. From them on, the aim was to statically evaluate the existence of significative differences between percentage frequency of answers regarding both groups of women and to assess whether findings could be in agreement with the female partner selection model proposed by evolutionary psychology, which is based on male direct or indirect parental investment.

II. Partner Selection Criteria in Heterosexual Males and Females: an Evolutionary Psychology based Perspective

According to the theory of evolution, behaviors, the mind and culture itself emerged through the union of genetics and the evolutionary environment of the species (epigenetics). Therefore, trying to break the human individual into biological and non-biological (natural and cultural) would mean perpetuating an ancient dualism (BARKOW ET AL, 1992), when actually both instances constantly act conjointly and indivisibly. To Evolutionary Psychology, the existence of a bigger brain in the *Homo* genus (DE TONI ET AL, 2004) accounted for a range of new cultural developments even before the emergence of the *Homo sapiens* (CARVALHO, 1989). Therefore, the process of humanization was deeply characterized by cultural specialization (BUSSAB & RIBEIRO, 1998) consisting of a process in which culture created a human being that was capable of creating culture. The initially developed cultural context subsequently promoted the natural selection of new cerebral specialization, which would, by itself, produce more culture (CARVALHO, 1989). In this sense, what occurred during the process of hominization consisted of a natural aptitude for culture and a cultural aptitude for developing human nature (BUSSAB & RIBEIRO, 1998). Cultural evolution is not to be considered separately from natural selection, but rather its ultimate consequence. Culture has been present since the beginning of human evolution and has led humans towards becoming the species we currently are, even before the emergence of the *Homo sapiens*, having produced the brain that currently produces it (CARVALHO, 1989).

That being the case, it would be erroneous to consider that, once biological evolution produced a being that is physically capable of producing culture, he would break away from nature and start existing independently from it (CARVALHO, 1989). The human being is not currently free from its nature and immersed in culture, (BUSSAB & RIBEIRO, 1998), as to

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Evolutionary Psychology, nature and culture are intimately and indissociably connected: the human being is, in perspective, biologically cultural. In this sense, Evolutionary Psychology suggests the existence of generationally selected and transmitted psychological mechanisms, which came to be as fruit of the interaction between natural selection and cultural evolution in the ancestral evolutionary environment. These mechanisms have established behavioral patterns (ADES, 2009) and are directly influenced by current cultural factors. The aim of evolutionary theories is to understand in which ways does this influence occur (VIEIRA & PRADO, 2004).

When it comes to psychological mechanisms related to sexual and parental behavior, TRIVERS (1972) developed the Parental Investment Theory and defined it as any investment made by the parents of a descendent in the direction of increasing his chance of survival and future reproduction, leading to greater reproductive success of the species. (VIEIRA & PRADO, 2003). Evolution has led to both men and women being required to practice parental investment (TOKUMARU & BERGAMIN, 2005). Female parental investment has always been direct; however, male parental investment could be direct or indirect (HEWLETT, 1992; LORDELO ET AL, 2006).Fathers in the evolutionary environment aimed to seek resources that would allow care, feeding, support and protection of mothers (indirect investment) and of descendants (direct investment), along with the transmission of culture in the form of instructions and guidance (BUSS & SCHMITT, 1993; BOSSARDI & VIEIRA, 2010). Parental Investment Theory is considered to be the main influence of sexual selection (BORRIONE & LORDELO, 2005), which is, of female and male partner selection criteria. This states direct relationship between the type and degree of parental investment practiced by each and the specificities of their partner selection criteria.

When it comes to female partner selection criteria for long term relationships, BUSS (1999) states that once ancestral women practiced intense parental investment, there used to be a great cost for not choosing a partner wisely. Therefore, through evolutionarily selected psychological mechanisms, women have proceeded to select their partners based on indicators of genetic quality and quality of male parental investment (BUSS & SCHMITT, 1993). Among these indicators are the preference for men of good economic resources, good financial prospects, social status, ambition, stability, athletic figure, good health, interest and willingness to invest in children, and also who are older, loving and dependable (BUSS, 1999). The specificities of these indicators may vary depending on the culture of each society, however, in all of them what is sought by the female is still an indicator of indirect or direct male parental investment.

While male parental investment could be direct and indirect, female investment was always direct and involved mostly being fertile, having good health and caring for descendants. BUSS (1999) states that for a man to be reproductively successful, there was the need for them to be in relationships with fertile and caring women, who would provide general care to descendants. Female parental investment consists of gestation, lactation, protection and care for children. Therefore, through evolutionarily selected psychological mechanisms, men have proceeded to prefer female traits directly related to their ability to bear healthy children. In other words, men proceeded to seek for indicators of fertility, reproductive value and health.

In broader research, BUSS (1989) aimed to investigate if the same partner selection criteria would appear in different cultural contexts. A total of 33 countries in six continents and five islands were visited, and 37 cultural samples were extracted. As a result, BUSS (1989) denoted that in 36 out of 37 samples, women have valued the potential for economic gain, good financial prospect and ambition in men more than men have valued these traits in women. At the same time, women have valued traits of physical attraction and good appearance in men less than men have valued these traits in women. Women preferred men averagely 3.42 years older than them and men preferred women who were averagely 2.66 years younger. In no sample have men preferred women who were older than them.

BECH-SORENSEN & POLLET (2016) concluded that differences between male and female partner selection criteria for long term relationships have remained stable through the last decades. In this sense, women more than men tend to prefer partners who are older and to value financial gain. Men more than women tend to prioritize physical attraction. WANG ET AL (2018) have statistically demonstrated that women are around a thousand times more sensible to financial gain criteria in a potential partner than men. They also found that men tend to be successful in compensating lack of physical attraction with high level of material resources.

FALES ET AL (2016) determined that women tend to prefer stable financial gain, good current wage, equal or superior level of resources and a successful career more than men tend to prefer those in women. Men tend to prefer good appearance and attractive figure more than women tend to prefer these in men. Lastly, SOUZA ET AL (2016) found that men generally preferred younger female partners while women preferred older male partners. Women tend to value good capacity of financial gain, good prospect of future gains, social status and ambition more than men value these in women. On the other hand, men tend to value physical criteria related to fertility and youth such as silky and lustrous hair, white teeth, symmetrical face and low waist-to-hip ratio in women more than women in men.

Both men and women were evidenced to equally value mutual attraction, love, kindness and intelligence.

III. Method

Participants were chosen based on four previously stated criteria: cisgender, heterosexual and nulliparous women of any age, who were in a long-term relationship with a male partner. These women could desire or not desire to have children, now or in the future, with their current partners. Two large populations were therefore compared: 1) Cisgender, heterosexual and nulliparous women in a relationship who desired to have children with their current partners and 2) Cisgender, heterosexual and nulliparous women in a relationship who did not desire to have children with their current partners.

Data collection instrument consisted of an online questionnaire presented with *Google Forms* and formulated based on BUSS (1989). The first part of the questionnaire consisted of preliminary data after criteria for inclusion of participants was previously met and the second part inquired about partner selection criteria per se, as it follows:

Part 1: Preliminary Data: age of female participant and age of partner, frequency of contraception usage, types of contraception used, desire to have children or preference to be childless.

Part 2: Attribution of Likert Scale regarding presence or absence of each one of 23 traits in current male partner, where1 (Strongly Disagree), 2 (Disagree), 3 (Undecided), 4 (Agree) and 5 (Strongly Agree).

Through Fisher Exact Tests, the answer to each trait was separately analyzed in order to reveal if there were significative differences between the percentage frequency of answers of both compared groups. Each Test led to a value of p. P being lower than 0.1 indicates significative difference between compared percentage frequencies, whereas P being greater or equal to 0.1 does not. Statistical significance was of 10%.

IV. Analysis of Results

a) Traits without Significative Differences

The following 13 traits (2, 5, 7, 9, 13, 15, 17, 18, 19, 23, 25, 26 and 27) did not evidence significative differences between percentage frequency of answers of women who desired and who did not desire children with their current male partners ($p \geq 0.1$):

Chart 1: Traits without significative differences between percentage frequency of answers in both groups

Trait Number	Trait	Value of p
2	Frequency of contraceptionusage	p = 0.362
5	Goodcook and housekeeper	p = 0.943
7	Sociable	p = 0.118
9	Organized and refined	p = 0.68
13	Emotional stability and maturity	p = 0.396
15	Good social class	p = 0.178
17	Same religious beliefs	p = 0.278
18	Hardworking	p = 0.475
19	Same political beliefs	p = 0.722
23	Kind and understanding	p = 0.355
25	Inspiring personality	p = 0.358
26	Creative and artistic	p = 0.673
27	Good conversationalist	p = 0.627

b) Traits with Significative Differences

The following 14 traits (1, 3, 4, 6, 8, 10, 11, 12, 14, 16, 20, 21, 22 and 24) did evidence significative differences between percentage frequency of answers of women who desired and who did not desire children with their current male partners ($p<0.1$):

Chart 2: Traits with significative differences between percentage frequency of answers in both groups

Trait Number	Trait	Value of p
1	Age of female participant X desire for children where women who desired children were in majority 21to 25 years old and in minority 41 to 46 years old. Women who did not desire children were in majority 31 to 40 years old and in minority 18 to 21 years old	$p < 0.01$
3	Who is older: female participant or male partner? where in both compared groups, the majority of male partners is older than female participants. However, women who did not desire children were 10% more of older age when compared to their partners than those who did)	$p = 0.085$
4	Age difference between female participant and male partner	$p < 0.01$
6	Easygoing	$p = 0.087$
8	Similar educational background	$p = 0.059$
10	Good earning capacity	$p = 0.03$
11	You were or will be his first sexual partner	$p = 0.084$
12	Dependable	$p = 0.053$
14	Desire for home and children	$p < 0.01$
16	Good-looking	$p = 0.012$
20	Mutual attraction	$p < 0.01$
21	Good health	$p = 0.077$
22	Good education and intelligence	$p = 0.058$
24	Physically attractive	$p < 0.01$

In order to understand the specificities of differences between answers of the two compared groups in each trait, percentages of Strongly Agree (5) and Agree (4) were added, as well as percentages of Strongly Disagree (1) and Disagree (2). In all of them, women who desired children have agreed more and either disagreed equally or less than women who did not desire children with mentioned traits being present in their male partners.

V. Discussion and Conclusions

Out of 27 traits, 14 exhibited significative differences in percentage frequency of answers of women who desired and who did not desire children, where women who desired children agreed more with the mentioned trait being present; whereas the other 13 traits did not exhibit significative differences. When it comes to the first 14 traits, all of them are, aside from culturally valued, directly indicative of male parental investment and genetic quality. Similar educational background, good earning capacity and good education and intelligence all indicate possession of resources to be invested by the male, where the first could mean the same ability to transmit culture to children as the mother (direct parental investment); and the other two could mean the ability to obtain material resources to invest in both the mother and the children (indirect and direct investment). Similarly, desire for home and children, mutual attraction, easygoing and dependable are traits that not only establish greater proximity and care for the woman and children, but also guarantee that available resources will be invested in them. Lastly, good-looking, good health and physical attraction are indicative of genetic quality.

In addition, women who desired children are in majority 21 to 25 and in minority 41 to 66, whereas women who did not desire children are in majority 31 to 40 and in minority 18 to 21. The majority of women who desired children were therefore currently experiencing

the peak of their fertility and reproductive value, while the minority of them is already experiencing intense and progressive decline in fertility. Similarly, the majority of women who did not desire children are past their fertility peak and the minority of them is currently at the beginning of their greatest fertile period. Finally, women who did not desire children are 10% more of older age than their partners when compared to women who desired children. Preference for older male partners could be related to their greater possession of resources and greater ability to transmit culture for children than younger partners, whereas for women who did not desire children, there is less concern about having younger partners.

When it comes to the other 13 traits, all of them appear to be equally indicative of parental investment and culturally valued. Good cook and housekeeper, organized and refined are traits that both allow for the ability to take care of women and children, but are also fruit of an increasing cultural value attributed to men who are able to perform domestic tasks. Good social class and hardworking are traits that indicate the possibility of providing resources for woman and children, however at the same time, they do not indicate guarantee of actual investment being performed. Emotional stability and maturity, kind and understanding, sociability, inspiring personality, creative and artistic, good conversationalist, same religious and political beliefs are generic traits that tend to inhabit an imaginary of cultural idealization. A partner in possession of these traits is, apart from potentially able to invest in women and children, also culturally attractive.

In this sense, it would be erroneous to say that selecting a male partner who possesses certain traits is an entirely cultural or evolutionarily selected behavior. In both groups compared, women have selected male traits that are indicators of both male parental investment and genetic quality, but also of cultural value. However, results showed that partners of women who desire children tend to possess more traits directly related to the ability and tendency of practicing parental investment and of genetic quality than partners of women who do not desire children. On the other hand, when it comes to male traits that are equally indicative of parental investment and culturally valued, there have been no significant differences between selection criteria of women who desire and who do not desire children.

It is therefore possible to conclude that evolutionarily selected female psychological mechanisms regarding partner selection do currently manifest as fruit of an indissociable junction between culture and nature, what makes them not exclusively instinctive, but rather incorporated to a conscious net of thoughts, functioning according to current cultural context. It is intended that conclusions reached in the present work help weaken what is known as nature-culture dualism, thus defining an evolutive process as not solely biological nor solely cultural. The process of psychological evolution and its behavioral products are therefore simultaneously biological and cultural, in an intrinsically connected way.

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Basics of the Medieval Arabic Medicine: The Vascular Systems in the Canon of Medicine of Avicenna Incorporating a Translation of a Part of the First Book

By Zsuzsanna Kutasi
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Abstract- Drawing on the knowledge accumulated by the ancient Greek philosophers, medieval Arabic theoretical anatomy seeks to describe the organs, their roles and functions as well as their mutual relationships, embedding this description within a philosophical framework wherever higher or subordinate roles can be ascribed to the particular organs being discussed. According to *Ibn Sīnā (Abū ʻAlī al-Ḥusayn b. ʻAlī)*(Avicenna) (370-428 AH/980-1037 AD), everything in nature is connected with everything else, and the main operator of the body is the immortal divine soul (*rūḥ*). In the process of breathing, a part of the divine soul enters the lungs and then, being mixed with blood, the heart as well, in which the 'pneuma' is formed, which is channeled by the arteries throughout the body. The soul part of the inhaled air (*al-hawāʾ*) regulates the heart's heat and nourishes it. According to Ibn Sīnā, the heart has three cavities: one on the right side, one on the left side, and the third in the middle, which serves as a kind of blood store. The liver governs the right side, the spleen governs the left one.

Keywords: anatomy, blood-system, Islamic medicine, Avicenna, Ibn Sīnā.

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Zsuzsanna Kutasi

Abstract- Drawing on the knowledge accumulated by the ancient Greek philosophers, medieval Arabic theoretical anatomy seeks to describe the organs, their roles and functions as well as their mutual relationships, embedding this description within a philosophical framework wherever higher or subordinate roles can be ascribed to the particular organs being discussed. According to *Ibn Sīnā (Abū ʿAlī al-Ḥusayn b. ʿAlī)*(Avicenna) (370-428 AH/980-1037 AD), everything in nature is connected with everything else, and the main operator of the body is the immortal divine soul (*rūḥ*). In the process of breathing, a part of the divine soul enters the lungs and then, being mixed with blood, the heart as well, in which the 'pneuma' is formed, which is channeled by the arteries throughout the body. The soul part of the inhaled air (*al-hawāʾ*) regulates the heart's heat and nourishes it. According to Ibn Sīnā, the heart has three cavities: one on the right side, one on the left side, and the third in the middle, which serves as a kind of blood store. The liver governs the right side, the spleen governs the left one. The heart is located in the middle of the chest and maintains a kind of balance between the two vascular systems. The left side has been exalted because the divine soul comes from the air to the left side of the heart, and from here, it floods the whole body through the arteries. The right side of the body is dedicated to bodily functions like turning food into blood, nourishing the organs, and removing the excess. The right half of the body is operated by the left half through nerves originating from the brain. In the brain, the two sides merge. The source of the veins is the liver, while the arteries arise from the heart.

As part of a close reading of the text, I created a diagram of branches of the blood vessels to facilitate their identification. In many passages of the anatomical description, we only learn that the blood vessel in question branches in three, four, or five directions and travels in a particular order or towards certain body parts. There is always a branch between them, indeed the largest one, and by connecting these largest branches, we get the full path of a given blood vessel from the beginning to the end. Such as the route *v. cava superior* from the right ventricle (branches in two directions) - *v. brachiocephalica* (units to five) - *v. subclavia* (branches towards 4) - *v. axillaris* (branches towards 3) - *v. basilica* (2 components branch to 4 at the forearm) - *v. mediana cubiti* (branches towards 2) - *v. salvatella* from the heart to fingers.

In some cases, erroneous conclusions can be found in description of Ibn Sīnā wherever he connects blood vessels with different origins. Sometimes Ibn Sīnā begins to describe a route of a blood vessel and then continues to describe another blood vessel as if it were a continuation of the previous one. Alternatively, he also assigns branches belonging to one blood vessel to branches belonging to another blood vessel, such as the *v. jugularis interna,* in describing the units of the *v. jugularis externa*.

Keywords: anatomy, blood-system, Islamic medicine, Avicenna, Ibn Sīnā.

Foreword

If a medieval person wished to learn the routes and branches of the blood vessels, the autopsy of a corpse would be indispensable for the collection of such data[2].

The Arabic term *at-tašrīḥ* for dissection has a double meaning. Medieval Arabic authors used the word in the sense of "anatomy" in reference to an intact body, and also in the sense of "dissection" in reference to the exploration of a corpse. The noun *at-tašrīḥ* comes from the root *š-r-ḥ* (to cut up (flesh)). The ambiguity of the noun itself can be resolved by using the construction *ʿilm at-tašrīḥ* (the science of anatomy) to refer to the theoretical science, while the simple noun *tašrīḥ* can be reserved for referring to the practical process of dissection. The solution to this problem of interpretation, which has been a constant theme of Islamic medical literature since the Middle Ages, was provided by *Ḥāǧǧī Ḫalīfa* and *Muḥammad ʿAlī at-Tahānawī* in the 17th and 18th centuries, distinguishing between anatomical knowledge without dissection and understanding requiring dissection. (E. Savage-Smith 1995: 68-69).

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[1] By medieval Arabic medicine we mean the medicine of ancient origin practiced in the Arab Caliphate and itssuccessorstates and throughout the medieval Islamic world. In fact, most of the doctors were not Arabs (not even Muslim at first, but Jewish or Christian), but of Syriac (Aramaic), Iranian, Jewish, Turkish, or other descent, who wrote in Arabic, the language of science and culture at the time. Ibn Sīnā was not an Arab either, he was a Persian from today's Uzbekistan.

[2] „The question of whether human anatomical dissection was everpracticed in medieval Islamic society is not easily or un equivocally answered." Emilie Savage-Smith, Attitudes Toward Dissection in Medieval Islam (1995)

Medieval Arabic theoretical anatomy, based on the knowledge of ancient Greek philosopher-doctors, describes organs, their functions, and functioning, their relationship with each other on a philosophical basis, where there are organs with nobler and subjugated roles. According to *Ibn Sīnā (Abū ʿAlī al-Ḥusayn b. ʿAlī)* (Avicenna) (370-428 AH/980-1037 AD), everything in nature is connected with everything, and the leading operator of the body is the immortal divine soul, ar-rūḥ. In the process of breathing, a part of the divine soul enters the lungs and then, being mixed with blood, the heart as well, in which the 'pneuma'[3] is formed, which is channeled by the arteries throughout the body. The soul part of the inhaled air (*al-hawāʼ*) regulates the heart's heat and nourishes it. (*wa-manfaʿat háḍā al-hawāʼ al-muʿidd ʾan yuʿaddila birūḥihi ḥarārat al-qalbī, wa-ʾan yamudda ar-rūḥa bil-ǧawharihi allaḏī huwa ʾaġlabu fī mizāǧihi min ġayri ʾan yakūna al-hawāʾu waḥdatan ammā al-māʾu fal-ġiḏāʾu al-badani wa-ammā al-hawāʾu fal-ġiḏāʾu ar-rūḥi. wa-kulli wāḥid min ġiḏāʾi-l-badani wa-r-rūḥi ǧismun murakkabun lā basīṭun*.) (The task of this prepared air is to regulate the heat of the heart with the immortal divine soul within it, and to transmit to the divine soul its essence, which is the most definitive part of its constitution (*mizāǧ*), without the air being composed of a single component, but just as water is the substance nourishing the body, so air is the food of the divine soul. Each food of the body and soul is a complex substance and not simple.) (Ibn Sīnā, 1987: Volume 2/Book 3/1122.)

According to Ibn Sīnā, the heart has three cavities: one on the right side, one on the left side, and one in the middle, which serves as a kind of blood store. (*wa-fīhi ṯalāṯa buṭūn baṭnān kaṯīrān wa-baṭnun kal-wasṭi*[4]*, liyakūna lahu mustawdaʿu ġiḏāʾin yaġtaḏī bihi kaṯīfun qawīyyun yušākilu ǧawharahu wa-maʿdinu rūḥi yatawalladu fīhi ʿan dami laṭīfi.*)(There are three cavities in it, two large and one that seems to be in the middle, to store the food with which to nourish the heart. This food is dense and strong, resembling the essence of the heart. In the heart is the source of the divine soul, which is born in it from the fine blood here.) (Ibn Sīnā, 1987: Volume 2/Book 3/1195.)

Well, even if Ibn Sīnā had dissected the heart himself, it would have been difficult for him to refute the unquestionable claim of Aristotle since antiquity that the heart has three cavities.[5] After all, the atria consist not only of those two ears, which are well visible from the outside at the base of the heart; but also of the two small cavities (atria) below them. The smooth-walled lower part of the atria was probably still considered part of the ventricles, and the upper uneven-walled ears of the atria were the natural atria at the time. The smooth lower part of the atriums may be the "middle cavity," the third ventricle.

According to Islam, dissection of the human body in the Middle Ages was not condemned or forbidden, at least as far as the autopsy of the bodies of non-Muslims is concerned. The Muslim principle, derived from the Prophet's hadith, reads: "There are three pillars of knowledge that can be acquired: the authentic recitation of verses from the Qur'an, the study of sayings and traditions attributed to the Prophet Muḥammad (called *ḥadīṯ*), and the knowledge of customary practices of the very early Muslim community (called *sunna*). Everything else that is outside of them is extra to study," and in the Middle Ages, it was modified to say (related that the Prophet said) that there are two forms of science: the science of bodies and the science of religions. (E. Savage-Smith 1995:69-73)

For a long time, the science of bodies, i.e. medicine, was practiced only by Jews and Christians, with Muslims relying on the latter's expertise. This is because Islamic law forbade the mutilation of Muslims' bodies, the breaking of their bones, and the cutting of their bodies before and after death, all of which were allowed for those of other religions. However, it has been recognized that knowledge of anatomy is essential for surgeons (*al-ǧarāʾiḥīyūn*), phlebotomists (*al-faṣṣādūn*) and cuppers (*al-ḥaǧǧāmūn*),[6] as they can only do their job well by knowing the exact location of the muscles, blood vessels, and nerves. The dissection of the body alone can only give the performer of autopsy as much knowledge as for the butcher, so it is also essential to acquire prior anatomical knowledge. (E. Savage-Smith 1995: 82-90)

In the 9th century, the Arabs began translating ancient Greek medical manuscripts, including the anatomical works of Aristotle and Galen, based on autopsies, which provided the basis for Arab doctors to

[3] Pneuma also plays a central role in medieval Arabic physiology and philosophy. There are three types of pneuma (*rūḥ*) that are related to the faculties (forces) that control the body. Within the three main forces, there are several smaller forces in the body. The three main forces are the brain-centered mind faculties *al-quwā an-nafsāniyya*, the liver-centered natural faculties (*al-quwā aṭ-ṭabīʿiyya*) and the heart-centered (animate) faculties (*al-quwā al-ḥayawāniyya*). The latter provide the life and cause the heart to contract and relax. (Ullmann 1978: 61)

[4] The termmay refer to a medium-sized ventricle also without indicating its exact location.

[5] During the autopsy of the animals, Diocles identified the two ventricles and the two atria in the heart, but did not dare to oppose the prevailing medical opinion of the age and Aristotle himself, so his discovery remained obscure. (Longrigg 1993: 71)

[6] The *ḥisba* manuals sharply distinguish between doctors and surgeons. Members of the two groups had to take examinations in different subjects before the market inspector (*ḥāsib*). The task of the market inspector or moral inspector was, among other things, to examine doctors. Phlebotomists and cuppers didnot count as doctors, but only as specialists in cupping and vascular cutting. Their prestige was much lower than that of surgeons and bone adjusters: their activities somewhat overlapped those of barbers. (Ormos 1996: 32) *Al-Bīrūnī (Abū Rayḥān* 362-440 AH / 973-1050 AD) counts phlebotomists as a separate group of doctors. (Ormos 1996: 35)

write their work. By the 13th century, the leading doctors of the Islamic world were Muslims. But by this time, philosopher-doctors, such as Ibn Sīnā, had been replaced by jurist-doctors such as *Ibn an-Nafīs* (609-687 AH-1213-1288 AD), who was a critic of the great medical canon of Ibn Sīnā (*al-Qānūn fīṭ-ṭibb*).

In about 1025, Ibn Sīnā completed a five-volume medical manual entitled *al-Qānūn fīṭ-ṭibb* (Canon of Medicine), which until the 17th century served as the basis not only for Arabic but also for European medical books. According to him, medicine is a particular class of sciences that includes theoretical and practical sciences. The foundations of his medical creed are the humoral theory and medical ethics of Hippocrates (460-375 B.C.), the theory and anatomy of the four-reason causality[7] of Aristotle (384-322 B.C.), and theory and practice-based anatomical descriptions of natural faculties of Galen (129-200 B.C). (Heldreth 2014: 1, 3, 11).

In his book, Ibn Sīnā often begins his statements as 'Galen said,' or 'according to Aristotle.' He quotes the thoughts of one ancient author and another. For example, at Galen, arteries no longer contain air, as Aristotle believes, but a mixture of refined blood and air. (Ibn Sīnā accepts Galen.) Or, for example, as regards the centers of the influential forces, according to Galenos, each faculty has a specific centers in the body, as Ibn Sīna confesses. According to Aristotle, however, the source of every faculty is the heart. (Ibn Sīnā, Volume 1/Book 1/91, 1987: Volume 1) Ibn Sīnā follows the theoretical system of Galen for the most part.

The anatomy of blood vessels is contained in the fourth chapter of the first volume. The author takes the description of the arteries (*aš-šarāyīn*/ *al-ʿurūq aḍ-ḍawārib*) forward, followed by reports of veins (*al-'awrida*/ *al-ʿurūq as-sākina*). The reason I do not analyze the descriptions in this particular order is that, in its summary of the veins, the text also reveals the influence of the Galenic idea of the vascular system forming an integral whole that determines the functioning of the organism, this idea serving as a general introduction to the anatomy of the particular arteries.

Ibn Sīnā describes noble (heart, liver, spleen, arteries) and subjugated organs (stomach, intestines, veins), processes assigned to the right and left sides. The organs are philosophically connected. The liver governs the right side, the spleen governs the left one. The heart is located in the middle of the chest, lending a kind of balance between the two vascular systems. The left side has been exalted because the divine soul comes from the air, from nature, to the left side of the heart, and from here, it floods the whole body through the arteries.[8] The right side is dedicated to mundane functions, like turning food into blood and nourishing the organs, and removing excess. The right half of the body is operated by the left half, through the nerves originating from the brain. In the brain, the two sides merge.

Al-Maǧūsī (ʿAlī b. al-ʿAbbās) (Haly Abbas) (died cc. 982-994 AD/ 371-383 AH) mentions a 'third cavity' (*at-taǧwīf aṯ-ṯāliṯ*) called manfaḍ when describing the ventricles of the heart, which Manfred Ullmann translates as 'passage'. (*manfaḍ* -exit, passage, Fonahn, 1922:1935. serial number) (*min at-taǧwīf al-ayman ilā at-taǧwīf al-aysar manfaḍun yusammihu qawmun taǧwīfan ṯāliṯan wa-laysa ḍālika kaḍālika*.) (al-Maǧūsī 1939: 64).

(The heart has a right and a left ventricle separated by a partition. In this partition there is a passage (manfadh) which many people (Aristotle is meant) call a 'third ventricle', but this is incorrect.) (Ullmann 1978: 65).

The term *manfaḍ*, which is explained concerning to the ventricles as *taǧwīf,* or "cavity" (cavity, Fonahn 1922:3189), is later repeatedly described in the description of al-Maǧūsī when it comes to the openings (*fūhāt*) of the great blood vessels entering or exiting the heart. (Here, the meaning of *manfaḍ* is the same as that of *fūha*.) (*ammā al-manfaḍāni al-laḍāni fī at-taǧwīf al-aysar fa-aḥaduhumā fūhat al-ʿirqi aḍ-ḍāribi*). As for the two passage ways in the left ventricle, one of them is the opening of the artery). (al-Maǧūsī 1939: 64).

This term (*manfaḍ*) is missing from the heart description of Ibn Sīnā (see Ibn Sīnā 1987: Volume 2/Book 3 1195-1196).

The expression (*min at-taǧwīfi-l-aymani ilā at-taǧwīfi-l-aysari manfaḍun*) can also be interpreted as meaning that this 'passage' is opening of the truncus pulmonary starting from the right ventricle and leaning towards the left one. The truncus pulmonary leaves the base of the heart below the the aorta opening, beginning from the left ventricle. (Below the aortic arch, is divided into two branches, into the right pulmonary artery and left pulmonary artery and branching out in the lungs.) The opening of the blood vessel thus bends from the right ventricle to the left ventricle. (*fa ammā al-manfaḍu allaḍī min at-taǧwīf al-ayman ilā al-aysar fainnahu min al-ǧānib al-ayman awsaʿu ṯumma yaduqqu qalīlan qalīlan ilā an yantahī ilā al-ǧānib al-aysar.*) (As for the opening that runs from the right ventricle to the left

[7] Aristotle developed his teaching on the theory of the four fold causation from Plato's ideology. According to Plato, the material principle alone is not enough to explain the movement, effects (shaping spiritual principle) are also needed. Plato saw the idea as a shaping principle. In Aristotle, the four causes that cause change are the material cause, the active cause, the formal cause, and the ultimate cause. In his theory, he started from the movement (the development of beings) in which matter takes on a new internal form. It performs this shaping of the material while achieving some purpose.

[8] According to al-Maǧūsī, the cone-shaped heart surrounded by the lungs also leans to the left side because the' animal soul' is based here. (Ullmann 1978: 65)

ventricle, it becomes more expansive on the right and narrower as it reaches the left.) (al-Mağūsī 1939:65)

At the base of the pulmonary artery, starting from the right ventricle, is a funnel-like transition, a funnel-like cavity tapering off towards the left and upwards, and a smooth-walled exit from the right ventricle to the pulmonary valve. This cavity is located between the right ventricle and the pulmonary artery. It continues at the level of the coronary sulcus into the pulmonary artery, leaving the heart to the left.

In the heart description of Ibn Sīnā, it is a passage, a channel (*mağrā*) between the two ventricles, which expands as the heart expands and then compresses as the heart elongates. It moves with the heart like the part in the right ventricle from which the pulmonary artery originates.

I used modern anatomical textbooks and online image and video sources to identify the blood vessels in the text of Ibn Sīnā. I wrote the Latin names of the recalled blood vessels in parentheses to translate the Arabic text, and I identified the blood vessels already named in Arabic in the text from the trilingual anatomical dictionary of Adolf Fonahn, called 'Arabic and Latin Anatomical Terminology Chiefly from the Middle Ages.' While reading the text, I made a diagram of the branches of the blood vessels, which made it much easier to identify them. In many places in the anatomical description, we can only know that the blood vessel in question branches in three, four, or five directions and travels in specific directions or towards certain parts of the body. There is always a branch among them, indeed the largest one, and by connecting these largest branches, we get the full path of a given blood vessel from the beginning to the end, such as the route of *superior vena cava* from the right ventricle (branches in two directions) – *brachiocephalic vein* (units towards five) – *subclavian vein* (units towards 4) – *axillary vein* (units towards 3) – *basilic vein* (2 branches branch to 4 at the forearm) – *cubital median vein* (branches towards 2) – *salvatella vein* from the heart to fingers Tracing these routes is not easy because the veins in question run in exactly the opposite direction to the way the medieval text seeks to follow their route, thus making it necessary to constantly rely on knowledge from other types of sources (anatomical textbooks) to establish the successive places by which the particular blood vessel passes. In the Arabic text, the veins start from the liver and from there enter the heart or travel downwards towards the legs. The arteries begin from the heart and travel towards the head and body.

In some cases, erroneous conclusions can be identified in description of Ibn Sīnā wherever he connects blood vessels with different origins: For example, Ibn Sīna also classifies *vertebral vein* from the ribs as a branch of the *subclavian vein*, but it no longer flows into the vein under the clavicle but directly into the *brachiocephalic vein*. Or, for example, the two iliac veins (*v. iliaca communis dextra* and *sinistra*) ten at their branching mix the branches of the inner and outer iliac veins. The first to fourth branches describe the outer branches, the fifth to eighth branches of the internal iliac veins, and then the ninth branch actually again belongs only to the external and the tenth branch to the internal iliac vein.

Sometimes Avicenna begins to describe a blood vessel and then describes another blood vessel as if it were a continuation of the previous blood vessel. Such as in explaining the branches of *internal jugular vein* and *external jugular vein*. It also assigns units belonging to another blood vessel to branches belonging to the blood vessel described.

Description of veins (Ibn Sīnā 1987: Volume 1 / Book 1 84-89)

The quiet blood vessels (*al-'urūq as-sākina*) or veins all start from the liver. [9] First, two blood vessels grow out of the liver: one on the concave side. The main merit of this blood vessel is the involvement of food in the liver, it is called the *al-bāb* (*v. portae*). The other blood vessel exits the convex side. It main function is to transport food from the liver to the organs, called the empty vein. (*al-aǧwaf*) (*v. cava (inferior)*). [10]

Anatomy of the portal vein (v. portae) [11]*:*

First, the deep part of the portal vein in the liver is divided into five branches and then gives further smaller units until it reaches the convex surfaces of the liver[12]. From here, a vein (*v. cystica*) leads to the

[9] According to the Galenic vision, the liver is the place where blood is born, the center of venous system and the source of nourishing power.

[10] The visceral surface of the liver (the part facing the viscera) is concave, here is the he paticportal (*porta hepatis*). This is where the hepatic portal vein (*v. portae*), also known as the varicose vein, enters the liver. The hepatic portal vein is formed behind the head of the pancreas from the confluence of the posterior intestinal vein *(v. mesenterica superior*) and splenicvein (*v. lienalis/ v.splenica*.) Upon reaching the hepatic portal, it usually enters in two branches. The posterior empty vein (*v. cava inferior*) does not originate from the liver but is formed by the confluence of the two common iliac veins (*v. iliacacommunis*) at 4th-5th lumbar vertebrae. After collecting the used blood from the legs, pelvic and abdominal organs, and then taking blood from the liver, it draws blood from there. The inferior vena cava is just embedded into the liver, rather than divided into branches in it or becoming part of it. The veins of the liver release branches into it, the blood of which is thus carried on to the heart. Because the empty vein embedded into the liver and leaves it toward the convex side, ancient and medieval observers may have thought that the vein originated in the liver. In fact, all blood vessels (arteries, veins) come out or enter the liver gate.

[11] The portal vein carries venous blood corresponding to the odd branches of the abdominal aorta into the liver. (The odd branches of the abdominal aorta travel to the stomach, intestines, pancreas, spleen, and liver.)

[12] The liver has a portal circulation, which means that the vein enters the gland and divides into capillaries like an artery, then collects and leaves as a vein. Within the liver, the hepatic artery (which also arrived through the hepatic portal) to nourish the liver, its capillaries is mixed with capillaries collected by portal vein, then split into branches, and then flowed together into the 3-5 large hepatic veins (*vv. hepaticae*) and through them into the inferior venacava (*v. cava inferior*).

gallbladder. These smaller branches are like the roots of a tree that penetrates deep into their place of origin. The side of the vein that is close to the concavity of the liver splits into eight branches as soon as it separates from the liver. Two of these branches are small; the other six are large[13].

One of the two small blood vessels is (*v. pancreatico duodenalis inferior*).[14] Travels to the duodenum to attract food, then gives smaller branches, and one of these enters an organ called the pancreas. The other small blood vessel (*v. pylorica*) at the lower part of the stomach and the stomach gate (*al-bawwāb*) (*pylorus*) (where the lower opening of the stomach is) is divided into branches to absorb food.

6/1. One of the six large blood vessels (*v. coronaria ventriculi*)[15] travels to the surface of the stomach to feed the outside of the stomach. The inside of the stomach, on the other hand, benefits from the undigested food that is in it by assimilating it to itself directly, the food becoming thereby the very material of the stomach.

6/2. The second large blood vessel (*v. lienalis*) travels from the six to the spleen to nourish it, but before it comes the spleen, it produces branches, of which the most visible blood vessel turns to the pancreas and then returns to the spleen. Once it reaches the spleen, a chunky unit (*v. gastroepiploica sinistra*) returns to the left side of the stomach to feed it. The branch that penetrates the inside of the spleen reaches the middle, and then a branch starts up and down from it. The upward-moving blood vessel branches off, and a branch gets the upper half of the spleen to feed it. The other department (which goes down) runs the curvature of the stomach and then turns in two directions. One (*v. gastrica sinistra*) travels to the left side of the abdomen to nourish it.[16] The other (*v. gastroepiploica dextra*) plunges into the stomach at the mouth of the stomach (*fam al-ma'ida*) to stimulate the bitter, astringent part of the black bile, from which excess humours flow out. It excites the stomach and this tickling force arouses the appetite.

The downward branch (from inside the spleen) (*v. gastroepiploica sinistra*) also splits in two: one branch branches off in the lower half of the spleen to nourish it. The other branch comes to the omentum (*aṭ-ṭurab*) and units in it to feed it.

6/3. The third large vessel starts on the left of the six (*v. mesenterica inferior*) and branches into the mesentery (*ǧadāwil al-'urūq*) (~ mesocolon), which surrounds the rectum (*al-ma'ī al-mustaqīm*) (~ mesorectum) (*v. rectalis superior*) to absorb what is in the sediment of the digested food[17].

6/4. The fourth large branch is divided from the six (*v. gastrica dextra*) into hair-thin branches. Some of these branches run to the convex outer half of the stomach, on the right side, where they meet the branch of the vein (*v. lienalis*) originating from the left side of the spleen. Some of these hair-thin branches turn to the right side of the omentum (*aṭ-ṭurab*), branching in it, and encountering the branches coming from here on the left side, from the spleen.

6/5. The fifth branch of the six (*v. mesenterica superior*) is distributed in the blood vessels of the mesenteric (*al-ǧadāwil*) (*v. colica dextra / sinistra*), [18] which are around the colon (*al-qūlūn*) to absorb nutrients.

6/6. The sixth branch of the six large vessels (*v. ileocaecalis*) [19] is also divided into branches, and most of the departments pass around the jejunum (*aṣ-ṣā'im*), the others along the small intestine (*al-lafā'if ad-daqīqa*). around the part that connects to the appendix (*al-a'war*) to extract food from it.

Anatomical description of the branch of the empty vein that moves upwards

First, the base of the empty vein (*v. cava inferior*) is divided into hair-thin branches in the liver itself to attract food from the hair-thin blood vessels of the portal vein (*v. portae*).[20] The branches of the empty vein come from the inside the liver, i.e. the convex side of the liver (*ḥadabat al-kabid*). The branches of the portal vein enter the inside of the liver from the concave side of the liver (*taq'īr al-kabid*).[21]

Then the trunk of the empty vein rises from the convex side of the liver and splits into two branches: an ascending branch and a descending branch. The upward branch pierces the diaphragm (*ḥiǧāb*),[22]

[13] The portal vein has four roots: *v. coronaria ventriculi, v. mesenterica superior, v. mesenterica inferior* and *v. lienalis.* In the description, the other veins are the tributaries of these veins.

[14] One of the branches of the portal vein, *superior mesenteric vein* is a tributary.

[15] A vein passing through the small curvature of the stomach, which is opens into the trunk of the *portal vein*.

[16] The two gastric veins (*v. gastrica sinistra et dextra*) and the two gastroepiploic veins (*v. gastroepiploica sinistra et dextra*) anastomoses with each other and supplies the stomach.

[17] Venous drainage of the lower two-thirds of the rectum is not part of the portal circulation.

[18] The right colic vein (*v. colica dextra*) a branch of superior mesenteric vein (*v. mesenterica superior*) and the left colic vein (*v. colica sinistra*) belongs to the inferior mesenteric (*v. mesenterica inferior*)system. Both transport blood from the colon to the liver.

[19] A branch of superior mesenteric vein (*v. mesenterica superior)*.

[20] The hepatic veins (*vv. hepaticae*) flow into the inferior venacava. In the description, we can read this in reverse. It is not the empty vein that divides into hairline branches, but the capillaric veins flow into the main collecting blood vessel.

[21] The convex surface (wall surface) of the liver is located towards the diaphragm. The concave surface (visceral) is towards the stomach and intestines. The hepatic veins flow close to the convex side of the inferior vena cava, these may have seemed to the medieval observer as if the empty vein branched towards the liver.

[22] The inferior venacava behind the sternum, at the height of the 8th vertebrae (T8) at the *hiatus cavae inferioris* drills through the

penetrates into and is substituted by two other branches, which are divided into sub-branches and transport food to the diaphragm. Then, passing by the pericardium, it sends many large branches, which (eventually) branch out as capillaries and feed it.[23] It is then divided into two units:

A large branch (*v. cava inferior*) reaches the heart and penetrates the right atrial ear (*uḏun al-qalb al-ayman*)[24]. This blood vessel is the largest of the heart. This one is larger than the others because the other blood vessels are responsible for sucking out the breath (*an-nasīm*), which is used to deliver nutrients. And the nutrient is much fuller than the intake air. It is, therefore necessary that the opening of the blood vessel carrying it be wider and that the blood vessel be larger. This blood vessel, as it enters the heart, is replaced by three valves (*aġšiya ṯalāṯa*)[25], the lid of which (*masqafuhā*) moves from the inside outwards and the outside, so that it can draw food from them as the heart expands. Then (the blood vessel) does not return (to its original state) after extension (*al-inbisāṭ*). Its membranes (its valves) are the most robust.

This vein is replaced by three blood vessels which, passing by the heart, rise from it to the right ventricle and travel towards the lungs, close to the left (ventricle) where the arteries originate).[26]

1. The wall of one of the vessels (out of three) is bilayer[27] like the arteries, called the *vena arteriosa* (arterial-like vein) pulmonary artery. (*al-warīd aš-širyānī* / *truncus pulmonalis*, *a. pulmonalis*)[28]

Its primary merit is that the blood sprayed from it is so infinitely delicate, a delicacy similar to the essence of the lungs. This blood is taken directly from the heart, meaning that it does not mature in the same way as the blood that flows in the *arteria venosa* (*aš-širyān al-warīdī* /*v. pulmonalis*, (venous artery) (pulmonary vein).[29] The secondary merit is that the blood is perfectly worth it.

2. The second branch (*v. Cordis Magna*) of these three travels around the heart and is then sprayed inside the heart to nourish it. It happens (*sinus coronarius*), where the empty vein sinks into the right atrium.
3. The third branch (*v. hemiazygos accessoria*)[30] leans to the left in humans, then turns to the fifth vertebrae, rests on it, and gives branches to the lower eight ribs and the muscles and organs close to it.

As for the blood vessel starting from the opening of the empty vein[31] (*v. cava superior*), having passed three valves[32] it rises and reaches the base of the heart, then it leaves the heart and produces hair-thin

diaphragm, with the right phrenic nerve (*n.phrenicus dexter*), and in the company of the right pericardiac phrenicartery (*a. pericardiaco phrenica dextra*).

[23] The inferior venacava after leaving the liver, drills through the diaphragm, then the pericardium and flows into the right atrium. No other veins arrive at this stage. The vein running parallel to it on the rightside, on the otherhand, receives smaller veins from several places, including the pericardium. The azygos vein begins on the rightside of the lumbar vertebrae like ascending lumbarvein, take supveins from several places, then close to the heart flows into superior venacava before it penetrates the right atrium.The description of inferior venacava thus passes into the description of another vein. The unnamed vein that replaces the posterior empty vein in the diaphragm is the azygos vein.

[24] The ear (*auricula, sinus venarum cavarum*) is a finger-like extension of the atrium that is separated from the real atrium by a border groove (*sulcus terminalis*). The atrium consists of two parts: a lowers mooth-walled part and an upper uneven-walled part to which the ear is attached. The two ears surround the arteries from the ventricles. During relaxation, it is filled with blood and then empties when it contracts. According to some ancient authors (Aristotle, Galen) and the medieval Arabic idea, the heart has three cavities. In addition to the two large ventricles, which probably included the smooth-walled lower part of the atria, this is the lower atrium, or "small ventricle," that functions as a blood store, the third ventricle of the heart. (Ibn Sīnā 1987: Volume 2 / Book 2 1195)

[25] It is a tricuspid valve at the atrial-ventricular boundary (tricuspidal). The lower main collection blood vessel (*v. cava inferior*) has only a rudimentary valve to prevent backflow. And the upper main blood vessel has no valve. The description that "three valves take its place" or "replaced by three valves" (*yataḫallafu lahu aġšiya ṯalāṯa*) can be interpreted as meaning that the vein ends here.

[26] *Wa hāḏa al-waridu yaḫlufu 'inda muḥāḏātal-qalbi 'urūqan ṯalāṯatan taṣīru minhu ilā ar-ri' ati* (Ibn Sīnā 1987: Vol. 2/ Book 2/ 1195 p.) The blood vessels described have no connection to the incoming inferior venacava. One of the blood vessels departing from the right ventricle, the pulmonary artery (*a. pulmonalis*), exits the right ventricle by leaning toward the left atrium. The blood vessel (2nd) traveling around the heart is the heart's own blood vessel. The largest of the veins of the heart is the *v. Cordis Magna*, running upwards on the anterior surface of the ventricles. In the *sulcus coronarius* it turns to the left and dilates like a coronary sinus and opens into the right atrium. The other veins in the heart either open directly into the atriumor flow into the coronary sinus.

[27] Each artery and vein has a three-layered, i.e. triple. The layers of the arteries may not vary in number, only in their complexity depending on how close or far they are from the heart. These layers are not visible to the naked eye. There are no valves in the arteries, this is also true for large collecting blood vessels. The cross section of the arteries is circular and that of the veins is elongated. According to the Arabic description, *al-warīd aš-širyānī* –pulmonary artery bilayer, like the'real arteries,'*aš-širyān al-warīdī*–pulmonary vein, unlike 'real arteries,' is single-layered. The pulmonary artery opens from the arterial mouth of the right ventricle, the onset of which is conically dilated (*conus arteriosus*). There are three crescent-shaped valves here, just like at the left ventricular artery, where the aorta exits the heart (*bulbus aortae*). In this feature, the two blood vessels is similar.

[28] Fonahn, serial number 3343. In the description of al-Mağūsī this blood vessel is called *al-'irq aš-širyānī*.

[29] Fonahn, serial number 2988. In the description of al-Mağūsī this blood vessel is called *aš-širyān al-'irqī*.

[30] Only one bloodvessel exits the right ventricle (*truncus pulmonalis*), which divides to the right half and lefthalf of the lungs (*a. pulmonaris dextra et sinistra*), and three blood vessels enter (*vena cava inferior, vena cava superior, v. Cordis Magna*). Therefore, I think that the third blood vessel described here does not actually exit the ventricle, but from behind the heart, and goes down from the 1st rib to the 7th rib, past the spinal vertebrae, and then passes to the rightside at the 8th vertebra and flow into the azygos vein. Its collection area is the posterior body wall, posterior pericardial surface, esophagus, and lungroots (*vv. bronchiales*).

[31] The medieval author probably considers the superior vena cava (which actually arrives from above, from the lungs) departing the right atrium to be the continuation of the inferior vena cava ending here.

[32] Right venous mouth, tricuspid valve.

branches (*šu'ab ša'rīya*) at the upper parts of the gator plate (mediastinum) deviding the chest in two (*fī a'ālī al-aġšiya al-munaṣṣifa lil-ṣadri*), in the upper parts of the pericardium (*fī a'ālī al-ġilāfi*), and in the soft flesh called thymus (*ṭawṭa*) (*v. thyroidea*).[33] Then, close to the clavicle (*at-tarqūwa*), it adds two branches diagonally in the direction of the clavicle, two sides apart (*v. brachiocephalica dextra et sinistra*).[34] Both components are divided into two units (*v. subclavia* and *v. jugularis interna*).[35] One branch (*v. subclavia dextra et sinistra*) passes downward to the right and left of the sternum until it reaches the larynx (*ḥanğara*) (*v. jugularis anterior*)[36]. Going down, it adds branches to the muscles between the ribs (*v. vertebralis*).[37] Their openings meet the openings in the blood vessels scattered throughout the muscles.[38] A group of these leaves (*barazat minhā*) towards the muscle outside the chest (branches of *v. axillaris*.[39]

Once the blood vessel (a branch of the internal jugular vein) has supplied the larynx (with nutrients), a group breaks out of it towards the shoulder, forming and moving (muscle)[40] and gives branches in it (*v. thoracoacromialis*).[41] A group travels downward under the straight abdominal muscle[42] and units into it (*v. epigastrica*).[43] The ends of the blood vessels are connected to the ascending branches of the lumbar vein (*al-warīd al-'aǧzī*) (*v. iliaca communis*).[44]

The remaining branches of both pairs (right and left) split into five at the clavicle[45]:

1. One branch continues in the chest and nourishes the first four ribs. (*v. subscapularis*)
2. The second branch supplies the area around the two shoulders.
3. The third branch travels to and feeds the deep-lying muscle of the neck.
4. The fourth branch penetrates the cavities between the upper six vertebrae of the neck and reaches the head through them. (*v. intervertebralis*)
5. The fifth branch is the largest of all and leads to the armpit from all directions (*v. subclavia*) and then splits into four branches:

5.1 The first branches into a muscle in the sternum, one of the blood vessels needed to move the shoulder joint.

5.2 The second branch continues to branch into the soft flesh (*al-laḥm ar-raḫū*) and membranes (*aṣ-ṣifāqāt*) of the armpit. (*v. axillaris*)

5.3 The third branch (*v. thoracoepigastrica*) descends from the side of the chest to the delicate lower abdomen (*marāq*).

5.4 The fourth branch is the largest of the four and is divided into three branches[46]:

5.4.1 A branch branches off in the muscle in the concavity of the shoulder. (*v.cephalica*)

5.4.2 The second branch travels in the large muscle at the armpit. (*v. brachialis*)

[33] The thyreoid vein (*v. thyreoida*) which collects venous blood from the thymus, branch of brachiocephalic vein.

[34] One of the tribes of the superior vena cava coming from above to the right atrium is the right brachiocephalic vein, which, together with its left counter part, can take up branches mainly from the pericardium, the thymus, and from the deep of neck and from the spine (*v. vertebralis*).

[35] The brachiocephalic vein collects branches from both sides. From the clavicle to the subclavian vein, from the brain to the internal jugular vein.

[36] The anterior jugular vein flows into the subclavian vein.

[37] The subclavian vein (vein under the clavicle) is made up of three branches: *v. jugularis anterior* from the inside of the neck (the area of the larynx), *v. jugularis externa* from the outer surface of the neck, and *v. thoracoacromialis* comes from the shoulder girdle. From the ribs the vertebral vein,another branch of brachiocephalic vein collects blood.

[38] According to the ancient idea (Erasistratos), blood vessels are connected to each other through openings at their ends. These openings are usually closed, they only open in case of over production of fluids, inflammation, fever. This allows blood to pass from the veins to the arteries. (Brain, 1986: 125.) This may not be the case in the Arabic text, but simply describes the tangled web of thins mall blood vessels in this way.

[39] The axillary vein (*v. axillaris*) flows into the vein under the clavicle (*v. subclavia*) and collects superficial veins in the chest, abdomen, and upper extremities. The axillary vein passes below the small pectoralis muscle (*m. pectoralis minor*) from the axillary trench. The axillary vein progresses at the lower edge of the major pectoralis muscles till as*vv. brachiales*. The 'muscle outside the chest' is the deltoid muscle (*musculus deltoideus*), one of the muscles of the shoulder, below which the cephalic vein arrives from the forearm in the axillary vein.

[40] The muscles that move the shoulder and upper limbs include the back muscles: *m. pectoralis major* (large pectoral muscle), *m. pectoralis minor* (small pectoral muscle), *m. subclavius* (muscle under the clavicle), *m. serratus anterior* (anterior saw muscle).

[41] *v. thoracoacromialis* (chest-shoulder vein) flows into the subclavian vein. Its collection area is *m. deltoideus*, *m. serratus anterior* and the shoulder joint.

[42] Of the abdominal muscles, the straight abdominal muscle (*rectus abdominis*) runs down bothsides of the midline of the abdominal wall. The muscles originate from the cartilage of the ribs 5th, 6th, 7th at the height of the sternum and adhere gradually to the pubicbone, tapering downwards from the navel.

[43] Both the superficial and deepveins of the abdominal wall, the accompanying veins of the epigastric arteries (*vv. epigastricae*) are led partially upward in the axillary artery (*v. thoracoepigastrica*) and towards the subclavian vein, partly down to the femoral vein and deeper into the external iliacvein (*v. epigastrica inferior*).

[44] The azygos vein take up lumbar segmental veins from the rightside of the vertebral bodies of the lumbar spine. Then continuing upwards on the rightside of the spine, the*v. Azygos* picks up its left pair at the height of the 7th vertebra, the*v. hemiazygos*, (and *v. hemiazygos accessoria*, also on the left) and then the superior vena cava flows into the superior and through it into the right atrium of the heart. Although the veins in the lumbar area are collected by the lower empty vein (*v. cava inferior*), certain areas are not reached by this vein, such as the lumbar areas of the posterior trunkwall, which are collected by the *v. azygos* system.

[45] It is a branch of *v. brachiocephalica dextra* and *sinistra* coming to the *v. cava superior* from bothsides (right-left). The largest of the five branches is the *v. subclavia*. The other four branches are veins from the collection area of the *v. brachiocephalica*: from the area of the head, neck, thyroid gland, thymus, esophagus, pericardium, upper extremities and part of the chest.

[46] This is still th eaxillary vein.

5.4.3 The third branch is the largest of the three, moving from the upper arm towards the hand, called *al-ibṭī* (*v. basilica*).[47]

The blood vessel that remains from the first branch (the other branch of the *v. brachiocephalica*) and one of the branches (*v. subclavia*) gives this many branch that moves upwards towards the neck.[48] However, before it penetrates deep into the neck, it splits into two branches. One is the external jugular vein (*al-widāǧ aẓ-ẓāhir*) (*v. jugularis externa*)[49] and the other is the internal jugular vein (*al-widāǧ al-ġā'ir*) (*v. jugularis interna*).[50] The outer jugular vein, as it rises from the clavicle, splits into two branches:

1. One branch, as soon as it separates (from the main branch), turns forward and to the side. (*v. jugularis externa anterior*)
2. The other branch first turns forward and then moves down. It then grows, becoming visible a second time at the clavicle. It bypasses the collarbone and then rises and becomes visible on the neck until it reaches the first branch and merges with it. (*v. jugularis externa posterior*)

The two of them will become the known external jugular vein. Before the two join, two branches separate from it: One turns to the center, and then, at the meeting point of the two clavicles, inside, the two branches meet. The other branch moves diagonally around the neck visibly and does not meet any other blood vessels after that.

From this pair of blood vessels (an internal, and external jugular vein) many veins branch out like cobwebs that can no longer be distinguished (*tafūt al-ḥass*). From the second pair of blood vessels (external jugular vein) three identifiable veins separate that are significant. The rest cannot be explored. One of these identifiable veins extends to the shoulder and is called *al-katifī / al-kitfī* (*v. cephalica antebrachii*).[51] From there continues the *al-qīfāl* (*v. cephalica*)[52] and two more veins on either side of it (*v. brachialis* and *v. basilica*) that accompany it to the tip of the shoulder (*ra's al-katif*). One of them closes before reaching the end of the shoulder, but gives branches towards the direction of the shoulder. Of the two blood vessels, the one that passes in the anterior part (*al-mutaqaddim*) reaches the apex of the shoulder at the top of the upper arm (*ilā ra's al-'aḍud*) and branches there. The *al-katifī / al-kitfī* (*v. cephalica*) is reached by both blood vessels together at the back of the hand.

The external jugular vein, as soon as it separates into branches, splits again in two, and one of these latter penetrates deep into the upper jaw (*v. maxillaris*) in the form of thin branches. The other unit is much larger and branches off at the jawbone (*v. linguofacialis*, *v. facialis*). Both blood vessels give components around the tongue and outside the jaw muscles. The branch in the upper jaw appears close to the surface and units in the head and ear areas.[53]

The internal jugular vein (*al-widāǧ al-ġā'ir*) (*v. jugularis interna*) passes by the esophagus and rises straight next to it.[54] In its way, it gives branches[55] that mix with the branches coming from the external jugular vein (*al-widāǧ aẓ-ẓāhir*) (*v. jugularis externa*). Each vessel is subdivided into other branches at the esophagus (*al-marī'*) and the larynx (*al-ḥanǧara*) (*v. pharyngealis*) and all deep-seated muscles. The end of the blood vessels penetrates the end of the lambda suture (*ad-darz al-lāmī*)[56] (*sutura lambdoidea*) of the skull,[57] where branches are given, and some of these branches are distributed between the first and second vertebrae.[58] Of these, a hair-thin blood vessel reaches the joint between the head and the neck (*v. cervicalis transversalis*), and from there the blood vessels start toward the membrane covering the skull (*v. jugularis posterior externa*). The blood vessels reach the junction of the two skull bones and there they dig into the inside

[47] Fonahn, serial number 1612.
[48] This branch is not moving upwards, but another: *v. jugularis externa*.
[49] Fonahn, serial number 3585.
[50] Fonahn, serial number 3586. Arriving in the right atrium two large bloodvessels flow into the superior vena cava, one from the rightside (*v. brachiocephalica dextra*) and the other from the leftside (*v. brachiocephalica sinistra*). Both branches are connected by two large bloodvessels froma bove: one is the vein under the collarbone (*v. subclavia*) and the other is the internal jugular vein (*v. jugularis interna*). The external jugular vein (*v. jugularis externa*) arrives at first into the internal jugular vein or into the subclavian vein and only then into the brachiocephalic vein.
[51] Fonahn, serial number 1764.
[52] Fonahn, serial number 2710.
[53] The facial vein (*v. facialis*) is the main superficial drainage vein of the face. It forms around the innercorner of the eye (here is the*v. angularis*) from the smaller veins of the forehead (*v. trochlearis superior*), the back of the nose (*v. orbitalis superior*), the eyelids and the anterior cavity. The main drainage vein of the deeper layers of the face is the*v. retromandibularis*. It develops on the innerside of the parotidgland in the trench below the temporal bone, at the confluence of *v. temporalis superficialis* and *v. maxillaris*.Its main collectionarea is the area around the deep mastication muscles. Going downwards like *v. retromandibularis lateralis*, flow with the facial vein and as *v. facialis communis* flows in internal jugular vein.
[54] The internal jugular vein originates in the posterior part of the *foramen jugulare* based on the skull. A broad, sac-like vein that travels almost vertically down the neck in a common connective tissues heath with the internal carotid artery (*a. carotis interna*) and with the vagus nerve (*nervus vagus*). With a lower dilation (*bulbus venae jugularis inferior*) behind the upper part of the clavicle (in the *angulus venosus*), flows to the subclavian vein.
[55] On the onehand, the brain transports venous blood through the foramen jugulare, and on the otherhand, it collects the venous branches of the hard meninges, inner ear, pharynx, larynx, by *v. retromandibularis anterior* and by *v. facialis communis*.
[56] Fonahn, serial numbers 1110, 1111: '*derez*– sutura' The Arabic *daraza, yadruzu, darzun* means'sew'.
[57] Here is the opening (*foramen jugulare*) from which the internal jugular vein exits the skull.
[58] The internal jugular vein flows into the subclavian vein. Its collection area does not cover the area behind the ear and the nape of the neck, only the deeper areas of the whole head and neck. That is, the branches mentioned in the Arabic text belong to the external jugular vein.

of the head. The other branches also penetrate deep into the head at the end of the lambda suture, and then additional components are inserted into the two meninges (*ġišāʾiyā ad-dimāġ*) to nourish them and to connect the hard meninges (*al-ġišāʾ aṣ-ṣulb*)(dura mater) with what is around and above it.[59] He then rises to feed the membrane covering the skull (*al-ḥiǧāb al-muǧallil lil-qiḥf*). It then travels down from the soft meninges (*al-ġišāʾ ar-raqīq*) to the brain (*ad-dimāġ*) and branches into it like the arteries. The blood collected from the 'thick' (hard) meninges (*aṣ-ṣifāq aṯ-ṯaḫīn*) is taken to a spacious, open place (*al-faḍāʾ*) where the blood contains. From here, it branches off between the two meninges. This big place is called *maʿṣara* (torcular Herophili).[60] As the capillaries approach the central ventricle of the brain (*al-baṭn al-awsaṭ min ad-dimāġ*) (*ventriculus tertius*), they necessarily become larger blood vessels and are absorbed in the torcular Herophili.[61] Flights branch off from it and then extend further from the central ventricle of the brain to the two anterior chambers[62] (*al-baṭnān al-muqaddimān*) (*ventriculus lateralis*). The veins here meet the ascending arteries and form a network known as *aš-šabaka al-mašīmīya* (*plexus chorioideus*, vascular plexus in the ventricles). [63]

Anatomy of the veins in the hands[64]

As for *al-kitfī* (*al-katifī*) (*v. cephalica*), it is also known as *al-qīfāl* (*v. cephalica*). The first branches in the skin and at the back of the upper arm (*al-ʿaḍud*) are separated as it passes parallel to the upper arm. It then splits into three parts near the elbow joint:

1. One is the *ḥabl aḏ-ḏirāʿ* (a vein running upwards on the lateral side of the upper arm, *v. cephalica pollicis*)[65] which extends to the surface of the radius (*az-zand al-ʿaʿlā*)[66] and then the lateral - *waḥšī*) turns sideways in the direction of the bulging (*ḥadabat az-zand al-asfal*).[67] It is divided into branches at the bottom of the lateral parts of the wrist (*ar-rusġ*).
2. The second branch moves towards the elbow bend (*mʿaṭif al-mirfaq*) on the outside of the forearm (*as-sāʿid*) and mixes with the extension from *al-ibṭī* (*v. basilica*)[68].

Two of them will be *al-akḥal* (*v. nigra, v. mediana cubiti*)[69]

3. The third branch enters (into the upper arm) and there it mixes with the branch also from the *al-ibṭī* (*v. basilica*).

As for the *al-ibṭī* (*v. basilica*)[70], it first gives branches that dig into the muscle [the muscle of the upper arm], then branch out into it and end there, except for one that reaches the forearm (*as-sāʿid*). As in *v. basilica* comes the area around the elbow joint; splits in two[71]:

1. One of the two branches penetrates deeply and connects to the deep branch of the *al-qīfāl* (*v. cephalica*)[72] on the left side, and then runs next to it for some length before separating again. One of them goes down to the inner side (*al-insīy*)(*medialis*) until it reaches the little finger (*al-ḫinṣir*), the ring finger (*al-binṣir*) and half of the middle finger (*al-wusta*). The other branch passes upward and is separated into several parts in the back of the hand.

[59] The hard meninges (*dura mater*) are fibrous, dense connective tissue discs with endothelial-lined dura ducts (sinuses) in which venous blood flows from the brain. This is the oute rlayer of the brain, under which a layer of loose connective tissue covers the surface of the brain like a „cobweb" (*arachnoidea*). This layer contains no blood vessels. The third meninges (*pia mater*) lie snugly against the surface of the brain, filling all the fissures and ditches (sulcus/sulci), rich in blood vessels. Together with the arachnoidea, they form the soft meninges (*leptomeninx*).

[60] Fonahn, serial number 1961. Torcular Herophili is the confluence of venous sinuses at the protruding part nape of the skull. (Connecting point of lateral, sagittal, and occipital venous sinuses.)

[61] The internal cerebral veins flow from the right and left into the large cerebral vein (*v. cerebri magna*, Galen's vein) at the upperwall of the 3rd brain chamber. This vein flows into the *sinus rectus* and then to the connecting point of the cerebral venous sinuses (torcular Herophili). From here it enters a venous sinus (*sinus sigmoideus*) that bends in an "s" shape, from which the blood will be removed from the skull by the internal jugular vein.

[62] The lateral ventricles have front, rear and lower horns. Here in the text we are only talking about the front horn. (A more detailed description of the anatomy of the brain can be found in another chapter: Ibn Sīnā 1987: Volume 2 / Book 3. 807 p.) The two lateral ventricles and the third ventricle between them, are located in the cerebellum. The anterior horn of the lateral ventricle is in the frontal lobe, the posterior horn is in the occipital lobe, and the lower horn is in the temporal lobe. In a horseshoe shape, they surround the third ventricle between the two hemispheres, a narrow cavity between the thalamus and the hypothalamus. Each of the lateral ventricle produces liquor. From the lateral ventricles, the liquor enters the third ventricle, and from there to the fourth one through the ducts and openings between the ventricles.

[63] Fonahn, serial number 2957.

[64] The hands are palms forward next to the body. In this baseline, the two bones that makeup the forearm are parallel to each other, so that the radius is on the lateral side, while the ulna is on the medial side (supinatio: parallel position). If the hand is palm backwards, the two bones are transverse to each other (pronatio). Knowledge of this is required to interpret and track the description of blood vessels.

[65] Fonahn, serial number 1488.

[66] Fonahn, serial number 3683.

[67] Fonahn, serial number 3684.

[68] *v. basilica*: basilic vein, medial skin vein of upper limb

[69] Between the cephalic vein and the basilic vein there are thick anastomoses in the area of the elbow region, which are superficially located, one of these connecting blood vessels being the *v. mediana cubiti*. Fonahn, serial number 100. (*vena nigra*, black vein)

[70] Fonahn, serial number 1612.

[71] *v. basilica:* collects the capillaries of the skin veins of the back of the hand in the ulnar direction.

[72] *v. cephalica*: cephalic vein, the lateral vein of the upperlimb, collecting the skinv eins of the back in the radial direction.

2. The other extension from the two branches of the basilic vein split into four units at the forearm. [73]

2.1 One of its units divides from the lower parts of the forearm to the wrist.

2.2 The second unit branches over the first extension, just like the first unit.

2.3 The third branch is distributed in the middle of the forearm in this way.

2.4 The fourth branch is the largest, and it is the one that becomes visible. It goes upwards and sends branches to components of *al-qīfāl* (*v. cephalica*) and from them will be the branch of *al-akḥal* (*v. mediana cubiti*). Which is not related to them, that remains of the original unit of the *al-bāsilīq* (*v. basilica*). This blood vessel penetrates into the deep again.

The *al-akḥal* (*v. mediana cubiti*) begins on the inner side (*al-insīy*) (*medial*), then downwards on the forearm (*az-zand al-ʿaʿlā*) (on the radius) and then turns in the lateral direction (*ʿalā al-waḥšī*) and gives two branches, similar to the shape of the Greek letter lambda. Its upper part is placed on the side of the radius and runs to the wrist, then passes through the back of the thumb (*al-ibhām*), then runs between it and the forefinger (*as-sabāba*) and the index finger. The lower part turns in the direction of the ulna (*ilā ṭaraf az-zand al-asfal*) and divides into three branches:

1. One of the departments turns towards the place between the middle finger and the index finger and connects with the branches of the blood vessel, which return to the index finger from the upper part and merge with it as one blood vessel.
2. The second unit is called *al-uslīm* (*al-usaylim*) (*v. salvatella*)[74] which branches off between the middle (*al-wusṭā*) and the ring finger (*al-binṣir*).
3. The third extension extends between the ring finger (*al-binṣir*) and the little finger (*al-ẖinṣir*).

This part concludes the description of the upwardly extending branch of the empty vein, which is the more minor part of the empty vein.

Anatomy of the downward empty vein (al-aǧwaf an-nāzil)

The first downward part of the empty vein is the one that leaves the liver. Before it rests on the spinal column, it becomes hair-thin branches[75] that progress to the layers of the right kidney (*lafāʾif al-kulya*) (*v. renalis dextra*). It will branch out into it and the parts around it to nourish them. After this, a thick blood vessel separates into the left kidney (*v. renalis sinistra*), which is also divided into hair-thin branches in the sheath of the left kidney (*lafāfat al-kulya al-yusrā*), and in the parts close to it to nourish them. Then two large blood vessels, called the *aṭ-ṭāliʾūn*[76] (*vv. renales*), separate from it [from the downward empty vein] and travel to the two kidneys to clean the watery part of the blood (*māʾiyat ad-dam*). The kidneys extract their contents (*ġiḏāʾuhā*) from the two kidney veins, the aqueous part of the blood, and one blood vessel from the left blood vessel goes to the left testis in men and the left ovary in women.[77]

Like the arteries, the veins travel similarly, branching out, in the testicles and ovaries. The blood vessel that goes to the left kidney always 'absorbs' its contents from the left renal vein (*yaʾẖuḏu ʿabbatan minhu*). And the blood vessel that goes to the right kidney gets its food from the right kidney vein. In the kidneys, there is a duct in which the sperm (*al-minā*)[78] get mature. The sperm is originally red, given its white colour only by the thickness and roundness of the wall of the blood vessels in the conduit and by the effect of a substance originating in the spinal column.[79] Much of this blood vessel is absorbed in the penis and cervix and, in places already mentioned in the description of the arteries and renal veins. A branch rests against the empty vein along the spine and starts down. It gives a branch to each vertebra, penetrates and branches into the muscle at the vertebrae, -veins branch toward the two hips and end at the abdominal muscles. There are blood vessels that travel into the openings between the

[73] In the elbow bend the basilic vein on 2 branches, the cephalic vein splits into 3 branches. In the forearm, the arteries are accompanied by 2-2 veins, called 'accompanying veins.'

[74] Fonahn, serial number 3630. The salvatella vein passes between the 4th and 5th hand bones.

[75] They do not branch out from the liver, but belong to the visceral branches of inferior vena cava. The under the liver part of the inferior vena cava contacts the medial edge of the right kidney and the right adrenal gland.

[76] Fonahn, serial number 3206.

[77] The testicular vein leaves the test is through the seminal cord and from the left test is flows into the renal vein, while from the right test is joins the inferior vena cava. Around the middle of the*m. psoas major*, the *ureter* intersects obliquely in men with the testicular artery (*a. testicularis*), in women the ovaric artery (*a. ovarica*) and the surrounding braided veins (*plexus pampiniformis*).

[78] Sperm are produced by germ cells in the inner half of the testis and mature in the epididymis. The *funiculus spermaticus* (seminal duct) enters the pelvis through the groin as part of a seminal cord containing blood vessels and nerves. Its widened section extends to the bottom of the bladder and then merges between the bladder and the urethra on the inside of these minal vesicle with its outlet tube.

[79] The duct in the kidney is the *ureter*, which has a part of the abdomen (*pars abdominalis*) and a pelvis (*pars pelvina*). In the abdominal section, the urethra intersects with the internal spermatic artery (*a. spermatic ainterna*). Under the paired renal artery, the paired internal spermatic artery (in men) and the paired ovaric artery (in women) originates from the abdominal aorta. It crosses the external iliac artery (*a. iliaca externa*) at the border of *pelvis minor* and *pelvis major.* In men, the ureter crosses the duct of semen in the pelvis minor, in women with uterine artery (*a. uterina*). Arteries are accompanied by veins everywhere. Because of this, due to the myriad crossings back and forth, it may have seemed to the medieval observer that the formation of the sperms had something to do with the kidneys and the leads from it. In the renal gate, the renal vein (*v. renalis*), the renal artery (*a. renalis*) and ureter they are behind each other. The inferior vena cava travels parallel to the spine, into the inferior vena cava arrives *v. renalis* after collecting smaller veins collected from the renal filter system. The image of sperm changing from red to white was probably the result of the entanglement of blood vessels and the urethra.

vertebrae to the spinal cord. When (the empty vein) reaches the last vertebra,[80] it turns in two directions: they turn to the right (*v. iliaca communis dextra*) and to the left (*v. iliaca communis sinistra*), and then both move in the direction of the thighs. Both give branches to ten before reaching the liver.

1. One branch (*v. iliaca externa*) moves towards the lumbar region (*al-matnā*n) (*regio lumbalis*).
2. The second branch (*v. iliaca interna*) is hair-thin and extends to the lower abdomen.
3. The third branch (branch of *v. iliaca externa*) is divided the muscle of the sacrum (*os sacrum*)
4. The fourth branch (branch of *v. iliaca externa*) is divided into the pharyngeal muscle *('aḍl al-maqʿada*) and the outer half of the tail (*ẓāhir al-'aǧuz*).
5. The fifth branch (*plexus uterovaginalis*)[81] in women turns towards and branches in and around the cervix (*'unuq al-raḥm*) and in the bladder (*al-maṯāna*) (*plexus vesicalis*). The vessel that leads straight to the bladder splits into two parts: one branches into the bladder, and the other turns toward the neck (*cervix*). This branch multiplies in the penis in men and is divided into a few components in women. Of the blood vessels that extend laterally to the uterus, some branches run upward to the breasts to connect them to the uterus (*v. epigastrica inferior*).[82]
6. The sixth branch (*plexus pudendalis*) moves towards the muscles of the pubic bones *('aẓm al-ʿāna*) (*ossa pubis*).
7. The seventh branch moves upward in the straight abdominal muscle. These blood vessels (*vv. epigastricae*) are connected to the ends of the blood vessels that descend from the chest towards the lower delicate part of the abdomen (*marāq al-baṭn*). From the origin of these descending blood vessels (*min aṣl hāḏihi al-'urūq*) are the blood vessels that reach the uterus in women (*plexus uterovaginalis*).
8. The eighth branch (*plexus panpiniformis*) extends to the genitals (*al-qubl*) in both men and women.
9. The ninth branch (*v. femoralis*) spans and adds units to the inner half of the thigh.
10. The tenth branch moves visibly from the urethra (*al-ḥālib*) towards the hips (*ilā-l-ḥāṣiratayni*) (lumbar region, *regio lumbalis*) (contact with the vascular descending vessels (*vv. epigastricae*)) with its end branches. Of the many small vessels, this is the one which eventually becomes a larger vessel (*v. testicularis*) and end in the testicles *('aḍl al-unṯayayn')*.[83]

The blood vessels that do not collect in the large blood vessel leading to the testicles go to the thighs and give larger or smaller branches. One of these branches goes to the muscle on the anterior surface of the thigh, and another branch deepens in the muscle (medial side) of the lower and inner halves of the thigh (*fī 'aḍl asfal al-faḫiḏ wa-insiyyihi*). Many small branches branch off deep in the thigh, which remains beyond these, becoming below the knee joint into three branches:

1. The lateral branch of these extends from the fibula (*al-qaṣabat aṣ-ṣuǧrā*) to the ankle joint (*mafṣil al-kaʿab*).
2. The middle branch moves downward in the knee flexion and leaves in the muscle's units inner half of the leg. Two units branch off, one of which penetrates deep into the leg. The other of the two tibias reaches the anterior half of the tibia and mixes with the extensions of the lateral unit.
3. The third branch, the *al-insīy* (*internalis, medialis*), turns to the veined side of the leg (*al-mawḍiʿ al-muʿarraq*) and then goes down to the ankle on the convex side of the tibia (*aṭ-ṭaraf al -muḫaddab min al-qaṣaba al-ʿuẓmā / al-kubrā*). Then it moves forward from the middle, this is the *aṣ-ṣāfin* (*v. saphena*) [84]

[80] This is not the end of the spine, only the end of the vertebrae. The end of the dorsal vertebraeis in the lumbar region 4th-5th at the vertebrae, at the height of the *articulatio sacroiliaca*. Coming from the direction of the two hips where *v. iliaca communis dextra* and *sinistra* meet and flow here to inferior vena cava. Here in the description, the blood vessels proceed in reverse, as it is the medieval idea that the veins and not the arteries are the ones that deliver nutrients to the organs.

[81] This branch already belongs to the internal iliac vein (*v. iliaca interna* or also known as *v. hypogastrica*). The *hypogastric vein* transports blood from the organs of the pelvis. There are well-developed venous braids around the organs here: 1. *Plexus haemorrhoidalis* (around the rectum), 2. *Plexus vesicalis* (around the bladder), 3. *Plexus pudendalis (*around the pubic bone, bladder and urethra), 4. *Plexus uterovaginalis* (around the uterus and vagina).

[82] *Inferior epigastric vein* branch of *external iliac vein*.

[83] The testicular vein leaves the testicle in the seminal cord. Here in the description it goes exactly the other way around. On the right it flows into the inferior vena cava, on the left into the renal vein.

[84] The Greek and Arabic meanings of the name of the rose vein (*v. saphena*) differ significantly. While the meaning of the vein that Celsus still called the ankle vein (*vena ad malleolos*) was 'clear, visible, 'the Arabic word means 'hidden.' This is because, in contrast to other skin veins in the human body, which are well visible through the skin in a healthy state, the much of saphenous vein, which runs from the ankle to the thigh, cannot be seen, it remains hidden. However, it appears behind the inner ankle. It was also used for blood sampling in the Middle Ages. The rose vein used to be called 'tűnér' in Hungarian means 'disappearing vein.' His German name also reveals a lot about it: Frauenader (female vein) as women more often suffered from dilation of this blood vessel (varicositas, network varicose veins), Scheinader (false artery), or Rosenader (rose vein). The Arabic participle figure *ṣāfin* also means a horse, that stands on three legs, and bends one of its front legs. (Lane 1872: 1703). This condition contradicts the resting position of horses, in which one of their hind hooves is placed on their rim, and thus rested, since most of their body weight is carried by the front legs. While grazing, the horse can bend one of its front legs, thus he stands on three legs or, as Lane writes, the nomads can tie one of the front legs of the horse to its forearms to prevent them from wandering far away.

These three branches branch to four directions: Two lateral units start to the foot from the direction of the fibula (*al-qaṣabat aṣ-ṣuġrā*) and two units from the inside: one to the upper part of the foot and the little toe (*al-ḫinṣir*) branches off. The second department is the one that mixes with the side units that branched off from the previously mentioned internal branch (*al-insīy*). The latter two components off at the lower parts of the foot.

Description of the arteries (Ibn Sīnā 1987: Volume 1. / Book 1. 81-84 p.)

The 'pulsating blood vessels' (*al-'urūq aḍ-ḍawārib*), in other words, the arteries (aš-šarāyīn), were created to be bilayered[85] (*ḏāt aṣ-ṣifāqayn*). Of the two layers, the interior is more solid because it is the meeting point of the two layers. The essential nature of the divine soul (*ar-rūḥ*) (carried by the arteries) is its strong movement. The purpose of this is to protect and preserve its essence, to strengthen its keeping vessel.

The source of the arteries from the two cavities of the heart (*min taǧwīfay al-qalbi*) is the left cavity (*at-taǧwīf al-'aysar*) (*ventriculus sinister cordis*).[86] Because the right hole is closer to the liver, it is necessarily responsible for attracting and processing food.[87]

Anatomy of the venous artery (as-širyān al-warīdī) (arteria venosa / pulmonary vein)[88]

First, two arteries exit the left ventricle:

1. One of these ends in the lungs and branches off in it to absorb the breath and to carry from the heart to the lungs the blood that feeds the latter. Because the heart is the mediator of nourishment for the lungs, blood comes from the heart to the lungs. The origin of this blood vessel is in the most delicate part of the heart,[89] where the veins that enter it penetrate. This artery is single-layered, unlike other arteries, so it is called a venous artery (*aš-širyān al-warīdī*). It was created as a single layer to be more refined, more flexible, and more suitable for expansion and contraction. Thus it is better suited to disperse the fine-textured, vaporous blood into the lungs that corresponds to the essence of the lungs and is very similar to the blood that has matured in the heart.This blood does not need further maturation than the blood that enters the heart through the empty vein. Mainly not because the lungs are close to the heart, so hot, mature nutrients can be easily accessed. The part that pulses in it is a thin / small part, but you should not be afraid of it breaking apart during pulsation as it is vital. It does not need to increase its mass like the other strong arteries adjacent.

The arterious vein (*al-warīd aš-širyānī*) (*vena arteriosa* / pulmonary artery)[90] is close to the lungs; in fact, it is only the posterior part that runs past the spine.

The venous artery (*aš-širyān al-warīdī*) (*arteria venosa* / pulmonary vein)[91] branches only in the front half of the lung and then penetrates deep into larger and smaller parts. If we compare the strength (*al-wiṯāqa*) and the elasticity (*as-salāsa*) of this 'artery' (*aš-širyān al-warīdī*), which allows it to easily expand and contract and thus disperse the blood that is in it, then we find that it needs flexibility more than it does strength and thickness.

The other artery, whichever is greater, was called the aorta of Aristotle. As it exits the heart, it gives two branches: the larger one bypasses the heart; and offers branches in different parts (*a. coronaria sinistra*). The other unit, the smaller one, turns around and branches off in the right ventricle (*a. coronaria dextra*). What is left out of these two small blood vessels; it is the aorta itself. As it separates from the heart, it splits into two parts: the larger part (*arcus aortae / aorta descendens*) nourishes the descending blood vessels (*muraššiḥ lil-inḥidār*), as the smaller vessel (*truncus brachiocephalicus*) travels upwards into the blood vessels above the heart (*muraššiḥ lil-iṣ'ād*).[92] The artery (*aortic descendens*) that nourishes downward blood vessels has been created to accommodate the larger number and size of parts that are under the heart. At the aorta exit, there are three complex valves that open from

[85] The wall of each blood vessel (artery, vein) consists of three layers. The structure of the layers of the arteries varies, (not their number), depending on how close or far they are from the heart. In the description these are probably not essential layers, as they are not visible to the naked eye.

[86] Fonahn, serial number 3197.

[87] Here food becomes the substance of the heart. This is because the third digestion takes place in the organs, during which the food that comes in the blood, becomes the substance of the organ, that is, it is absorbed. The liver rules over the rightside of the body. According to the Galenic idea the liver is the place of the second digestion and here has the origin of veins and the site of blood formation.

[88] Fonahn, serial number 2988. The pulmonary vein (actually has not one but 4 pulmonary veins) arrives in the left atrium from the lungs and does not leave the left ventricle toward the lungs. The description of the role of the artery is rather fits pulmonary artery, starting from the right ventricle to the lungs. The two heart valves mentioned later (left venous or mitral valve), on the other hand, are true for pulmonary vein(s) in the left ventricle. 'The veins that come to him, to the finest part of the heart', can be pulmonary veins (*vv. pulmonales*).

[89] The right and left halves of the heart are defined not only anatomically but also philosophically. The left half of the heart, and within it the left ventricle, contains the finer, more ethereal matter. This is the nobler part of the heart, and the arteries that follow from it, which transmit the divine immortal part of the soul to the rest of the body, are nobler than the veins to the rightside of the heart (by the lower empty vein / *v. cava inferior*), which are denser, heavier, nutrient-filled blood is delivered. The wall of the left ventricle is actually the thickest part of the heart. This is where the great blood stream begins, the blood pumping into the aorta with tremendous force. The aortic valve therefore ossifies into older mammals in old age. (This has already been observed by IbnSīnā. 1987: Volume 2, Book 3. 1196 p.) The right ventricle has a much thinner wall than the left.

[90] Fonahn, serial number 3340.

[91] Only one lung vein is examined or described.

[92] Blood flows in the blood vessels very slowly, oozes, according to the idea taken from antiquity.

the inside out. [93] If there were only one or two valves here, it would not be enough to do its exercise just by increasing its size. It would be difficult to move the two valves. And if there were four valves here, they would have to be very small, unable to do their exercise. If they were to increase in size, the path of blood would narrow. The venous artery (*aš-širyān al-warīdī*) (*v. pulmonalis*) has two valves that turn inward,[94] and the number of its valves has been reduced to two because it does not require perfect calm. Here, more flexibility is needed to make it easier for fog-like vapors to break out, flow out, and blood to enter the lungs.

Anatomy of the ascending artery

Of the two branches of the aorta, the ascending branch (truncus brachiocephalicus) becomes bisected.

1. The larger (*a. carotis communis*) goes upwards towards the gum (*al-liṯṯa*)[95] and then turns diagonally to the right until it reaches the soft flesh of the thymus (*al-laḥm ar-raḫū at-tūṯī*).[96] Then it will split into three branches here. Two of these are the two arteries called as-subātān (*a. carotis*)[97] and rise to the right side and left side along with the two external jugular veins (*al-widāğān al-ġā'irān* / *v. jugularis externa*). The third branch (*a. subclavia dextra*) runs in the sternum (*al-qaṣṣ* / *sternum*), in the real ribs (*al-aḍlāʿ al-awwal al-ḫullaṣ* / *costae verae*)[98], and branches off in the first six cervical vertebrae at the sides of the clavicle (*al-tarqūwa* / *clavicula*)[99] to finally reach the tip of the shoulder (*raʾs al-katif* / *acromion*)[100] and then the various parts of the palms.
2. The smaller branch (*a. subclavia sinistra*) moves towards the armpit (*al-ibṭ* / *axilla*) (*a. axillaris*) and then divides into components like the third branch of the more giant. [101]

Anatomy of the two carotid arteries (aš-širyānān as-subātiyān / a. carotis communis sinistra et dextra)

Both carotid arteries split into two branches reaching the end of the neck:[102] an external (goes in front) (*a. carotis externa*) and an internal (goes at the rear) (*a. carotis interna*).

The branch in front (*a. carotis externa*) splits in two:

1. For an inner branch, [this branch actually belongs to the *a. carotis interna*], which extends to the tongue (*al-lisān*) and the inner half of the jaw muscle (*al-ʿaḍl al-fakk al-'asfal* / *musculus masseter*) (*a. maxillaris interna*).
2. An outer branch which rises upwards to the anterior half of the ears (*quddām al-uḏunayn*) to the temporal muscles (*ʿaḍl aṣ-ṣudġayn*) (*a. temporalis superficialis*) and leaves many branches in them while the top of the head (*qullat ar-ra*'s). Here, at the top of the head, the blood vessels originating in the right side and the left side respectively come together.

The posterior branch (*a. carotis interna*)[103] is also divided into two parts:

1. Most of the smaller branches move backward and branches into the muscle surrounding the joint of the head. The rest turns towards the posterior base of the brain (*qāʿida muʾaḫḫar ad-dimāġ*), inward into the old hole (*ṯaqb ʿaẓīm*)[104] at the lambda seam (*ad-darz al-lāmī*).[105]
2. The more giant then enters the hole in front of the spot, which is in the clavicle (*al-ʿaẓm al-ḥağarī* / *pars petrosa ossis temporalis*)[106] and continues towards the miracle net (*aš-šabaka* / *rete mirabile*).[107] From

[93] The aorta originates from the left arterial mouth and has 3 semilunar heart valves that originate in the inner perimeter of the mouth and open outward from the heart.

[94] The pulmonary vein opens into the left venous mouth, enters the left ventricle through two cuspidal valves. The heart valves open inwards towards the ventricle.

[95] Fonahn, serial number 266. The meaning of "gum" is difficult to interpret here, but the word means only that, in other dictionaries as well.

[96] Fonahn, serial number 1812. The thymus gland (thymus) is located above the heart, where the large blood vessels enter and exit the heart. The thymus leans against the base (upper part) of the heart, behind the grip of the sternum. In Arabic, "raspberry-like loose flesh."

[97] Fonahn, 2986, serial numbers 2987. Three arteries branch from the aortic arch: *truncus brachiocephalicus*, *a. carotis communis sinistra* and *a. subclavia sinistra*. The *truncus brachiocephalicus* then splits in two, and these are the *a. carotis communis dextra* and the *a. subclavia dextra*. So the rightside of the two common carotid arteries does not branch directly from the aorta, but starts from the brachiocephalic trunk towards the head.

[98] Fonahn, serialnumber 1136.

[99] Fonahn, serialnumber 3226.

[100] Fonahn, serialnumber 3226.

[101] From the subclavian artery (*a. subclavia*) to the armpit will be axillary artery (*a. axillaris*), then moving on to the upper arm called brachial artery (*a. brachialis*), in the forearm it is divided into radial artery (*a. radialis*) and ulnar artery (*a. ulnaris*) and then finally reaches the palm of the hand.

[102] The common carotid artery branches off at the lingual bone into an outside and an inside branch: external carotid artery (*a. carotis externa*) and internal carotid artery (*a. carotis interna*). This site is at the third cervical vertebra, at the upper edge of the thyrcartilage.

[103] The internal carotid artery actually travels without branching into the skull, where it is divided into several branches and is involved in the blood supply to the brain.

[104] The two carotises have a separate entrance opening into the skull, not through the 'bighole' (*foramen occipitali magnum*), but through two small openings (right and left) next to the 'bighole.' They enter the temporal bone through the foramen caroticum (through *canalis caroticus*) at the base of the pars petrosa belonging to the temporal bone.

[105] The lambda suture attaches the occipital bone to the two wall bones of the skull. (*sutura lambdoidea*)

[106] Fonahn, serial number 535.

[107] Fonahn, serial number 2956. The term rete mirabile was coined by Galen, who discovered the division of the internal right and left carotid arteries in some species of animals, but not in human. Joseph Hyrtl wrote about this: *Dieses Rete mirabile existirt wirklich, aber nicht im Menschen, sondern bei den Katzen, Schweinen, Delphinen, und besonders entwickelt bei den Wiederkäuern, wo es seiner Grösse und seines Reichtums wegen.* (Onomatologia Anatomica. Geschichte und Kritik der anatomischen Spracheder Gegenwart. Wien, 1880: 450 p.) The internal carotid artery lacking in cow's brain (ruminate), but is

here, a network of blood vessels is intertwined with other blood vessels, and layers are deposited on layers, and grooves follow on the tracks; they cannot be separated from each other because they are connected, forming a network.[108] The blood vessels give branches forward, backward, right, left, spreading in the net (*aš-šabaka*) (*rete mirabile*). Then a couple of these gather; as if these two are worth the first. The meninges form a hole for them where they can ascend to the brain. They then branch into the soft meninges of the brain (*al-ǧišā ar-raqīq* / *pia mater*),[109] then into the brain (*ǧirm ad-dimāġ* / *medulla*),[110] inside, and into the thin membrane lining the inside (*ṣifāq buṭūnihi*).[111] It reaches the openings of the small blood vessels that previously ascended here, and then the beginnings of the small downward veins. [They climb, they descend] because this is the best way for the continuous flow of blood to reverse at the ends of the blood vessels. The ascending branch is where the immortal divine soul (*ar-rūḥ*) enters, which is subtle, agile, and has an upward motion, and has no need to turn by the vessel of the carrier or to be emptied. If this were to happen, it would lead to the emptying of the blood that carries it and make it harder for the soul to move because the soul is moving upwards more easily. The movement and subtlety of the soul are enough to manifest in the brain what is needed, and, the brain to heat it. Therefore it is covered with a net under the brain, and therefore the arterial blood returns, and with it the soul too, and it becomes similar[112] to the nature of the brain (mizāğ) after maturation. It then gradually becomes accessible in the brain and, in the network between the skull and the hard meninges.

Anatomy of the descending artery (descendant aorta) (aš-širyān an-nāzil) (aorta descendens)

The descending artery (*aorta descendens*) first progresses straight to the fifth vertebra[113] in contrast to the base of the heart (*ra's al-qalb*) where the thymus (*aṯ-ṯawṯa*) is also present as the support and reinforcement of the heart. It is located between it and the vertebrae of the spine (*'iẓām aṣ-ṣulb*) and the esophagus (*al-marī*). As soon as the artery reaches this place, it turns to its right so it does not pass through it. It then ascends to the diaphragm (*al-ḥiǧāb*), attaching to the membranes to not constrict the blood vessel.[114] After reaching the fifth vertebra, it takes a turn and starts down the spine until it reaches the sacrum (*'aẓm al-ʿaǧuz*). As it passes through the chest, it leaves hair-thin small branches that disperse in the blood vessels of the lungs (*wi'ā 'al-ri'a*) (*a. bronchialis*).[115] Its limbs reach the trachea and give branches at each vertebra along the way until it finally reaches between the ribs and the spinal cord. From the chest, two arteries reach the diaphragm (*al-ḥiǧāb*), separating to the right and to the left. One of the arteries (*aorta abdominalis*) branches to the stomach, liver, spleen.[116] A branch of the liver becomes free toward the bladder.[117] An artery then grows and goes to the mesenterium (*al-ǧadāwil*), which is located around the small intestine and colon (*al-amʿā' ad-diqāq wa-l-qulūn*).[118] Then three arteries separate from this (the

found in his eyes. The rete mirabile is a network of blood vessels in which many branches of the branching artery continue to merge into an artery again. Rete mirabiles lows down arterial blood flow. It is found in the cranial cavity, in the eye, in the glomeruli of the kidney. Galen believed that the life spirit (spiritus vitalis) was transformed into the animal (or animate) spirit (spiritus animalis) in rete mirabile and was then distributed throughout the entire body from the brain along the nerves.

[108] The artery, along with its bony duct, bend satright angles and reaches the sphenoidal bone almost horizontally. Its course here is peculiar: on eachside of the body of the sphenoidal bone there are sinuses in double membrans in which the venous blood of the brain flows. This vein of these sinuses is called *sinus cavernosus* and, in its cavity in addition to the internal carotid artery, important cerebral nerves also run. These formulas are connected by connective tissue beams that make the interior of the venous sinus cavernous, as described herein.

[109] According to Fonahn's dictionary (serial number 1407.) it is the *arachnoidea*. The arachnoidea does not contain blood vessels, while the soft meninges (*pia mater*) are rich in blood vessels. The *arachnoidea* and *pia mater* together form the soft meninges (*leptomeninx*). The soft meninges are the third meninges that lie tightly against the surface of the brain.

[110] Fonahn, serial number 1625.

[111] Among these blood vessels is, for example, the *posterior commonartery*, which establishes a connection to the *internal carotic artery* and between the posterior branch of the *posterior cerebral artery* (*vertebral artery*). The *choroidal artery* leads to the lateral ventricles of the brain and forms a dense loop system in them that produces liquor.

[112] As a result of the third digestion, which takes place in the organs and which actually corresponds to the use of the nutrient. The food brought by the blood will be part of the brain, absorbed, and incorporated into the tissues of the brain.

[113] The heart is located between the 2nd and 5th ribs.

[114] According to today's division, the descending aorta has a thoracic section (*aorta thoracica*) that extends from the end of the aortic arch to the diaphragm and the other (*aorta abdominalis*) that extends from the diaphragm to the abdomen. The thoracic aorta enters the abdominal cavity through the hiatus aorticus (aortic opening) of the diaphragm in front of the spinal column. This opening (tendonous ring) is between the two tendonous-structured legs (crus) of the diaphragm and the spine (at the height of the 12th vertebrae), so it is not affected by the contractions of the diaphragm, the blood supply to the aorta is continuous, i.e. it does not narrow the blood vessel.

[115] The visceral branches of the thoracic aorta include the arteries that supply the tissues of the lungs (*a.bronchialis*), the esophagus (*aa. oesophagae*) and the pericardium (*rami pericardiaci*).

[116] The odd visceral branches of the abdominal aorta supply the liver (*a. hepatica*), the stomach (*a. gastrica*), the pancreas (*a. pancreatica*), and the spleen (*a. lienalis*).

[117] One of the branches of the artery leading to the bladder, the internal iliac artery (*a. iliaca interna*) (*a.vesicalis inferior*) to the lower part of the bladder, or *aa. vesicales superiores*, which runs to the upper part of the bladder, i.e. does not originate from the liver.

[118] The odd visceral branches of the abdominal aorta supply blood to the small and large intestines. These are the (*a. mesenterica superior)* upper mesenteric artery supplies the small intestine and (*a. mesenterica inferior*) lower mesenteric artery supplies the colon.

mesentery):[119] The smallest of them reaches mainly to the left kidney and branches into its cover layers (*lifāt*) and the surrounding organs (*al-aǧsām*) and gives them life (*yufīduhā al-ḥayāt*).[120] The other two blood vessels go to the two kidneys so that the kidneys can extract the aqueous (liquid) part of the blood from them. These two blood vessels most often extract unclean blood from the stomach and intestines, then separate into two arteries and go to the testes / ovaries (*al-unṯayayn*).[121] Of the two, the artery arriving at the left is always associated in one piece with the artery (*a. renalis*) arriving at the left kidney. The artery that arrives at the left testicle may only come from the left kidney. And the artery that goes to the right testicle always comes from the largest artery (*aš-širyān al-'aʿẓam / aorta*). It is rarely associated with any blood vessel (*istaṣḥaba šay'an*) that reaches the right kidney. Then two smaller arteries separate from this large artery and branch into the blood vessels of the mesentery (*ǧadāwil al-'urūq / via venarum* / mesenteric vessels) that surround the rectum (*al-maʿī al-mustaqīm*) (mesorectum). The tributaries (šuʿab) branch out into the spinal cord (*al-nuḫā'*) and penetrate the cavities of the vertebrae. Some blood vessels travel to the hips, others to the testicles / ovaries. A small pair of these blood vessels — not the ones we will mention in the case of men and women — end at the anterior (*al-qubl*) and mix with the veins. As soon as the largest artery (*aorta abdominalis*) reaches the last vertebra, it splits into two branches, forming a Greek letter of lambda, along with the vein associated with it (*v. cava inferior*).[122] One branch turns to the right side, the other to the left side, then they pass the sacrum and run towards the thighs (*aa. iliacae externae*). Before returning to the thighs, both give branches to the bladder (*aa. vesicales*) and the navel (*a. umbilicalis*). They meet at the navel. This part is well seen in newborns.[123] In a fully developed fetus, the ends of these blood vessels dry out, leaving only their bases, from where the two arteries branch into the muscle in the sacrum. The artery, which extends from here to the bladder (*al-maṯāna*), branches into it (*aa. vesicales*), its ends reach to the penis (*al-qaḍīb*) in men (*a. pudenda interna, a. profunda penis*), in women to the uterus come (*a. uterina*). For women, this is a small pair of wires. The arteries leading to the legs first divide into two large branches in the thighs, laterally (*waḥšīyyan*) (*a. profunda femoris*) and medially (*insīyan*) (*a. femoralis*).[124] The outer branch also bends towards the inner side and leaves branches in the muscle there, then starts down and turns forward (*a. tibialis posterior*) and gives a large branch to the thumb (*al-ibhām*) and middle finger (*as-sabāba*).[125] The remainder straightens out of the blood vessel and passes through most of the leg (*a. peronea*) under the veins.[126] The arteries described include those that travel with the veins: for example, the two blood vessels from the liver to the navel in the abdomen of the neonate (*a./v. umbilicalis*), the branches of the venous artery (*a. pulmonalis / v. pulmonalis*), the artery to the fifth (back) vertebra (*aḍ-ḍārib an-nāfiḏ*) (*arcus aortae*) axillary artery (*a. /v. axillaris*), the two carotid arteries (*as-subātān / a. carotis dextra et sinistra*) blood vessels in the diaphragm, the blood vessels penetrating the shoulder with the lateral branches (*a. /v. subclavia*), the stomach (*a. /v. gastrica sinistra*)[127], the liver (*a. hepatica*, *vv. hepaticae*), the spleen (*a./v. lienalis*), the blood vessels leading to the intestines (*a./v. mesenterica inferior*), the blood vessels descending from the fine lower abdomen (*a./v. iliaca communis*) and the blood vessels, which branch off at the sacrum (*'aẓm al-'aǧuz*) (*a./v. iliaca externa* and *a./v. iliaca interna*). The artery (*aorta abdominalis*) rests tightly on the vein (*v. cava inferior*) that is in the muscle passing by the spine, so that the lower rank of the two carries the nobler (*liyakūn aḫassuhumā ḥāmilan lilašrafi*). As for the limbs, the artery travels deep under the vein to be hidden, and the vein gives it protection. The vein forms a kind of protective shield above it. Arteries are associated with veins for two reasons: one is that the veins attach to the membranes in which the arteries are lined and draw water (*tastaqī mimmā baynahumā min al-aʿḍā'*) from the

[119] It does not start from the mesentery, but the abdominal aorta branches off to both kidneys: *a. renalis sinistra et dextra.*

[120] According to the medieval idea, the artery transports the life force / spirit (spiritus vitalis) from the heart to the target organs. The immortal part of the soul, the pneuma, gives life to the organs.

[121] The internal spermatic artery (*a. spermatica interna*) and the ovaric artery (*a. ovarica*) branch off from the abdominal aorta.

[122] The end of the dorsal vertebrae in the lumbar region 4th-5th at the vertebrae, at the height of the sacroiliac joint. The abdominal aorta (*aorta abdominalis*) forks off into two iliac arteries (*a. iliaca communis*).

[123] The common iliac artery splits into two iliac arteries, which form an external branch (*a. iliaca externa*) and an internal branch (*a. iliaca interna*) on eachside. The internal visceral branches of the hypogastric artery (*a.hypogastrica* or *a. iliaca interna*) supply blood to the organs of the pelvis on the right and left sides, such as the bladder. In intrauterine life, one more branch was derived from the hypogastric artery. In the fetus, the main branch of hypogastric artery is umbilical artery (*a. umbilicalis)*, which adheres to bothsides of the bladder and then to the inner surface of the anterior abdominal wall, and run upto the umbilical cord, and through it to the navel ring. After birth, this artery is removed or transformed into a connective tissue bundle in the lateral ligament of the bladder. (*ligamentum umbilicale laterale*)

[124] The external iliac artery hides under the groin tape (*ligamentum inguinale*), and in the thighs like femoral artery (*a. femoralis*) progresses further down to the popliteal space. The largest branch is the *profunda femoral artery*, which originates a few centimeters below the inguinal region and immediately penetrates deep.

[125] The tibial artery (*a. tibialis*) is continuation of popliteal artery (*a. poplitea*) in the leg along the tibia. Its end is *dorsal pedis artery*, which runs from the center of the line between the ankles to the first metatarsal bone.

[126] Accompanying veins are veins that run parallel to the arteries and have a triple layer of walls. In the limbs from the middle of the brachial artery downwards, each artery is accompanied by two veins, the branches of which correspond to those of the arteries.

[127] Or *v. coronaria ventriculi*, which travels along the small curvature of the stomach and opens into the portal vein.

organs between them. The other is to take the water apart.[128]

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[128] In the muscle next to the spine, the artery travels over the vein, "the lower rank carries the nobler one," while in the limbs, on the contrary, the vein travels over the artery to protect it as a kind of "protective shield".

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Hidden Management of the Strike at UNAM 1999-2000

By Alejandro Cuevas-Sosa

Abstract- In addition to biomatter, the human *body* includes a *bioenergeme* (personal component of organized bioenergemal energy; BEG) and also a possible third virtual (temporary, potential) component as well or *biointerfaceme*. From my experience regarding *bioenergemal communication* (BELC, relative to the BEG) practice with BEGs that are either at the *BEL universe* (where the BEGs arrive after the body biocollapses, dies)or at the *biomaterial* (BML) *universe* (space-time), it is possible to biocommunicate with human BEGs regarding topics of mutual interest, like the strike in the National Autonomous University of Mexico (UNAM, acronym in Spanish) 1999-2000. Of course, any BEG can establish BELC from the BEL universe to any BEG at the BML universe and vice versa or between themselves there or here. In the biodialogue that we establish through any relaxation validated technique, the bioimage of a BEG would be a living and acting virtual biointerfaceme, just like the rest of bioimages that are formed during it or in dreams.

Keywords: *biomaterial-bioenergemal universes, bioenergemal communication, bioenergeme, neuromindego, national autonomous university of mexico, mexico city, strike.*

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I. Introduction

In BELCs from November 15 to 19, 2015, we invited BEGs of the former president of Mexico Ernesto Zedillo Ponce de León and some former rectors of the National Autonomous University of Mexico (UNAM). The BEG of Zedillo accepted that he promoted the strike in the UNAM from 1999-2000 in order to discredit the Institution. Thus, supporting people, national and foreign, who sought to appropriate it and dogmatize it. And that "I am ashamed and I apologize to all the university students who had to leave the Institution when my stupid neuromindego (brain, thoughts and ego; NMEGO) stopped UNAM". He acknowledged as his own those responses from a BELC that we had with him on October 11, 2008.[1,2] In the 2015 BELCs Zedillo's BEG accepted that he and former rector Francisco Barnes de Castro were in collusion to strike UNAM, which remained closed from April 20, 1999 to, say, April 24, 2000, a year and days of conflict. Barnes, at the beginning of the strike, surrounded by journalists, declared that he was prepared for a strike that was going "for a long time".[3] He acknowledged that the comment was irrelevant "because there I demonstrated or my BEG made it evident the plan against UNAM".[1] I never before thought of treating this problem in detail in the BEL investigation, until 2015 when I intuited it after the former rector of UNAM Guillermo Soberon Acevedo published his memoirs. All the BEGs mentioned agreed that their comments could be published.[1]

a) Protest

Convinced of the crude political handling of the strike at UNAM, from my part, on August 21 and September 25, 1999, I published two articles in the English medical journal *Lancet*[4,5] and on October 7, 1999, by invitation, I published an article in the English scientific journal *Nature*.[6] In the three articles, I denounce the political manipulation of the strike at UNAM, I call on the international scientific community to protest the strike and I invited it to the rescue of UNAM; furthermore, in the article published in *Nature*, I blame the university authorities for being in collusion with the Zedillo government to declare and sustain this deleterious strike. A couple of weeks after the article published in *Nature* and six months after the strike started: 1) Former rectors Guillermo Soberon Acevedo and Octavio Rivero Serrano went to a national television newscast to comment on the strike. 2) Also, two weeks after the above, on November 12, 1999, thirty-five days after the *Nature* article, to everyone's obvious relief, Barnes resigned from the rectory. And, 3) the following week, on November 19, 1999, almost six weeks after the article in *Nature*, Juan Ramón de la Fuente Ramírez, then Secretary of Health (1994-1999) of the Zedillo government, was appointed rector. Juan Ramón knew how to calm the mood that were very exacerbated. I only note three antecedents, 1) that on August 5, 1999, two weeks before the first article in *Lancet*, Barnes threatened that if the work stoppage continued, UNAM could "close its doors indefinitely".[3] 2) On November 10, 1999, two days before Barnes' resignation, 64 members of the University Council supported him and only 10 were against it.[3] In other words, there was a majority of members of the Council who were involved, by omission or by commission, in the problem. And, 3) that between August 25 and 28, 1999, just a week after the first article in *Lancet*, Zedillo changed his distant and elusive speech of the university conflict for one in which he issued an ultimatum to the strikers to end the strike before "using State methods".[3]

Everything is that the three articles began to circulate, we were able to send multiple letters abroad

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with copies of them. We addressed various international organizations and personalities. We received multiple samples of support. The BEG of Zedillo recalled that it gave instructions to the Ministry of Foreign Affairs stating that "it was urgent to give an answer" and that the problem was going to be solved. He himself, referring to an international meeting, added that: "Someone commented that the highest academic institution is in trouble and, when this happens, the country goes bankrupt: 'put beams and good foundations for your institution, otherwise your country will come down', they told me". The BEG of Rosario Green Macias, Secretary of Foreign Affairs at the time, specified: "We only had to give a brief answer and of a solution, because they wanted to know what to answer you".[1]In Zedillo's opinion, the above was to "fix what had already gotten out of hand" and that the articles gave rise to "an international alarm and led to this stopping, otherwise it would have continued". He ordered that they "find out" about me, but that at UNAM "there was sufficient information". He admitted that the three articles also influenced to change his closure against the UNAM. Soberon acknowledged that in his memoirs he comments on this matter of the strike "collaterally but not specifically". Rivero reproaches himself: "My folly in supporting meaningless projects".[1]

Regarding the strike, Zedillo ordered that they be made known: "Only the publications of authorized newspapers". Juan Ramón knew about the three articles, but Soberon insisted: "They should not be considered or disseminated". Soberon accepted that this was the case and that he did it because of: "The forceful way in which events are discussed". He added that he would have liked to take that initiative, thus the articles had not been published, that the "merit" would have been his: "And that would have been a moment to remember".[1,4-6] Hence, these data are not mentioned in his memoirs either. Regarding the publication of these articles, the BEG of Juan Ramón assured: "Fortunately, doctor, you indeed listen to your BEG and made known the events as they were presented, and hence the problem has been resolved, because it was spoken with the appropriate people so that it was solved and terminated". Both the Zedillo and Soberon BEG affirmed that both were subjected to sexual abuse in childhood.[1,2] His parents blamed Soberon as a child for having caused the sexual abuse he suffered and, for this reason, they beat him; no support from them for their child. Based on this antecedent, Soberon justifies how corrupting and unsupportive he is.[1] And the BEG of Zedillo accepted that he likes to grope men, children and ephebos.[1,2]

b) Destructivity of Guillermo Soberon Acevedo

Being Secretary of Health (1982-1988), Soberon tried to alter or disappear the General Hospital of Mexico, for patients with few resources, located in Mexico City (CDMX, acronym in Spanish). At that time, I published a newspaper article: *La function médicosocial del Hospital General*. [*The medical-social function of the General Hospital*.] El Día, p. 21, October 30, 1985. According to Soberón, after this article he stopped that project and admitted that he did not address this issue in his memoirs either and recognized that they only contain half-truths. For UL, a BEG close to Soberon, "it is inevitable that when a NMEGO [the one from Soberon] agrees to act in this way, it is prevented from living peacefully. Let's say that he himself has his own sanction, he is a man who lives permanently burdened". Moreover, the BEG of Jaime Martuscelli Quintana, advisor to the UNAM rectory, believes that Soberon fears that he will speak "because he knows that he has corrupted many people and the truth is always known".[1] Juan Ramón's BEG stated: "It's good that there are voices that speak out when others we are silent, but that we also support. Congratulations!"[1]

c) Upgrade

BEL communications on February 5 and June 12&14, 2020. In the rectory of the UNAM is Enrique Graue Wiechers, who, competing with Barnes, is emerging as the most negligent predator to ever occupy that position. He held back a bit in his first quadrennium, but in the second term he sank into despair. Well known public facts suggest that he has finished organizing a gang of hooded men whose BEG assured they are paid with cash or drugs. Drug addicts are those who carry out the most violent and destructive operations against university students, men and women, and against the facilities, leaving most of them useless. But now, Graue is desperate because these cloaked men have already gotten out of control, annoying the community without any restraint and occupying schools and colleges at the time they want and even disregarding the order to hand them over, pressuring them to give more money and/or drugs. All with absolute impunity, they are untouchable, neither the UNAM nor the local government promote any action to stop them. The manipulated autonomy of the university is the perfect parapet.

d) Behavior of Enrique Graue Wiechers

Graue's BEG accepted that the Ophthalmology Institute that he built in front of The American British Cowdray Hospital in CDMX, was partly built it by diverting resources from the UNAM; in this regard he stated: "I shouldn't have done it, doctor". He also admitted owning a "construction company," which is "in the name of a relative". It would not be difficult for this to be the one in charge, at UNAM, of the restorations. The formula is very simple: build => destroy => rebuild => huge profits by inflating prices. Graue has had a meteoric career at UNAM, so I affirmed that it appeared that everything was fixed, and Jaime Martuscelli Quintana's BEG pointed out: "That everything was bought". Graue, in the BELC of December 19, 2021,

accepted that this was the case. If he bought the positions he has had and the one he has now, he will feel an uncontrollable urge to get his money back, and even more, before this second four-year term is over.

e) Enrique Grauerudeness

Graue had stated several times "I am not afraid" (just like a sociopath). But finally, his BEG landed him and he said he felt "discovered", that he feels "the need to" slow down; and to UNAM and Mexico he says: "I feel trapped, discovered and scared; it is not easy to deceive others. We are not an example to follow, as we are also a fraud. I owe a lot [to Mexico] and I am very sorry to have deteriorated the image of UNAM" (almost a sociopath). In case something is missing, the BEGs of the drug dealers who thrive on the University Campus affirmed that Graue: "He agrees with the negotiations for the sale of drugs in the faculties. He doesn't get involved, but he's involved" He didn't deny this either. Regarding a possible anger with the UNAM, the BEG of Graue asserted: "I have no anger with the UNAM, it is an anger with myself. It is a dissatisfaction with hoarding power and the need to benefit materially". Because people close to him: "They came to less and came to commit fraud". He went through hardships, then. Graue's BEG let us know that he has been taking high doses of tranquilizers for more than two decades, which, ignorant of the side effects, have damaged his kidneys, causing, as a first warning, high blood pressure. So, he takes antihypertensive drugs, by doing so, the message to his kidneys is that he does not understand the warning and continues to self-destruct. And he claims to be a physician. Scientific research does not interest him. Without a doubt, money is more addictive than drugs and together they form a 'social nitroglycerin' that holds humanity in check. UNAM is a non-profit educational institution in which 60% of the students receive a financial support scholarship. Graue remarked: "It bothers me to deal with screwed up people". A glaring contradiction.

f) Claudia Sheinbaum Pardo and Enrique Graue Wiechers: partners?

The BEG of Graue alluded to alleged "negotiations" with Claudia Sheinbaum Pardo, head of government of CDMX, because: "She is going to support the restoration and other schools are going to be built". What company repairs the damage perpetrated by the hooded men and women in CDMX? Claudia Sheinbaum's behavior may be similar to Graue's, but she denied any negotiation with him. However, Claudia Sheinbaum behaves as an ally of Graue, not of the UNAM. Do they both really care if there are conflicts of interest or not? For example, on September 9, 2021 the renowned UNAM researcher Alfredo Torres Larios was found dead inside his laboratory at the Institute of Cellular Physiology located on the University Campus. There are unknowns that it would be advisable to clarify about this case: (1) what was the motive for the possible murder (Alfredo's BEG affirms that this was the case); (2) since he was alone at his workplace, the assault was specifically directed at him (due to labor or partner conflict?); (3) it is necessary to discover who, national or foreign, could have watched him and perpetrated the homicide, and locally who provided the information to find him; (4) is it true that Alfredo Torres Larios was immobilized with a volatile anesthetic (chloroform and/or ether) or something similar?; and (5) was an anti-doping test performed on the autopsy fluids? It seems to be comfortable –although it shouldn't be so–or for any reason convenient to the authorities (of UNAM and CDMX) to declare what happened with this investigator as an "accident", but it has not yet been ruled out that he has been the victim of an assault that, to prove it, requires a professional investigation.[7] Is it taking place?

II. Conclusions

1) In a BELC performed on December 19, 2021 Guillermo Soberon Acevedo declared: "Doctor, it is a pleasure to greet you ... Whoever is in power loses the objective of his function at UNAM, as others we have lost it". At UNAM, he had an influence: "[regarding] mismanagement and the loss of its essence in the training of critical professionals".
2) Invited to the same BELC, the BEG of Matthew Walker, expert on sleep neurophysiology, stated: "Doctor, it is a real delight, it is a pleasure to be intuiting, that our BEGs have biocommunicated".[8]

Abbreviations: BELC, bioenergemal communication; BML, biomaterial; BEL, bioenergemal; BEG, bioenergeme; UNAM (acronym in Spanish), National Autonomous University of Mexico; CDMX (acronym in Spanish), Mexico City; NMEGO, neuromindego

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A Study to Evaluate the Effectiveness of Video Assisted Teaching (Vat) on Knowledge Regarding Prevention of Corona Virus among Staff Nurses Working in Ah & RC, B G Nagara, Karnataka

By Dipankar Maiti & Dr. Balaji MS
Rajiv Gandhi University of Health Sciences

Abstract- At present scenario COVID infection creates a pandemic and cruel deadly situation through worldwide. First case of Corona virus infection reported in Wuhan City of China in December 2019. Beginging from normal fever & common cold it becomes severe with the symptoms of breathing difficulty, persistent fever, loss of taste & smell etc. It travels through air from human to human as a form of droplet infection. So, to check and increases the knowledge regarding prevention of corona virus among staff nurses working in AH & RC, B.G Nagara, Karnataka; I have done one video assisted teaching (VAT) session. Among total 60 staff nurse I have divided them into two groups as follows: 40 members in Experimental group & 20 members in Control group. The data collection done from 01-10-2021 to 11-10-2021 in AH & RC, B. G Nagara.

Keywords: MERS, SERS, CDC, N 95, RT PCR, and VAT.

GJMR-K Classification: DDC Code: 305.26 LCC Code: HQ76.14

Strictly as per the compliance and regulations of:

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Keywords: MERS, SERS, CDC, N 95, RT PCR, and VAT.

I. Introduction

Corona Virus is an RNA virus mainly affects birds & mammals. The name "coronavirus" is consequent from Latin corona, denoting as "crown" or "wreath". At first, Coronaviruses were discovered in the year 1960. But later in 2012 a new type of coronavirus was identified, initially called Novel Coronavirus 2012, and now officially named as MERS-CoV. Chinese four family members have been identified with coronavirus in the UAE.[1] But now a days the frequent changing variant of Corona virus affecting humans & causing mild to deadly Respiratory problems including common cold, fever, breathing difficulty, loss of smell, loss of taste, even death in severe cases. In human more lethal varieties or strains of this virus are SERS (severe acute respiratory syndrome), MERS (Middle East respiratory syndrome), COVID-19 (Coronavirus disease 2019).[2] Based on the statistics dated 13 Aug 2021, 08:00 IST (GMT+5:30) in India Total active cases are 3,87,987; total cured 3,12,60,050; total deaths 4,29,669; total samples tested 48,94,70,779. The following states are in red light spotted areas due to over increasing COVID cases -Maharashtra, Delhi, Kerala, Andhra Pradesh, Karnataka.[3,7]

Experts believe that COVID infection mainly spreads through person to person through respiratory system by inhalation. Droplets or aerosols, Airborne transmission, Surface transmission, Faecal-oral- these are some routes of Corona Virus transmission.[4] The CDC endorses that by covering the mouth and nose with a tissue while coughing or sneezing by using inner part of the elbow is more convenient if no tissue is available around.[9] They suggest to do frequent hand washing too at least for 20 seconds if time is not adequate.[10] Using frequent hand sanitizer containing at least 60% alcohol also helps a lot to prevent spreading of COVID infection, but only when soap and water are not hardly available.[2]

COVID-19 reported symptoms include fever, pneumonia, haemoptysis cough, fatigue, headache, diarrhoea and dyspnoea. Preventive measures such as wearing masks, using hand hygiene practices, avoidance of public contact, case detection by doing more rapid & RT-PCR tests, contact tracing, and quarantines have been discussed as ways to reduce transmission.[8] As per latest studies no specific antiviral treatment has proven effective; hence, infected people primarily rely on symptomatic treatment and supportive care.[5]

A study was conducted in USA on November 4,2020 entitled as Interim Infection Prevention and Control Recommendations for Healthcare Personnel During the Coronavirus Disease 2019 (COVID-19) Pandemic. They have also mentioned to get updated about modes of transmission, clinical management, air or ground medical transport, or laboratory settings,

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current mode of testing & vaccination from the health care setting or physician.[6]

II. Objectives of the Study

1) To identify the knowledge of staff nurses giving care to COVID patients in experimental and control group regarding COVID prevention.
2) To determine the knowledge of staff nurses giving care to COVID patients in experimental and control group regarding COVID prevention after the administration of Video Assisted Teaching (VAT).
3) To evaluate the effectiveness of Video Assisted Teaching (VAT) by comparing post-test knowledge scores regarding COVID prevention between experimental and control group among staff nurses giving care to COVID patients.
4) To associate the pre-test knowledge scores with selected socio-demographic variables regarding COVID prevention among the staff nurses of COVID patients in experimental and control group.

III. Methodology

Methodology of research organizes all the components of study in a way that is most likely to lead to valid answers to the problems to have been posed.

a) Research approach

The selection of the research is a basic procedure for the conduction of research study. In view of the nature of the problem selected for the study and objectives to be accomplished, evaluative research approach was adopted.

b) Research design

The form research design denotes to a plan of a scientific study. Research design combines the most important methodology decisions that researches makes in leading a research study. It depicts the complete plan for organization of scientific examination. It helps the researches in choice of subjects, manipulation of the independent variable, observation of a type of statistical investigation to be used to interpret the data.

The research design selected for the present study was pre-test and post-test with nonequivalent control group design.

GROUP	PRETEST	INTERVENTION	POST TEST
Staff Nurses giving care to the COVID patients	Knowledge regarding COVID Prevention	Video Assisted Teaching (VAT)	Knowledge regarding COVID Prevention
	O_1	X	O_2

Key

O1 = Assessment of pre-test scores
X = Video Assisted Teaching (VAT)
O2 = Assessment of post-test scores

c) Variables under study

A notion which can take on different qualitative standards is called a variable.

d) Independent Variable

An independent variable is that stances alive and is not dependent on any additional.

In the study independent variable refers to the Video Assisted Teaching (VAT) on COVID Prevention.

e) Dependent Variable

A dependent variable is the variable the researcher involved in understanding, explaining or forecasting.

Knowledge of staff nurses about COVID prevention is the dependent variable in this study.

f) Population

The entire set of individuals or objects withsome common features.

In the present study the population comprised of staff nurses of COVID patients.

g) Sample and sample size

Sample: Sample is a subgroup of a population designated to participate in a research study. It is a position of the population which signifies the entire population.

In this study samples were staff nurses giving care to the COVID patients in the AH & RC.

Sample size: 60 staff nurses were selected.

h) Sampling technique

Sampling refers to the course of selecting the portion of population to signify the whole population. Non-probability convenient sampling technique was espoused for the present study.

i) Selection and development of tool

The tool selected in research must be the vehicle that acquires the best data for drawing conclusions to the study. The tool act as an instrument to assess and gather the data from the respondents of the study.

Keeping in mind a self-administered questionnaire was selected and developed. The main purpose behind developing this tool was need of the hour to educate the staff nurses of COVID patients. The tool was developed based on,

- Past clinical knowledge of the student investigator.

- Related review of literature (Books, Journals, Periodicals, and articles published and unpublished research studies) was reviewed and used to develop the tool.
- Based on the concept of the study.
- Based on the opinions of the subject experts.

Based on the purposes of the study, the blue print was arranged under 3 main areas namely information, conception and application. The arranged items were imperilled to content validation, pre-testing and estimation of reliability.

IV. Results

a) Presentation of Data

The analysed data has been organized and presented in the following sections: Section 1: Description of socio demographic variables of the caregivers in the experimental and control group.

The analysed data has been organized and presented in the following sections.

Section A: Description of socio-demographic variable of the COVID patient admitted in AH & RC.

Section B: Analyses and interpretation of pre-test and post-test level of knowledge of experimental group.

b) Data Collection and Analysis

Prior permission was obtained from the hospitals (Adichunchanagiri Hospital & Research Centre), B. G Nagara to conduct the study. The data was collected by the investigator from 01-10-2021 to 11-10-2021 in Adichunchanagiri Hospital & Research Centre, B. G Nagara. Pre-test was conducted on 01-10-2021 by distributing the questionnaire to the staff nurses of COVID patients; the time was taken for the completion of the pre-test was approximately 60 minutes. Soon after the pre-test the VAT was given to the participants. On 10th day 11-10-2021, the post-test was conducted by using the same tool, to determine the effectiveness of the VAT. The data obtained was analysed by using descriptive and inferential statistics in terms of occurrence, percentage, mean, standard deviation, paired 't' test and Chi-square test.

Pre-Test knowledge distribution

Table 1: Frequency and percentage distribution of pre-test level of knowledge of staff nurses in control and experimental group.

n=60

Level of knowledge	Pre-test			
	Control group (n=20)		Experimental Group (n=40)	
	Frequency (f)	Percentage (%)	Frequency (f)	Percentage (%)
Poor	16	80	30	75
Average	3	15	8	20
Good	1	5	2	5
Very Good	0	0	0	0

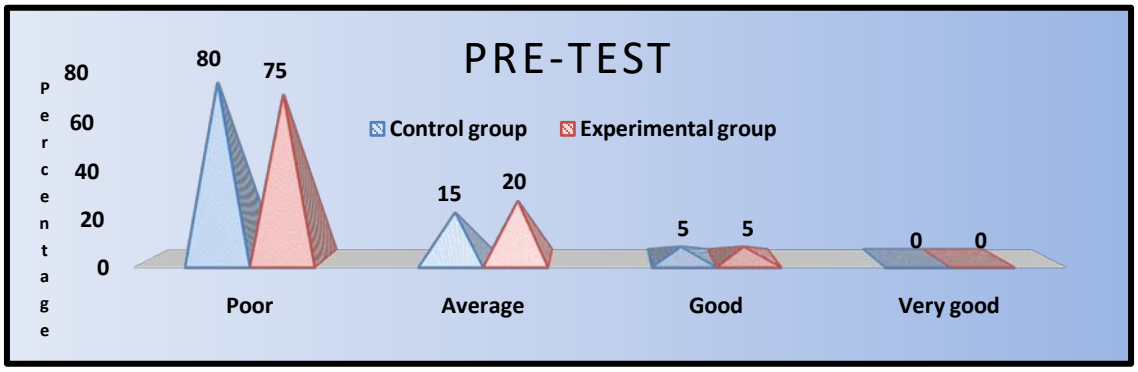

Fig. 1: Clustered pyramid diagram representing percentage distribution of pre-test level of knowledge of staff nurses in control and experimental group.

Post-Test knowledge distribution

Table 2: Frequency and percentage distribution of post-test level of knowledge of staff nurses in control and experimental group n=60

Level of knowledge	Post-test			
	Control group (n=20)		Experimental Group (n=40)	
	Frequency (f)	Percentage (%)	Frequency (f)	Percentage (%)
Poor	12	60	0	0
Average	6	30	3	7.5
Good	2	10	25	62.5
Very Good	0	0	12	30

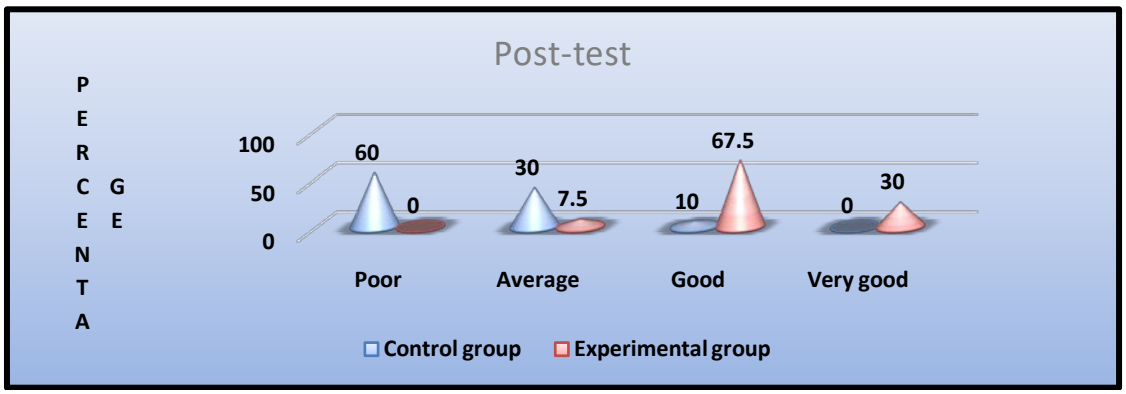

Fig. 2: Clustered cone diagram representing percentage distribution of post-test level of knowledge of staff nurses in control and experimental group

Area-wise Pre-Test & Post-test knowledge distribution

Table 3: Area-wise pre-test and post-test knowledge score between control and experimental group. n=60

Area	Max. possible score	Pretest				Post test			
		Control Group		Experimental group		Control group		Experimental group	
		Mean±SD	Mean%	Mean±SD	Mean%	Mean±SD	Mean%	Mean±SD	Mean%
Anatomy and physiology	6	3.4±1.4	56.66	3.9±1.5	65	4.1±1.5	68.33	4.94±1	82.33
Corona Virus Infection	15	7.5±3.3	50	6.96±2.76	46.4	10.65±2.64	71	12.75±2.22	85
COVID Prevention	14	3.45±1.4	26.53	4.2±1.69	32.30	4.025±1.78	30.96	8.71±1.48	67

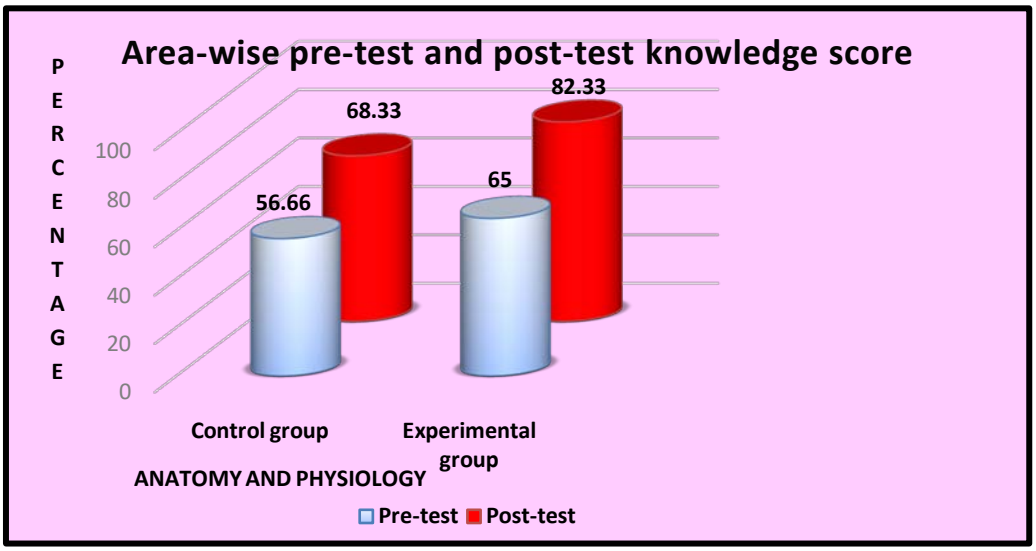

Fig. 3: 3-D cylinder diagram showing area-wise anatomy and physiology mean percentage of pre-test and post-test knowledge score between control and experimental group.

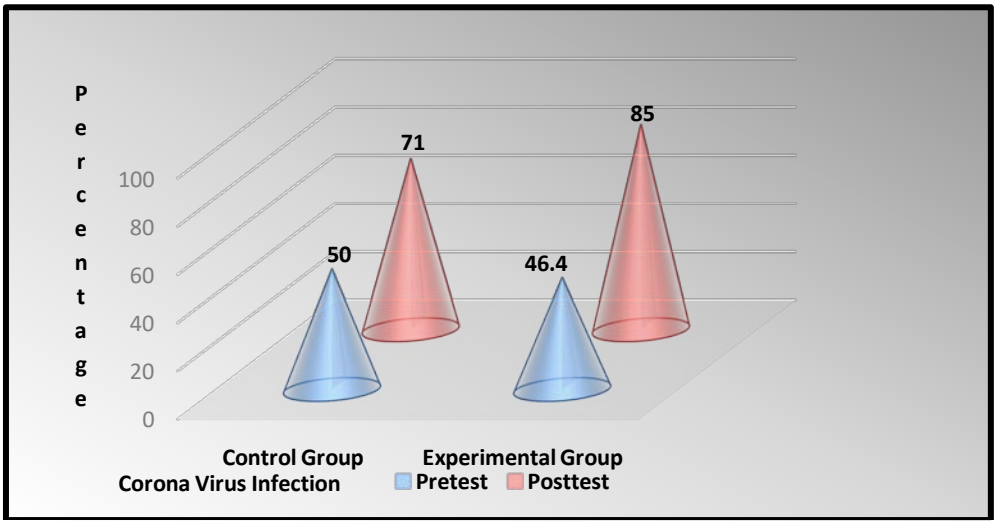

Fig. 4: 3-D cone diagram showing area-wise Corona Virus Infection percentage of pre-test and post-test knowledge scores between control and experimental group.

Fig. 5: Clustered column diagram showing area-wise COVID prevention mean percentage of pre-test and post-test knowledge scores between control and experimental group.

Effectiveness of Video Assisted Teaching (VAT)

Table 4: Effectiveness of Video Assisted Teaching (VAT) on COVID prevention n=60

Group	% of Pretest knowledge score	% of Post test knowledge score	% of Gain in knowledge
Control Group	35	37.42	2.42
Experimental group	35.86	80.29	44.43

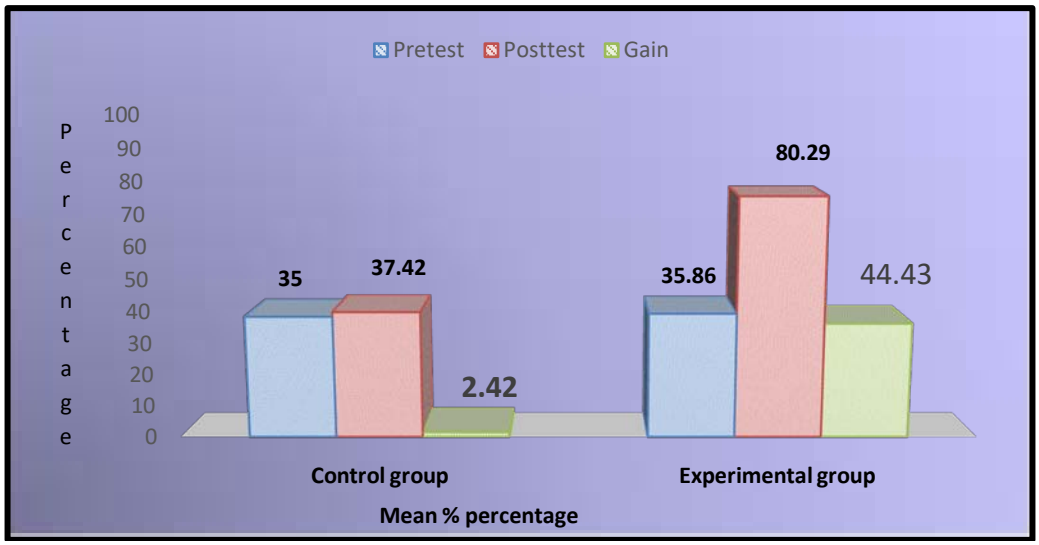

Fig. 20: 3-D clustered column diagram representing effectiveness of video assisted teaching in experimental group.

Inclusion criteria

a) Staff Nurses of COVID patient, willing to participate in the study.
b) Staff Nurses of patient infected with COVID who understand Kannada and English.

Exclusion criteria

a) Staff Nurses of COVID patients having visual and hearing defects.
b) Staff Nurses of COVID patients who are absent at the time of the study.

V. Discussion

Based on the objectives of the study, the findings of the pre-test knowledge score of staff nurses of COVID patients regarding COVID prevention shows that they were able to answer the questions up to some extent. In pre-test, staff nurses were having average 35% of knowledge in control group and 37.42% in experimental group in overall aspects. Staff Nurse's pre-test level of knowledge on COVID prevention shows 80% Poor, 15% Average, 5% Good in control group whereas 75% Poor, 20% Average and 5% Good in experimental group. Considering the aspects of COVID prevention, they are having below average knowledge.

Based on knowledge of staff nurses of COVID patients regarding COVID prevention above part of the study, findings of the post-test knowledge score of the staff nurses of COVID patients regarding COVID prevention shows that, staff nurses got 80.29% of overall score in experimental group after VAT. Post-test level of knowledge on COVID prevention says that 7.5% of them were having Average knowledge, 62.5% of staff nurses gained Good knowledge and 30% of them had Very good knowledge in experimental group and 60% Poor, 30% Average, and 10% Good knowledge in control group. Considering the post-test scores, staff nurses have shown adequate knowledge on all aspects in experimental group.

Based on the effectiveness of Video Assisted Teaching (VAT) regarding COVID prevention between the experimental & control group, the findings show significant increase in the post-test knowledge score after the administration of VAT. The post-test knowledge score in control group was 35.86% and the post-test knowledge score in experimental group was 80.29%. The difference between pre-test and post-test score was 44.43% in experimental group. In pre-test 35.86% of staff nurses were having inadequate knowledge in experimental group. After the administration of VAT, 80.29% staff nurses gained adequate knowledge in post-test. The result shows effectiveness of VAT on COVID prevention in experimental group.

VI. Conclusion

In conclusion the below mentioned initiation should be taken

1. Motivate the COVID infected patients and their family members to keep them updated with necessary knowledge with regarding aspects of COVID prevention & reoccurrence.
2. A suitable environment for learning could be maintained through regular clinical teaching and practice sessions on COVID prevention.
3. Regular different therapies should be demonstrated for gaining skill in COVID prevention.
4. A suitable counseling program should be conducted to the patient and staff nurses to strengthen psychologically.
5. The study suggests that respected government need to open more COVID care centers (CCC) in all areas to give more quality & significant care.

List of Abbreviation

CEST:- Central European Summer Time
MERS:- Middle East Respiratory Syndrome
N 95:- Non-Oil 95% efficiency
RT-PCR:- Reverse Transcription-polymerase Chain reaction
SERS:- Severe Acute Respiratory Syndrome
VAT:- Video Assisted Teaching
WHO:- World Health Organization
CDC:- Centres for Disease Control

Ethical Clearance: Ethical clearance has been obtained from the concerned authority and participants.

Source of Funding: The financial support relevant to this research studywas provided by the honorable Rajiv Gandhi University of Health Sciences.

Conflict of Interest: Have no conflict of interest relevant to this research study.

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About the Methods of General Treatment. Blood Vessels for Bloodletting in the Teachings of Ibn Sina

By Hikmatova Madina Furkatovna

Bukhara State Medical Institute

Annotation- I say that healing is done in three things. One of them is the regimen and nutrition, the second is the use of drugs and the third is the use of an action with the hand. By regime we mean the regulation of a limited number of necessary factors that usually exist; this includes food.

The prescriptions of the regimen correspond to the prescriptions of the drugs in terms of their quality. However, for nutrition, among these prescriptions there are special ones related to quantity, because food is sometimes forbidden, sometimes reduced, sometimes made in moderation, and sometimes increased in quantity.

Keywords: nutrition, food, medicine, hand action, relaxation, nature, dry, hot, cold, wet, IbnSina.

GJMR-K Classification: NLMC Code: WG 500

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Relevance

Indeed, food is forbidden when the doctor wants nature to be engaged in bringing the juices to a mature state, and they reduce the amount of food when the doctor's goal is to maintain the strength of the food. At the same time, attention will be paid to the strength, which may decrease, and to the bad juice, so that nature is not busy only with the digestion of a large amount of food. Attention is always drawn to what is more important, and such is either strength, if it is very weak, or illness, if the latter is very strong.

Food is reduced in two ways: 1) in terms of quantity and 2) in terms of quality. If you combine these two relationships, you also get a third relationship. The difference between the relationship of quantity and quality is this: there are foods with a large volume and low nutritional value, like vegetables and fruits, and if someone eats them in large quantities, then he increases the amount of food, but not its quality. There are foods that are low in volume but high in nutrition, such as rooster eggs and testicles.

We sometimes need to decrease the quality and increase the amount of food, namely, when the appetite is very strong and there are raw juices in the vessels. We want to satisfy the appetite by filling the stomach and to prevent a large amount of substance from entering the vessels in order for the substance already in them to mature first, and also for other purposes.

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Sometimes we need to increase the quality and decrease the amount of food. This happens in those cases when we want to increase the strength of the patient, but the nature that controls the stomach is so weak that it cannot cope with the digestion of food in large quantities.

For the most part, we strive to reduce and prohibit food when we are engaged in the treatment of acute diseases. We reduce food also in chronic diseases, but this decrease will be much less than the decrease in acute diseases, because in chronic diseases we are more concerned about the strength of the patient, because we know that the crisis of such diseases is far away, and their end is also far away. If you do not maintain strength, then there will not be enough strength until the moment of the crisis and it will not be enough to bring to a mature state of that, the period of maturation of which lasts a long time.

As for acute illnesses, their crisis is close, and we hope that the strength of the patient will not change him until the end of the illness. If we are afraid of this, then we will not excessively reduce food.

Whenever we are dealing with a disease that has begun recently and the manifestations of which are still calm, then we nourish such a patient in order to strengthen his strength. And if the disease begins to develop and its manifestations intensify, then we reduce the food in accordance with what was said above.

By doing this, we will shorten the time of the struggle of power. Before the end of the disease, we will significantly soften the regime.

The more acute the disease and the closer its crisis, the more we soften the regime, except for those cases when circumstances appear that prohibit us from doing so. We will mention this in the Book of Private Diseases.

Food, since it is eaten, has two more distinctive properties: 1) the speed of penetration, as, for example, in wine, and the slowness of penetration, as, for example, in fried meat and fried food in general, and 2) the ability to generate a thick blood that does not have fluidity, what comes from foods such as pork and veal; and the blood is thin, rapidly dissolving, which is the case from food such as wine and figs.

When we are willing to take action against the decline of animal power and want to raise it, and when

there is no time or energy sufficient to digest slowly digesting food, then we need fast-penetrating food. One should beware of giving fast-digesting food when it comes to eating previously-eaten, slowly-digesting food. Then we are afraid that both of them will mix and get what we have outlined above.

We are also wary of junk food after learning that blockages have begun to appear. However, we prefer highly nutritious and slow-digesting foods when we want to strengthen the patient and prepare him for vigorous exercise, and prefer light foods for those who have a faster pore thickening.

As for treatment with drugs, there are three rules for it: 1) the rule for choosing a medicine by its quality, that is, the choice of hot or cold, wet or dry, 2) the rule for choosing a medicine by quantity, and this rule contains the rule of measurement weight, and the rule for measuring properties, that is, degrees of hotness, coldness, and other things, 3) the rule for distributing the time of taking the medicine.

As for the rule of choice for the quality of drugs in general, the choice will go along the right path when recognizing the type of disease. Indeed, when the quality of the disease is understood, it is necessary to choose a medicine with the opposing quality, for the disease is cured by the counteraction, and health is preserved by assistance.

The quantitative measurement of a drug in two respects, taken as a whole, is made by the discernment of the medical arts, based on the nature of the organ, the degree of disease, and the factors that indicate the appropriateness and appropriateness of these drugs; these factors are gender, age, habit, season, country, profession, strength, and appearance.

Knowledge of the nature of an organ embraces the knowledge of four things: 1) the nature of the organ, 2) its natural structure, 3) its position and 4) its strength. As far as the nature of an organ is concerned, if its natural nature and its morbid nature are known, then through the insight of medical art it is known how much its nature has deviated from its natural nature; the amount of what will return nature to its natural state is determined. For example, if a healthy nature is cold, and a painful one is hot, it means that the latter has deviated from its natural nature very much, and strong cooling is needed. If both natures are hot, then a weak cooling is sufficient in this matter.

Regarding the natural structure of the organ, we have already said that it embraces several meanings - let them take a closer look at this place. Then know that some organs by their structure have convenient channels and have empty spaces inside and outside, and therefore the excess is removed from them with the help of mild and moderate medicines; others are not, and then there is a need for strong medicines. Some organs are also loose, while others are dense. For a loose organ, a light medicine is enough, and for a dense one, a strong medicine is needed.

Most of all, an organ that does not have a cavity at either of its two ends and does not have free space is in need of a strong medicine. This is followed by an organ that has this at one end. Then such an organ, which has free space on both sides, but itself is compact and dense, such as the kidneys. Then one that has cavities on both sides, but it is loose, such as the lungs.

As for the position of the organ, it is known to determine either the place of the disease or its complicity in the disease of another organ.

The use of the position of the organ associated with the knowledge of this complicity is especially important when you choose the side where the medicine is attracted and directed. For example, if the bad juice is in the convex part of the liver, then we remove it together with urine, and if it is in the deep part of the liver, then we remove it with the help of a laxative, because the convex part of the liver participates with the urinary organs, and its deep part - with intestines.

Using the location of the organ, they pay attention to three circumstances:

1) Its remoteness and proximity to the place of taking the medicine; if it is close, such as the stomach, then moderate medicines reach it in the shortest possible time and do their job there while maintaining their strength. But if an organ is removed, such as the lungs, then the strength of moderate drugs, before they reach the organ, is lost and therefore it becomes necessary to increase the strength of the drug. The strength of the medicine, meeting with a nearby organ, must be so great as to counteract the disease. If, however, there is a large distance between the organ and the drug, and there is a disease in which the drug, in order to penetrate the organ, needs a force that penetrates deeply, then it is necessary that the force of the drug be greater than required, such as medicinal dressings for inflammation of the sciatic nerve and other things;
2) Determining what needs to be mixed with the medicine so that it quickly penetrates the diseased organ: for example, a diuretic is added to medicines for the urinary organs, and saffron is added to heart medicines;
3) Determining from which side the medicine comes. For example, if we know that there is an ulcer in the lower intestines, then we inject the medicine through an enema, and if we suspect that there is an ulcer in the upper intestines, then we inject the medicine through drinking.

Sometimes both signs are taken into account together, that is, both the location and complicity of the functions of the organs. This should be done when the

bad juice has already completely poured into the organ, but should not be done if it is still pouring in. If the bad juice is still pouring in, we pull it away from that place, observing the following four conditions: 1) the opposite direction, for example, bad juice is drawn from right to left and from top to bottom; 2) complicity of the functions of organs, for example, menstrual blood is stopped by imposing two blood-sucking cups on both breasts, because in this case the blood is attracted to the accomplice; 3) correspondence, for example, in case of liver disease, bloodletting is done from the basil of the right hand, and in case of spleen disease - from the basil of the left hand; 4) the distance so that the place of attraction of the bad juice is not very close to the place from which the bad juice is drawn.

As for the case when the bad juice has already poured into the organ, then we act in two ways: either we remove it from the diseased organ itself, or we transfer it to a nearby organ that participates in the function of the first, from there we take it out, for example, in case of uterine disease we do bloodletting from the luteal vein, and in case of swelling of the tonsils, from a vessel under the tongue.

When you want to pull the bad juice in the opposite direction, first quench the pain of that organ from which the bad juice is attracted; at the same time, it is necessary to observe that the path of the bad juice does not lie through the dominant organs.

Using the power of the organ to determine the amount of medicine, there are three ways:

1) Take into account whether the body is dominant and initial. We are as afraid as possible to give strong medicines to the dominant organ, because then we will spread the harmfulness of the medicine to the whole body. Therefore, in necessary cases, we do not empty the brain and liver in one step and never cool them too much.

When we tie rags with absorbable drugs to the liver area, we must add astringent incense to them in order to preserve the strength of the liver. For the same purpose, we do the same when we give medicine to drink.

The most important organs in relation to which this rule is observed are the heart, then the brain, and after it - the liver;

2) Take into account the complicity of the functions of organs, even if these organs are not dominant, such as the stomach and lungs. Therefore, in case of fevers with a weak stomach, we do not allow the patient to drink too cold water.

Know that in general, the use of only one relaxing agent for the dominant and adjacent organs is very life-threatening;

3) The acuity or dullness of sensation is taken into account. Indeed, the very sensitive and nerve-rich organs should be protected from the use of drugs with bad properties, burning and painful, like yatu and others.

Medicines, from the use of which you need to refrain, are divided into three categories: stimulating resorption, cooling potentially, and having opposite properties, such as ragweed, tin white, burnt copper, and the like.

Here is a detailed rundown of medication selection.

As for determining the degree of the disease, then if, for example, during the illness there is a symptomatic high fever, it is necessary to cool it with a medicine with a very cold property; if with it there is a strong symptomatic cooling, then you need to warm it with strong heating drugs. If the heat and cold are not strong, then we are satisfied with the medicine, which has little strength.

As for drugs for a certain stage of the disease, then we must know in what stage the disease is. For example, if the tumor is in the initial stage, we use what only repulses it, and if it is in the final stage, then we use what causes resorption. And if the tumor is between these two stages, then we mix both drugs together.

If the disease in the initial stage is acute, then we moderately soften the regime, and if the acute condition continues until the stage of completion of the disease, then we soften more.

If the disease is protracted, then at first we do not apply such a softening of the regimen as before the stage of completion of the disease, although most of the chronic diseases, except for fever, are cured with the help of a light regimen. Also, if the disease is accompanied by a large amount of raging bad juice, then we empty the body at the initial stage of the disease and do not expect the bad juice to ripen. If it is in moderation, then we force it to ripen and then we do the emptying.

As for the testimony obtained from the moments requiring appropriate measures, it is easy for you to find out them. Air is one of those things; it is necessary to pay attention to whether the air is conducive to medicine or disease.

We say that if, if the necessary measures are taken to a later date or these measures are facilitated, the diseases become dangerous and there is no guarantee that the forces will not disappear, then strong measures should be taken from the very beginning. And when there is nothing dangerous, then it is necessary to move to stronger measures gradually, and only when light measures prove to be insufficient. See, do not avoid what is good, for otherwise the action will be delayed. You should also not stand on any erroneous position, because then you cannot eliminate the harm from it. Also, one should not stop at one treatment with one drug, but rather change the drugs. Indeed, one who is accustomed to one remedy does not experience its action. Everybody, even every organ and even the same body and one and the same organ sometimes

experiences the effect of drugs, sometimes does not experience or experiences the effect of one drug, and the other does not.

If it is difficult to determine the disease, leave it to nature and do not rush. Indeed, either human nature will prevail over the disease, or the disease will be defined.

If the illness is accompanied by some kind of pain, or the like, or something that caused pain, such as a blow and a fall, then one must start by soothing that pain. If you need to dull pain, then do not overuse drugs such as sleeping pills, because it, dulling the pain, becomes habitual and is eaten as edible. If you know that this organ is very sensitive, then feed the patient with something that very thickens the blood, for example, harisa; if you are not afraid of cooling, then give him such cooling agents as lettuce and the like.

Know that the number of good and effective treatments includes the use of something that enhances mental and animal strength, such as joy, meeting the patient with what he loves, and constantly finding him with a person who pleases him. Sometimes it is helpful to be constantly with courageous people and with those whom he is ashamed of. This removes some of the things that are harmful to the patient.

Moving from one city to another and from one climate to another, the change of one environment to another, is among the close to this kind of treatment.

It is necessary to oblige the patient to accept such a position and perform such actions that would correct the diseased organ and bring it to a normal nature. For example, a cross-eyed child should be obliged to stare at shiny things; a person with facial paralysis should be offered to look in a Chinese mirror. All this, truly, makes you try to straighten your face and eyes. Sometimes such efforts lead to recovery.

Some of the rules that you should remember are the following: as far as possible, you should not apply strong treatments during strong seasons; for example, in summer and winter, strong laxatives, cauterization with iron, opening and emetics should not be used.

There are also cases when treatment should be carried out after a subtle study, namely, when one disease requires two opposite measures. For example, the disease itself requires refrigeration, and its cause is warming, such as a fever requires refrigeration and a blockage that causes the fever requires rewarming; or vice versa. It also happens that, for example, a disease requires warming, and the phenomena caused by it require cooling.

So, a bad juice that causes kulandzh needs warming, tearing off and liquefying, severe pain from it - in cooling and dulling sensitivity; it happens and vice versa. Know that not every overflow of the body and not every bad nature should be treated by opposite actions, that is, emptying and counteracting the bad nature of the environment, and for the most part other good and important measures applied against overflow and bad nature are sufficient.

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3D Printing, Complement to Approach in Complex Lesions

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Abstract- The use of 3D printing is a technology in increasing expansion in the area of the medical sciences. We describe it the technical characteristics of 3D printing and a protocol of obtaining of models three dimensional as a complement to the imaging studies for the approach of complex injuries. 3D printing of five areas of interest corresponding to vascular lesions, spinal, renal and pulmonary by additive manufacturing technique. 1.75mm extrafill polylactic acid was used, following the imaging method DICOM medical, 3D reconstruction in format STL and G-code of each structure, being carried out Ender-3 computer printing. They were printed structures at a scale of 50-75% of the real volume, with average processing time of 32.4 min. This technology allows you to individualize care of patients with complex injuries, raising the quality of medical services, techers and decreasing the direct costs of care per hospital stay.

Keywords: 3D printing, polymers in additive manufacturing, 3D design, surgical planning, personalized medicine.

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Strictly as per the compliance and regulations of:

3D Printing, Complement to Approach in Complex Lesions

Impresión 3D, Complemento En El Abordaje Terapéutico De Lesiones Complejas

Boris Luis Torres [α], Gloria Castillo Lara [σ], José Antonio Travieso Rodríguez [ρ], Emilio Fidel Buchaca [ω], Jordi Llumà i Fuentes [¥] & Bárbara Adrover Monserrat [§]

Resumen- El uso de la impresión 3D constituye una tecnología en expansión creciente en el área de las ciencias médicas. Describimos las características técnicas de la impresión 3D y un protocolo de obtención de modelos tridimensionales como complemento a los estudios de imagen para el abordaje de lesiones complejas. Se realizó impresión 3D de cinco áreas de interés correspondientes a: lesiones vasculares, espinales, renales y pulmonarespor técnica de fabricación aditiva. Se usó Ácido Poliláctico extrafill de 1,75mm, siguiendo el método de obtención de imágenes médicas DICOM, reconstrucción 3D en formato STL y código-G de cada estructura, realizándose impresión en equipo Ender-3. Se imprimieron las estructuras a escala del 50-75% del volumen real, con tiempo promedio de procesamiento 32.4 min. Esta tecnología permite individualizar la atención al paciente con lesiones complejas, elevando la calidad de los servicios médicos, docentes y disminuyendo los costes directos de atención por estadía hospitalaria.

Palabras clave: impresión 3D, polímeros de fabricación aditiva, diseño 3D, planificación quirúrgica, medicina personalizada.

Abstract- The use of 3D printing is a technology in increasing expansion in the area of the medical sciences. We describe it the technical characteristics of 3D printing and a protocol of obtaining of models three dimensional as a complement to the imaging studies for the approach of complex injuries. 3D printing of five areas of interest corresponding to vascular lesions, spinal, renal and pulmonary by additive manufacturing technique. 1.75mm extrafill polylactic acid was used, following the imaging method DICOM medical, 3D reconstruction in format STL and G-code of each structure, being carried out Ender-3 computer printing. They were printed structures at a scale of 50-75% of the real volume, with average processing time of 32.4 min. This technology allows you to individualize care of patients with complex injuries, raising the quality of medical services, techers and decreasing the direct costs of care per hospital stay.

Keywords: 3D printing, polymers in additive manufacturing, 3D design, surgical planning, personalized medicine.

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I. Introducción

La fabricación aditiva hace referencia a aquellos métodos de fabricación por adición de material y utilizados con el objetivo de producir nuevos componentes complejos y durables, mientras que la impresión 3D consiste en fabricación de modelos o piezas finales de modo rápido pero de resolución limitada y normalmente se suele utilizar una forma concreta de técnica aditiva.[1,2]

El origen de la impresión 3D data de 1980 por el Dr Kodama, en 1981 este adquirió su primera patente en el Instituto Municipal de Investigaciones Industriales de Nagoya, al inventar dos métodos de fabricación aditiva de un modelo de plástico tridimensional, con un polímero fotoendurecible. En 1983 Charles W. Hull inventó la impresión por estereolitografía, y al año siguiente registró la patente de un equipo con este método de impresión, lo que fue el eje de la empresa "3D Systems", primera compañía de impresión 3D del mundo. Según los reportes, en menos de 10 años nació la impresión 3D, incorporándose como término al Medical Subject Headings (MeSH) en el 2015, representando una transición tecnológica bajo la teoría de: "SI PUEDES DIBUJARLO PUEDES IMPRIMIRLO"[3]

Este trabajo tiene como objetivo describir las características técnicas de la impresión 3D y el protocolo de obtención del modelode interés en un centro de atención médica, iniciando desde el procesamiento de las imágenes diagnósticas hasta la impresión de modelos orgánicos o regionales en patologías complejas susceptibles de tratamiento quirúrgico.

II. Método

El proceso de crear objetos tridimensionales a partir de un modelo diseñado con ordenador mediante programas de diseño asistido por computadoras, comienza por la realización de estudios diagnósticos de TAC o IRM, a partir de lo cual se desencadena el post procesamiento de las imágenes obtenidas hasta finalizar en la obtención de un modelo tridimensional físico de la región definida.[4]

a) Proceso de obtención de las imágenes y planificación de modelado e impresión 3D

1. Obtención de las imágenes de TAC o IRM en formato DICOM
2. Definir, crear y modelar el área de interés en 3D, realizando su procesamiento en el software Phillips, versión 8.0 LOT 8.0.2.2.20820; aunque es posible emplear para este fin diversos programas de procesamiento de imagen, algunos de ellos gratuitos y otros comerciales, que permitan realizar reconstrucciones 3D en TAC o IRM y ofrezcan la posibilidad de salvar la imagen en formato exportable STL(STereo Litograpy, Standard Triangle Language o Standard Tessellation Language); es un formato de diseño asistido por computadora, de tipo binario o ASCII, que define la geometría de objetos en 3D.
3. Creación de fichero G-Code: Consiste en a través de un programa denominado Slicer, abrir el fichero STL y crear un fichero G-Code (nombre de un lenguaje de descripción de operaciones para máquinas de control numérico por ordenador) el cual genera información útil para la impresora teniendo en cuenta varios parámetros como la velocidad, la temperatura, los parámetros de la máquina, dimensiones máximas y de material. A partir de lo anterior, el software va creando las diferentes capas (slices) que la impresora, partiendo de la base del objeto va a ir creando, capa a capa, depositando el material de filamento que sale fundido a través de la boquilla extrusionadora. El fichero G-Code contiene datos asociados a movimientos en determinadas coordenadas tridimensionales X, Y, Z, y asociadas a la expulsión de cierta cantidad de material en determinada posición.
4. Impresión: El fichero G-Code se carga a la impresora a través de un dispositivo Micro SD. Al reconocer el diseño; la impresora inicia el proceso tomando el filamento de polímero aditivo, enrolado en un carrete en su extremo superior izquierdo, lo va derritiendo en el cabezal extrusor a una temperatura que varía de 180-220 grados.

Con el plástico fundido la máquina va creando capa por capa elevándose décimas de milímetros entre cada una de ellas, continuando hasta finalizar la impresión del objeto.

La estrategia de impresión determina los caminos del cabezal de la máquina en la creación de la pieza. En este contexto, las piezas impresas se componen de dos zonas características: el contorno y el relleno. El contorno es la piel que delimita la pieza y se corresponde con los perímetros exteriores.[5] El relleno es el formado por las trayectorias que sigue la boquilla para llenar el espacio vacío que queda dentro del contorno. La velocidad de impresión también es un parámetro modificable. Se puede definir para cada zona de impresión, siendo independiente para los contornos, rellenos, capas superior e inferior, lo cual afecta directamente la cantidad de material extruido. [6]

La pantalla del equipo ofrece información referente a: temperaturas del equipo y la base de impresión, tiempo de la impresión (rango de error teniendo en cuenta si el área de interés es cavitada o no), velocidad de impresión y progreso de la de la misma expresada en porciento.
(Figura 1)

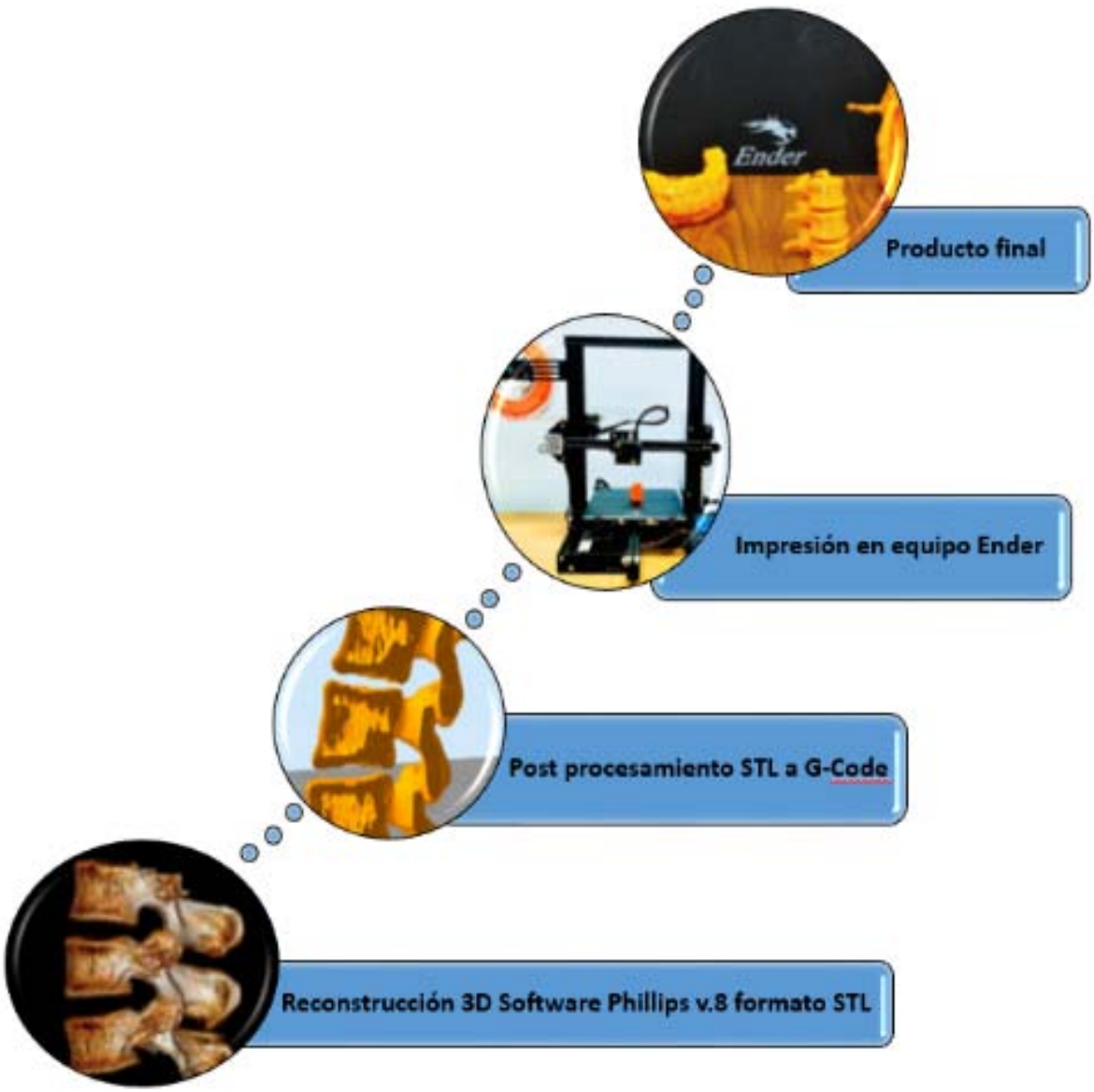

Figura 1: Procesamiento de imágenes médicas hasta obtención de área de interés impresa en 3D.

b) Características técnicas de la Impresión 3D

Ancho del filamento: Determinado por los diámetros de las boquillas de extrusión: 0,3, 0,4 y 0,6 mm. define el volumen y la superficie de los hilos extruidos, así como la superficie de soldadura entre filamentos.

Altura de la capa: Describe el grosor de cada capa y, por tanto, el número de capas que tendrá la pieza impresa. Afecta al volumen y superficie de los hilos, así como en la soldadura entre capas. El tiempo de fabricación es inversamente proporcional a la altura de la capa. Las capas más delgadas implican más capas para imprimir y más tiempo de producción.

Densidad de relleno: Representa la cantidad de material que se deposita dentro de los contornos. Evita movimientos relativos entre contornos y otorga robustez a las piezas.

Patrón de relleno: Define las trayectorias que sigue la boquilla para llenar el espacio vacío dentro del contorno. Cada patrón creará una geometría interior diferente que producirá diferentes comportamientos mecánicos.

Orientación: Los especímenes se imprimirán en la dirección de los 3 ejes de coordenadas: X, Y y Z.

Velocidad de impresión: Determina la velocidad de extrusión y deposición de los hilos. La velocidad se define para cada parte de la pieza (perímetros interior, exterior, roscas interiores, etc.) para optimizar el tiempo de fabricación. [5]

Tiempo promedio de impresión: variable teniendo en cuenta el área de interés, y el disello del relleno.

Contaminación acústica: mínima para ambiente de oficina mecanizada.

Consumo de energía eléctrica: 0.12kWh

Costo del consumo eléctrico en pesos nacionales: 0-100 kWh / 0.33 cup

c) Características de la impresora 3D

Modelo: Ender-3 3D.

Voltaje de entrada: 230V ó 115V

Material: Metal

Color: Negro

Dimensiones: LxWxH 20.87 x 14.96 x 7.87 pulgadas

Peso del artículo: 8.4 kg.

Calentamiento rápido, ocupando un tiempo de 3 minutos en calentar la boquilla (200-250 grados) y la cama caliente (50-60 grados) antes de empezar a imprimir.

La cama caliente de la impresora está hecha con vidrio de carbono, facilitando la retirada del modelo al culminar el proceso de impresión. Este equipo soporta reanudar la impresión de esta ser detenida voluntariamente o en caso de suspensión inadvertida del fluido eléctrico. En relación a los materiales gastables, el equipo soporta materiales de impresión como PLA (Ácido poliláctico)/ ABS (acrilonitrilo-butadienoestireno)/PETG (Polyethylene terephthalate)/ TPU (poliuretano termoplástico).[7]

Costo aproximado de la impresora: $ 260 (USD)[8]

Empresa: SHENZHEN CREALITY 3D TECHNOLOGY CO., LTD.

Materia prima: Filamento de polímero aditivo, PLA extrafill, diámetro 1,75mm, peso -mayor a 750g, trabaja a 190-210^0 de temperatura. Costo de 20.99-26.50 € por carrete.[9]

Objetivos propuestos

Impresión de modelos de áreas de interés para planificación quirúrgica en lesiones complejas.
Personalización de la atención médica.
Elevación de la calidad en la docencia médica.

Aprobación de la investigación

El presente estudio fue aprobado por el Consejo Científico del Hospital Clínico Quirúrgico "Hermanos Ameijeiras" y la Universidad Politécnica de Cataluña.

III. Resultados y Discusión

Tabla 1: Características de los modelos obtenidos y descripción de los parámetros de interés.

Área de interés	Descripción	Volumen respecto al tamaño real	Tiempo de procesamiento imagen DICOM-STL-G-code	Tiempo de impresión	Material empleado	Consumo eléctrico y costo (kWh/ $)
Espinal	Columna Lumbar 3 segmentos	70%	30 min	1h23min	PLA	0.17 / **0.33**
Vascular (Aorta)	Segmento abdominal de la a. Aorta, con sus troncos principales.	100%	25 min	2h20min	PLA	0.28/**0.33**
Vascular (Arterias ilíacas)	a. Aorta segmento abdominal y lesión oclusiva en a. ilíaca derecha	100%	30 min	2h02min	PLA	0.24/**0.33**
Riñón neoplásico	Lesión tumoral en polo inferior de riñon derecho	50%	37 min	1h18min	PLA	0.16/**0.33**
Tórax	Lesión neoplásica parahiliar derecha	25%	40 min	4h10min	PLA	0.44/**0.33**

La Impresión 3D constituye una tecnología de crecimiento sostenible, con personalización de la atención e innovación basada en el paciente dado por, la impresión de modelos orgánicos complejos sin la necesidad de moldes, empleo de diversos materiales biocompatibles o inertes como PLA, con buena resistencia a la tracción y calidad de la superficie, ideal para modelos y prototipos que requieran detalles estéticos para uso docente y asistencial, adaptando los

tratamientos acordes a las necesidades de cada paciente. [10]

Las piezas que fueron obtenidas tienen la ventaja de brindar asistencia profesional a los diferentes servicios médicos, aumentando un 25% el tiempo empleado en el procesamiento de las imágenes diagnósticas, con la ventaja de ser una tecnología de bajo coste en cuanto a consumo energético, apenas 2.88kWh en 24 horas, siendo económicamente de alta rentabilidad. [11] Esta tecnología al establecerse como complemento a la planificación quirúrgica de lesiones complejas brinda la posibilidad de individualizar la atención al paciente elevando la calidad de los servicios médicos y disminuyendo los costes; al facilitar el uso rentable de las salas quirúrgicas relativas al tiempo de equipo médico y paramédico e insumos, disminuir el tiempo de cuidado directo, el número de complicaciones transproceder y la necesidad de cirugías adicionales. [12-14]

En el área de Neurocirugía espinal, los beneficios de esta tecnología se basan en la disminución del riesgo de daño a estructuras vitales, principalmente en lesiones que involucran la unión craneoespinal, deformidades espinales por escoliosis y espondilolistesis, planificación de la cirugía espinal mínimamente invasiva y bioimpresión de discos intervertebrales. [15,16]

El número de documentos científicos referentes a impresión 3D por fabricación aditiva han aumentado desde 1987 con 556, hasta 2017 con 24.600, ubicados en la web de ciencia, lo que evidencia el interés creciente en la adopción de esta tecnología dado por sus ventajas económicas y la relación que muestra entre el éxito en la implementación y los resultados de la innovación.[14]

Referente a la contaminación sonora

El ruido es uno de los contaminantes más frecuentes en las oficinas incluidos los centros de trabajo no industriales. Ciertamente en estos ambientes rara vez se produce pérdida de la capacidad auditiva y aunque los niveles de ruido que se manejan están por debajo de los niveles dañinos, si producen otros efectos como: alteraciones fisiológicas, distracciones, interferencias en la comunicación o alteraciones psicológicas. Estos efectos son difíciles de valorar y, en la práctica, el ruido producido por la impresora en funcionamiento maneja niveles bajos de presión sonora (20-20000Hz), bajo nivel de interferencia conversacional bajos (rango de Noise rating aceptable en oficinas mecanizadas 50-55), tiempo de reverberación menor a 1 segundo.[17]

La alta rentabilidad (margen bruto que se aplica sobre el coste de los materiales oscila entre el 90 y el 95%, llegando incluso en algunos objetos hasta el 97%), los ahorros de tiempo y costo en el proceso de atención hospitalaria post proceder quirúrgico, su empleo para las investigaciones biomédicas y su uso en la elevación de la calidad del proceso de formación docente hospitalario, hacen que esta tecnología sea disruptiva, con establecimientopaulatino en el mercado internacional de los insumos médicos y en la atención médica personalizada.

Consideraciones éticas

La investigación se realizó conforme a los principios de la ética médica, a las normas éticas institucionales y nacionales e internacionales vigentes y a los principios de la Declaración de Helsinki.[18]

Fuente de Financiamiento

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Contribución de los autores

Boris Luis Torres Cuevas: Conceptualización, investigación, administración del proyecto, edición y revisión.

Gloria Esther Castillo Lara: Conceptualización, investigación, redacción, revisión y edición.

José Antonio Travieso Rodríguez: Adquisición de fondos, investigación, recursos y administración del proyecto.

Emilio Fidel Buchaca Faxas: Supervisión y validación.

Jordi Llumà i Fuentes: Software y metodología.

Bárbara Adrover Monserrat: Softwarey visualización.

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3. Ask your guides: If you are having any difficulty with your research, then do not hesitate to share your difficulty with your guide (if you have one). They will surely help you out and resolve your doubts. If you can't clarify what exactly you require for your work, then ask your supervisor to help you with an alternative. He or she might also provide you with a list of essential readings.

4. Use of computer is recommended: As you are doing research in the field of medical research then this point is quite obvious. Use right software: Always use good quality software packages. If you are not capable of judging good software, then you can lose the quality of your paper unknowingly. There are various programs available to help you which you can get through the internet.

5. Use the internet for help: An excellent start for your paper is using Google. It is a wondrous search engine, where you can have your doubts resolved. You may also read some answers for the frequent question of how to write your research paper or find a model research paper. You can download books from the internet. If you have all the required books, place importance on reading, selecting, and analyzing the specified information. Then sketch out your research paper. Use big pictures: You may use encyclopedias like Wikipedia to get pictures with the best resolution. At Global Journals, you should strictly follow here.

6. Bookmarks are useful: When you read any book or magazine, you generally use bookmarks, right? It is a good habit which helps to not lose your continuity. You should always use bookmarks while searching on the internet also, which will make your search easier.

7. Revise what you wrote: When you write anything, always read it, summarize it, and then finalize it.

8. Make every effort: Make every effort to mention what you are going to write in your paper. That means always have a good start. Try to mention everything in the introduction—what is the need for a particular research paper. Polish your work with good writing skills and always give an evaluator what he wants. Make backups: When you are going to do any important thing like making a research paper, you should always have backup copies of it either on your computer or on paper. This protects you from losing any portion of your important data.

9. Produce good diagrams of your own: Always try to include good charts or diagrams in your paper to improve quality. Using several unnecessary diagrams will degrade the quality of your paper by creating a hodgepodge. So always try to include diagrams which were made by you to improve the readability of your paper. Use of direct quotes: When you do research relevant to literature, history, or current affairs, then use of quotes becomes essential, but if the study is relevant to science, use of quotes is not preferable.

10. Use proper verb tense: Use proper verb tenses in your paper. Use past tense to present those events that have happened. Use present tense to indicate events that are going on. Use future tense to indicate events that will happen in the future. Use of wrong tenses will confuse the evaluator. Avoid sentences that are incomplete.

11. Pick a good study spot: Always try to pick a spot for your research which is quiet. Not every spot is good for studying.

12. Know what you know: Always try to know what you know by making objectives, otherwise you will be confused and unable to achieve your target.

13. Use good grammar: Always use good grammar and words that will have a positive impact on the evaluator; use of good vocabulary does not mean using tough words which the evaluator has to find in a dictionary. Do not fragment sentences. Eliminate one-word sentences. Do not ever use a big word when a smaller one would suffice.

Verbs have to be in agreement with their subjects. In a research paper, do not start sentences with conjunctions or finish them with prepositions. When writing formally, it is advisable to never split an infinitive because someone will (wrongly) complain. Avoid clichés like a disease. Always shun irritating alliteration. Use language which is simple and straightforward. Put together a neat summary.

14. Arrangement of information: Each section of the main body should start with an opening sentence, and there should be a changeover at the end of the section. Give only valid and powerful arguments for your topic. You may also maintain your arguments with records.

15. Never start at the last minute: Always allow enough time for research work. Leaving everything to the last minute will degrade your paper and spoil your work.

16. Multitasking in research is not good: Doing several things at the same time is a bad habit in the case of research activity. Research is an area where everything has a particular time slot. Divide your research work into parts, and do a particular part in a particular time slot.

17. Never copy others' work: Never copy others' work and give it your name because if the evaluator has seen it anywhere, you will be in trouble. Take proper rest and food: No matter how many hours you spend on your research activity, if you are not taking care of your health, then all your efforts will have been in vain. For quality research, take proper rest and food.

18. Go to seminars: Attend seminars if the topic is relevant to your research area. Utilize all your resources.

19. Refresh your mind after intervals: Try to give your mind a rest by listening to soft music or sleeping in intervals. This will also improve your memory. Acquire colleagues: Always try to acquire colleagues. No matter how sharp you are, if you acquire colleagues, they can give you ideas which will be helpful to your research.

20. Think technically: Always think technically. If anything happens, search for its reasons, benefits, and demerits. Think and then print: When you go to print your paper, check that tables are not split, headings are not detached from their descriptions, and page sequence is maintained.

21. Adding unnecessary information: Do not add unnecessary information like "I have used MS Excel to draw graphs." Irrelevant and inappropriate material is superfluous. Foreign terminology and phrases are not apropos. One should never take a broad view. Analogy is like feathers on a snake. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Never oversimplify: When adding material to your research paper, never go for oversimplification; this will definitely irritate the evaluator. Be specific. Never use rhythmic redundancies. Contractions shouldn't be used in a research paper. Comparisons are as terrible as clichés. Give up ampersands, abbreviations, and so on. Remove commas that are not necessary. Parenthetical words should be between brackets or commas. Understatement is always the best way to put forward earth-shaking thoughts. Give a detailed literary review.

22. Report concluded results: Use concluded results. From raw data, filter the results, and then conclude your studies based on measurements and observations taken. An appropriate number of decimal places should be used. Parenthetical remarks are prohibited here. Proofread carefully at the final stage. At the end, give an outline to your arguments. Spot perspectives of further study of the subject. Justify your conclusion at the bottom sufficiently, which will probably include examples.

23. Upon conclusion: Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium though which your research is going to be in print for the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects of your research.

Informal Guidelines of Research Paper Writing

Key points to remember:

- Submit all work in its final form.
- Write your paper in the form which is presented in the guidelines using the template.
- Please note the criteria peer reviewers will use for grading the final paper.

Final points:

One purpose of organizing a research paper is to let people interpret your efforts selectively. The journal requires the following sections, submitted in the order listed, with each section starting on a new page:

The introduction: This will be compiled from reference matter and reflect the design processes or outline of basis that directed you to make a study. As you carry out the process of study, the method and process section will be constructed like that. The results segment will show related statistics in nearly sequential order and direct reviewers to similar intellectual paths throughout the data that you gathered to carry out your study.

The discussion section:

This will provide understanding of the data and projections as to the implications of the results. The use of good quality references throughout the paper will give the effort trustworthiness by representing an alertness to prior workings.

Writing a research paper is not an easy job, no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record-keeping are the only means to make straightforward progression.

General style:

Specific editorial column necessities for compliance of a manuscript will always take over from directions in these general guidelines.

To make a paper clear: Adhere to recommended page limits.

Mistakes to avoid:

- Insertion of a title at the foot of a page with subsequent text on the next page.
- Separating a table, chart, or figure—confine each to a single page.
- Submitting a manuscript with pages out of sequence.
- In every section of your document, use standard writing style, including articles ("a" and "the").
- Keep paying attention to the topic of the paper.
- Use paragraphs to split each significant point (excluding the abstract).
- Align the primary line of each section.
- Present your points in sound order.
- Use present tense to report well-accepted matters.
- Use past tense to describe specific results.
- Do not use familiar wording; don't address the reviewer directly. Don't use slang or superlatives.
- Avoid use of extra pictures—include only those figures essential to presenting results.

Title page:

Choose a revealing title. It should be short and include the name(s) and address(es) of all authors. It should not have acronyms or abbreviations or exceed two printed lines.

Abstract: This summary should be two hundred words or less. It should clearly and briefly explain the key findings reported in the manuscript and must have precise statistics. It should not have acronyms or abbreviations. It should be logical in itself. Do not cite references at this point.

An abstract is a brief, distinct paragraph summary of finished work or work in development. In a minute or less, a reviewer can be taught the foundation behind the study, common approaches to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Use comprehensive sentences, and do not sacrifice readability for brevity; you can maintain it succinctly by phrasing sentences so that they provide more than a lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study with the subsequent elements in any summary. Try to limit the initial two items to no more than one line each.

Reason for writing the article—theory, overall issue, purpose.

- Fundamental goal.
- To-the-point depiction of the research.
- Consequences, including definite statistics—if the consequences are quantitative in nature, account for this; results of any numerical analysis should be reported. Significant conclusions or questions that emerge from the research.

Approach:

- Single section and succinct.
- An outline of the job done is always written in past tense.
- Concentrate on shortening results—limit background information to a verdict or two.
- Exact spelling, clarity of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else.

Introduction:

The introduction should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable of comprehending and calculating the purpose of your study without having to refer to other works. The basis for the study should be offered. Give the most important references, but avoid making a comprehensive appraisal of the topic. Describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will give no attention to your results. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here.

The following approach can create a valuable beginning:

- Explain the value (significance) of the study.
- Defend the model—why did you employ this particular system or method? What is its compensation? Remark upon its appropriateness from an abstract point of view as well as pointing out sensible reasons for using it.
- Present a justification. State your particular theory(-ies) or aim(s), and describe the logic that led you to choose them.
- Briefly explain the study's tentative purpose and how it meets the declared objectives.

Approach:

Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done. Sort out your thoughts; manufacture one key point for every section. If you make the four points listed above, you will need at least four paragraphs. Present surrounding information only when it is necessary to support a situation. The reviewer does not desire to read everything you know about a topic. Shape the theory specifically—do not take a broad view.

As always, give awareness to spelling, simplicity, and correctness of sentences and phrases.

Procedures (methods and materials):

This part is supposed to be the easiest to carve if you have good skills. A soundly written procedures segment allows a capable scientist to replicate your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order, but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt to give the least amount of information that would permit another capable scientist to replicate your outcome, but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section.

When a technique is used that has been well-described in another section, mention the specific item describing the way, but draw the basic principle while stating the situation. The purpose is to show all particular resources and broad procedures so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step-by-step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

Materials may be reported in part of a section or else they may be recognized along with your measures.

Methods:

- Report the method and not the particulars of each process that engaged the same methodology.
- Describe the method entirely.
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures.
- Simplify—detail how procedures were completed, not how they were performed on a particular day.
- If well-known procedures were used, account for the procedure by name, possibly with a reference, and that's all.

Approach:

It is embarrassing to use vigorous voice when documenting methods without using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result, when writing up the methods, most authors use third person passive voice.

Use standard style in this and every other part of the paper—avoid familiar lists, and use full sentences.

What to keep away from:

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings—save it for the argument.
- Leave out information that is immaterial to a third party.

Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part as entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Use statistics and tables, if suitable, to present consequences most efficiently.

You must clearly differentiate material which would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matters should not be submitted at all except if requested by the instructor.

Content:

- Sum up your conclusions in text and demonstrate them, if suitable, with figures and tables.
- In the manuscript, explain each of your consequences, and point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation of an exacting study.
- Explain results of control experiments and give remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or manuscript.

What to stay away from:

- Do not discuss or infer your outcome, report surrounding information, or try to explain anything.
- Do not include raw data or intermediate calculations in a research manuscript.
- Do not present similar data more than once.
- A manuscript should complement any figures or tables, not duplicate information.
- Never confuse figures with tables—there is a difference.

Approach:

As always, use past tense when you submit your results, and put the whole thing in a reasonable order.

Put figures and tables, appropriately numbered, in order at the end of the report.

If you desire, you may place your figures and tables properly within the text of your results section.

Figures and tables:

If you put figures and tables at the end of some details, make certain that they are visibly distinguished from any attached appendix materials, such as raw facts. Whatever the position, each table must be titled, numbered one after the other, and include a heading. All figures and tables must be divided from the text.

Discussion:

The discussion is expected to be the trickiest segment to write. A lot of papers submitted to the journal are discarded based on problems with the discussion. There is no rule for how long an argument should be.

Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implications of the study. The purpose here is to offer an understanding of your results and support all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of results should be fully described.

Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact, you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved the prospect, and let it drop at that. Make a decision as to whether each premise is supported or discarded or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."

Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work.

- You may propose future guidelines, such as how an experiment might be personalized to accomplish a new idea.
- Give details of all of your remarks as much as possible, focusing on mechanisms.
- Make a decision as to whether the tentative design sufficiently addressed the theory and whether or not it was correctly restricted. Try to present substitute explanations if they are sensible alternatives.
- One piece of research will not counter an overall question, so maintain the large picture in mind. Where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

When you refer to information, differentiate data generated by your own studies from other available information. Present work done by specific persons (including you) in past tense.

Describe generally acknowledged facts and main beliefs in present tense.

The Administration Rules

Administration Rules to Be Strictly Followed before Submitting Your Research Paper to Global Journals Inc.

Please read the following rules and regulations carefully before submitting your research paper to Global Journals Inc. to avoid rejection.

Segment draft and final research paper: You have to strictly follow the template of a research paper, failing which your paper may get rejected. You are expected to write each part of the paper wholly on your own. The peer reviewers need to identify your own perspective of the concepts in your own terms. Please do not extract straight from any other source, and do not rephrase someone else's analysis. Do not allow anyone else to proofread your manuscript.

Written material: You may discuss this with your guides and key sources. Do not copy anyone else's paper, even if this is only imitation, otherwise it will be rejected on the grounds of plagiarism, which is illegal. Various methods to avoid plagiarism are strictly applied by us to every paper, and, if found guilty, you may be blacklisted, which could affect your career adversely. To guard yourself and others from possible illegal use, please do not permit anyone to use or even read your paper and file.

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Please note that following table is only a Grading of "Paper Compilation" and not on "Performed/Stated Research" whose grading solely depends on Individual Assigned Peer Reviewer and Editorial Board Member. These can be available only on request and after decision of Paper. This report will be the property of Global Journals.

Topics	Grades		
	A-B	**C-D**	**E-F**
Abstract	Clear and concise with appropriate content, Correct format. 200 words or below	Unclear summary and no specific data, Incorrect form Above 200 words	No specific data with ambiguous information Above 250 words
Introduction	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
Methods and Procedures	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
Result	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

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