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HUMAN EMBRYOLOGY IN ZAKARIYĀ AL-QAZWĪNĪ'S
THE MARVELS OF CREATION¹

It was in the period from the 8th till the 10th century AD that Islamic culture had its golden age and that the arts and sciences flourished. After this period however it started to decline and decay set in. It is in that period that many compilations were written. They were called cosmographies and most of them were written in Arabic. This article deals with the best-known Cosmography, the *Marvels of Creation* of Zakariyā al-Qazwīnī, and gives a translation of the chapters on human embryology.

The author

The author's complete name is Zakariyā bn Muḥammad bn Maḥmūd al-Kamūnī al-Qazwīnī, meaning Zachariya, son of Mohammed, son of Mahmoud, who descends from Kamoun and Qazwin. Kamoun is a non-traceable place, but Qazwin is a city north-west of Teheran in Persia. Al-Qazwīnī was born in Qazwin in the beginning of the 13th century AD which coincides with the beginning of the seventh century of the *Hijra* (H), the Islamic calendar. He descends from the famous jurispudent Ānas bn Mālik (died c. 709-11 AD). Thus it need not surprise us that al-Qazwīnī too became a *qāḏī*, a jurispudent and 'imām, a religious leader.

From autobiographical information and secondary sources we know that al-Qazwīnī travelled, when he was a young man, in the region of Persia, Iraq and Syria, visiting Baghdad (still a centre of religion, culture and power in those days) and Mosul and Damascus. He was a pupil of the writer and philosopher 'Athīr ad-Dīn al-'Abharī. He met the well-known philosopher and mystic Ibn al-'Arabī Muḥī d-Dīn in 1232 AD, and the philologist and geographer Sa'īd bn 'Abd ar-Raḥman al-'Andalūsi (al-Garnāṭī). Later on he became a Qadi in Wāsīt and al-Ḥilla, two cities not far from Baghdad. With the coming of the Mongols in 1258 AD he resigned from his post or was removed from it and found himself in exile. However, he stayed in Iraq and

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acquired the protection of its new governor, °Alā d-Dīn Aṭā Mulḳ al-Juwayni. It is in this last period of his life that he wrote his *Cosmography*. He died on the seventh of the month Moharram 682 H which is the equivalent of the seventh of April 1283 AD.

The Cosmography.

Al-Qazwīnī's *Cosmography* has two versions. Here we deal with the second version, which is dated 1279-80 AD. The complete title of the work is '*Kitāb °Aja'ib al-Makhlūqāt wa-°Gara'ib al-Mawjūdāt*', meaning "Book of the Marvels of Creation and Miraculous Aspects of Creatures". The work starts with a preface and four introductions, each of which explains the four notions in the title: '*°Aja'ib*', Marvels, '*Makhlūqāt*', Created Things, '*°Gara'ib*', Miraculous Aspects and '*Mawjūdāt*', Existing Things. They say in fact that the created things, *makhlūqāt*, make us marvel or contain marvels, *°aja'ib*, and that the existing things, *mawjūdāt*, can have miraculous aspects, *°gara'ib*.

The work itself is divided into two parts, the first deals with supraterrrestrial things, and the second with terrestrial ones. In the first part the author describes celestial phenomena, i.e. the moon, the sun, the stars and then speaks of the inhabitants of heaven, the angels. At the end of this part he explains the problems of chronology and of the Arabic and Syrian calendars. The second part begins with a treatise on the four elements, the meteors and the winds. The author then describes the division of the earth into seven climates and gives a description of all known seas and rivers. Having explained the causes of earthquakes and of the formation of mountains and wells, he passes in review the three kingdoms of nature: the mineral, the vegetable and the animal. The description of the animal kingdom is preceded by one of man, his character, embryology and anatomy, and by a characteristic of human races. All other living beings are discussed after jinns and *ghūls*, monsters, have been dealt with.²

The sources and the appreciation of the Cosmography.

Concerning al-Qazwīnī's sources we observe that of the countries he actually visited he gives eye-witness accounts in his *Marvels*. Of the other parts of the world he borrows much information from above all Yāqūt's geographical dictionary. Yāqūt was a famous traveller and geographer. He died in 1229 AD. This brings us to the appreciation of al-Qazwīnī's work. The Polish researcher M. Kowalska calls him "... an amateur geographer... (who) selected the available data rather uncritically often in a quite accidental way."

2. This description is taken from T. Lewicki, "al-Kazwīnī" in: *Encyclopaedia of Islam*, vol. IV (Leiden, 1965) 867.

been very popular and widely spread. The contents were interesting and it was readable.

History of the diverse manuscripts of the Cosmography.

As is the case with many old texts, the history of the manuscripts of al-Qazwīnī's Cosmography is very complex. It was F. Wüstenfeld who published in 1849 a first edition of it.⁷ For this edition he used seven manuscripts which he divided after comparison into three variants. For the bulk of his text he used the manuscript 'f', the youngest one, an exemplar of the third variant. (1741 AD). For the preface and the four introductions he took manuscript c, a second variant (1622 AD), because they lacked in f. The German scholar Julius Ruska scrutinized Wüstenfeld's manuscripts, added some new ones and came to a division of *four* variants of the Cosmography.⁸ Thus he classified f as a fourth variant, renaming it 'A', which we will use from now on too. He renamed c into 'C' and that one remained a second variant. The whole procedure he followed can extensively be read in his two articles, mentioned in note eight. He raised the question of al-Qazwīnī's authorship of the texts and posed that the first two variants were from his hand and the last two variants not. Then a new factor entered the discussion: codex 464 of the Royal and State Library of Munich, a manuscript of al-Qazwīnī's Cosmography. The date of 678 H (1280 AD) or 778 H (1376 AD) is written on it, the hundred is not visible any more. Ruska compared it with the present manuscripts and found large similarities with C. He opted that codex 464, 'M' from now on, might even be the original second variant of the Cosmography. For a little while the exact dating of M remained a problem, but it was Ettinghausen in his *La peinture arabe* who definitely put the date at 678 H/ 1280 AD, i.e. during al-Qazwīnī's life.⁹ He dated it on the ground of its illustrations, which fitted perfectly within the aesthetical principles of the 13th century AD. On the grounds of these facts we accept M as being the original exemplar of the second variants. It should be the base of all al-Qazwīnī-studies concerning his Cosmography. Herewith the history of the manuscripts is not closed yet: the text of M does not contain the embryology. All texts of the second variant do not mention it. A, the fourth variant text does and texts of the first variants as well. It is indeed very strange as the text of M goes from chapter two 'on man's character' to chapter four 'on man's anatomy'. The embryology, chapter three, is skipped. We do not know why. We discovered however two big pieces

7. F. Wüstenfeld, ed., *Zakarija Ben Muhammed Ben Mahmud el-Cazwīnī's Kosmographie, die Wunder der Schöpfung I* (Göttingen, 1849).

8. J. Ruska, "Kazwinīstudien", *Der Islam. Zeitschrift für Geschichte und Kultur des islamischen Orients*, vol IV (1913) 14-66, 236-262.

9. R. Ettinghausen, "La Peinture Arabe", *Les trésors de l'Asie* (Genève, 1962) 139-140.

on embryology in M's first introduction. That is why we present the embryology of al-Qazwīnī from two texts: the actual chapter of embryology from A and the two pieces in M.¹⁰

Sources of al-Qazwīnī's embryology

It is clear that al-Qazwīnī's text is of a medical nature. That is why we will give a short introduction of Islamic medicine and place al-Qazwīnī's embryology into it.

In the *Jāhiliyya*-period, the time before Islam in Arabia, medical knowledge consisted of information on the position of the organs of the human body and superficial knowledge of their function. With the appearance of Islam, this *Jāhiliyya*-medicine found a new form in the so-called *ṭibb nabawī*, medicine attributed to the prophet Mohammed: old knowledge in a new form. This *ṭibb nabawī* existed alongside with the Byzantine medicine that had filtered through into the new Islamic empire in the period of the reign of the Omayyad Dynasty, which ended in 750 AD. This medicine was of a rather primitive nature. Later, during the reign of the Abassids, which lasted until 1258 AD, a wave of translations of Hellenistic medical texts took place: Galen and with him Hippocrates entered the Islamic world. Aristotle's works became widely spread too. It is in this period that the great Islamic medical works were written such as Rhazes' *al-Ḥāwī* and Avicenna's *Canon*. They were all strongly influenced by Hellenistic medicine, Galen especially.

How did the Arabs handle this Hellenistic scientific wave? Their greatest contribution was the fact that they passed on the *ʿulūm al-ʿawāʾil*, the sciences of the ancient scholars. However, they did not add much new to it. They are not to blame for that, as Ullmann states in his *Islamic Medicine*: passing on was already a formidable contribution¹¹. Al-Qazwīnī's embryology fits within this scope. If we analyse his text, we detect the Hellenistic influences.¹² For example let us take a look at the factor of heat and cold, an important feature in ancient medicine. If we analyse al-Qazwīnī's text, we see that it plays an important role as well. It is the innate heat that assists in the mechanism of digestion. Both sperms, male and female, have a heating power. The male procreative organs are of a hotter quality than the female's. The right side of the womb is of a hotter composition than the left side. Heat is also an important factor in determining the sex of the child: if there is an extra heat in the 'substance' or at the moment of conception, a male is begotten, if not a female. If we look then at the ancients we see that for Hippocrates heat is a decisive factor for a living being to live or not to live. In its greatest quantity it

10. The exact account of the issue of al-Qazwini's authorship can be read in my thesis, chapter 2.

11. M. Ullmann, "Islamic Medicine" in: *Islamic surveys* (Edinburgh, 1978) 22-23.

12. A far more thorough analysis of the text can be read in my thesis, chapter 4.

is found in the heart where innate heat has its seat. Aristotle too supposes that life departs when the heart loses its heat. Galen reflects Hippocrates's and Aristotle's ideas on innate heat. Heat is in the sperm and the heart is the heat's centre. The idea that the heart is the well of life, which we read in al-Qazwīnī as well can evidently be traced to these sources. His description of the procreative organs of male and female are based on the principle of heat. This same notion can be read in Galen as well who says that due to 'the difference in temperature a difference of growth exists: the male's procreative organs protude whereas the female's are left inward. This, he says, makes coitus possible and space (the womb) is created for the fetus.¹³

By this example we see that al-Qazwīnī's embryology fits within Islamic medical science of those days. He too contributed in passing on a considerable quantity of medical knowledge, within the popular style of the *Cosmography*. In fact he did this in a pleasant way under the banner of what Einstein would say later: "Wer sich nicht wundern und begeistern kann, ist ein toter Mensch: seine Augen sind erloschen."

The text.

As already mentioned before, al-Qazwīnī was not too critical in his choice of information. Thus it need not surprise us that his texts are not carefully built up. They are of a loose character and switch from one subject to the other. The text is accompanied by additions and changes Ruska made in his two articles. We also added to the text the part on the procreative organs from the chapter on anatomy, found in A as well as in M.

TEXT

Embryological parts in M's first introduction. (fol. 4b. 2-8 and fol. 5b. 6-21).

fol. 4b. 2

Then, let him look at himself as he himself is full of miracles which cannot fill lifetimes not even by standing still at a tenth of a tenth of them! And to this pointed He, who is praised where He said: "In your souls, do you not see? "Look how He brought together male and female and how He joined the chain of desire in intercourse and how the sperm comes out through the movement of copulation and how the menstrual blood is drawn from the depths of the veins and how He brought them together in the wombs and how

13. Galen, *On the usefulness of the parts of the body I* trans. M.T. May (Ithaca, 1968) II, XIV 6 (628-629).

He has created the newly born from two sperms and how it is fed through the menstrual blood so that it grows and gets bigger and how He divided the parts of the sperm which are uniform parts — into bones, nerves, arteries, veins, tendons and flesh and how He composed from them the outer limbs: He rounded the head, split the ears and the eyes, the nose, the mouth and the rest of the openings. He stretched arms and legs, split their ends into fingers and the fingers into fingertips.

fol. 5b. 6

And the testicles and the procreative organs are for the fulfillment of desire and the survival of the species. This is all in the sperm when it is in the cavity of the womb. Lines and forms show themselves in it little by little although no moulder nor machine is to be seen. Praised be He, how great is He. He proved his own existence clearly. And then: observe the perfection of his power and his complete benevolence, for when the womb gets too narrow for the baby when its creation is complete, He guides its way so that it turns over and moves and asks to be let out just as every sensible person would ask to be released from confinement so that He may get out of that narrow space. Then He guides it to the breast so that when it gets out it swallows it up. And because it is weak and can digest light nourishment only He designed the creation of milk for it. He prepared it before its arrival like a host prepares the food before the arrival of the guest so that the milk can be obtained at the arrival of the newly born: its circumstances do not permit any delay. Subsequently, look at his benevolence and his mercy: how He delayed the development of teeth until precisely two years because during the first two years it is not fed but with milk so that it does not need teeth. And when it has grown it needs solid food and solid food needs to be chewed and then its teeth grow because of its need to deal with it and not later. So hard bones rise from the soft gums, well ordered like ordered pearls to chew and for the beauty. Then, look at the qualities of man, his senses and character and his different circumstances: how he becomes an adolescent, a young man, a middle aged and an old man. Let him be dazzled because of the marvels of his wisdom and let him be amazed about his power and greatness and which is mentioned here: the miracles of the body of men, less than a tenth of a tenth of it! And if these were the miracles of one creature with little volume and a weak body then look at the earth which is your hiding place, to its seas, rivers, mountains, trees, mines, plants and animals and then look up from them to the marvels between heaven and earth¹⁴ and then to the marvels of the heavens as the Exalted has said: "Look what is in the heavens and the earth. Let he look also

14. From here Wüstenfeld's text and M are similar.

at the seas. He does not know its shores, he does not know its ends nor its beginnings; and God leads to the things that are right.”

From A, Wüstenfeld p. 322 l.17.

322.17

I The third aspect: on the generation of man:

When nourishment has reached the stomach, the first force to influence it is the mechanism of digestion which purifies it by way of natural heat. Subsequently, it transports the purified nourishment to the liver and cooks it well in the liver once again. Then it distributes the nourishment among the blood-vessels and organs which are ready to receive it so that every organ gets its share. This results in growth, that is: expansion in all dimensions: length, breadth and depth.¹⁵ And from this food he takes a part and as it is impossible for one person to live forever, divine wisdom has decided to plant in every living (being) a power with which it draws forth the non-existent into existence to preserve that species and that is the power of intercourse and for that purpose he created a substance: the remainder of the food that is begotten from¹⁶ the last digestion (and that) is sent to the spinal cord and from the spinal cord to the two testicles. In them it changes into the nature of the sperm which tickles and causes the restlessness of a camel: it will not quiet down except when it loses that matter¹⁷. And it is a moist, sticky, hot substance, mingled with much pneuma confined to tracts with a strong sensitivity and when this substance has reached the testicles, it becomes white in them because of their shaking just as milk in the breasts. And then, when the need is there the pneuma arises from it and fills the cavities of the penis so that it grows and the sperm goes through the end of the penis and reaches the procreative organs of the female and the orifice of the womb receives it by opening up and the intense pulling (force) of the sperm of the female which

15. Here Wüstenfeld has left out a part of A and inserted instead the line: ‘*wa-mā fadala min il-gadha fi*’ “and the food that is left over from..” (*Wüstenfeld p. 322-21*), which he took from texts of the first variant, Ruska gave us back the text of A in this place, which translation we give here.

16. Here the part Wüstenfeld left out ends.

17. Here too Wüstenfeld has left out a substantial part (its text can be found in Ruska “Kazwinistudien”, 41, 48-49) and replaced it by texts of the first variant of which the translation is as follows: “And that is the reason for the union of the male and female. When the sperm has attained the womb, the sperm of the male and the female mix in the form of a ball. Then over it a thin hull is formed by way of the heat of the womb just as can be seen with dough when it is put in something warm. The mouths of the veins attach themselves to it from which the menstrual blood flows to the womb.”

having sprung from its testicle(s) drips in the vagina which is like an inverted penis and then the two spermatic fluids mix. The sperm of the male resembles the sperm of the female just as rennet resembles milk because in rennet there is a curdling power and in milk there is power to be curdled and in each of the spermatic fluids there is a heating, crushing power; and in the sperm of the male is an attaching power because the pneumata have the effect of claws of a predatory animal on its prey. Attaching itself to the womb together with the sperm it pierces the openings of the veins from which the menstrual blood flows to the womb and it pierces that which encloses the sperm: the membrane which we have mentioned. Then a pneuma is formed within this membrane which seeks to get out and this membrane is pierced just as the mouths of the veins of the womb are pierced and an opening is formed towards this membrane. The embryo feeds itself with nourishment and what is not good stops short around the placenta to assist the getting out at the time of birth.¹⁸ Then the molding power mixes together, with God's benevolence, the grease of the sperm, and that is the mixed pneuma¹⁹ and takes a part of it to the midst as a preparation for the heart and from its right side a part for the liver and from its upper side a part for the brains. Then the hilum is created, connected by means of a vein and an artery with the womb and that is the membrane that surrounds it from the beginning of (its) creation like a bag. This change takes place within six days. Then, after these six days lines and spots appear on it. This is completed on the ninth and tenth day. On the fifteenth day the menstrual blood penetrates the entire ball so that it becomes a blood clot. After this, in twelve days²⁰ the moisture becomes flesh, clearly to be distinguished into parts and limbs. Then the moisture of the spinal cord expands: it is the basis of the body. Then, after nine days the head separates itself. Shoulders and limbs²¹ (form themselves) from the ribs and the belly within a period of forty days, with forty-five days as a maximum and thirty-five days as a minimum, because the formation process of females is slower than that of males. Then, its bones appear. Subsequently they are covered with flesh that originates from the menstrual blood, just as the Exalted has said: "We created man from a strain of clay, then we made it into a sperm in a hidden dwelling; then we changed the embryo into a blood-clot and from the blood-clot into a piece of red flesh; then we made bones for this

18. Here the text Wüstenfeld left out ends.

19. 'wa-hiya r-ruh al-mukhalata' in A, but omitted by Wüstenfeld (correction Ruska p. 49).

20. Wüstenfeld has 'ya'ti', which is wrong according to Ruska. It should be 'bi'ithna' (taken from first variant texts, see Ruska p. 42-50).

21. Wüstenfeld has 'wa-l'atraq', which is wrong according to Ruska. It should be 'wa-l'atraf' (taken from texts of the first variant, see Ruska 42-50).

piece of red flesh and clothed the bones with flesh. We generated another creature.” (Sura 23: 13-14) Blessed be God, the greatest Creator!

323.11

II Chapter on the circumstances of the sperm in each of the nine months.

They assert that when the sperm has established itself in the womb, God, the Exalted, creates in it a power that draws the sperm to it. Then, the menstrual blood, that is thrust out of the body normally at the time of menstruation, draws to itself the sperm when it had established itself in the womb just as the flame of the lamp draws to itself the oil that is in the wick. Then the blood dries up around the sperm just as the white of an egg dries up around the yolk. The sperm coagulates when the heat has affected it in the same way that milk coagulates because of breezes. The sperm becomes a blood clot and remains like that for thirty days and 72 hours. The astrologers say that during this period it is under the influence of Saturn. Then God, the Exalted, makes heat appear in that clot. He makes its constitution wellbalanced and administers to it a kind of shaking and trembling. It stays in this condition until two months have passed. The astrologers say that during this period it is under the influence of Jupiter. Then God, the Exalted makes appear in it an increase of heat so that it becomes a piece of red flesh. And that is its nature until exactly three months. The astrologers say that during this period it is under the influence of Mars. When it has entered the fourth month the assembling of the parts which together build up the body is complete. The figure is formed, its nature is completed, the form of the limbs has become distinct, the joints are put together, the nerves are branched, the veins have spread within the flesh. Around this time the angel blows the spirit in it and in it flows the animal soul. This situation continues until exactly the fourth month and the astrologers say that during this period it is under the supremacy of the Sun. When it has entered the fifth month the process of creation is finished, the structure completed and the shape of all limbs has become visible: the sockets of the eyes are there, the nostrils are split open, the mouth is opened and so are the ears as well as all other passages. And this period takes until exactly the fifth month. The astrologers say that during this period it is under the influence of Venus. When it has entered the sixth month it starts to move more frequently: it kicks with its legs; it stretches its arms; opens its mouth; moves its lips and twists its tongue around. It sleeps and wakes up. This situation continues until exactly the sixth month and the astrologers say that during this period it is under the influence of Mercury. And when it has entered the seventh month its flesh increases, its body becomes fatter, its limbs more solid, its joints stronger, its movement more powerful and it experiences the narrowness of its place and it wishes to leave it. And if God, the Exalted, has so predestined it

gets out as a perfect fetus and lives. And if God, he is Exalted has not yet predestined it then it stays there till after the seventh (month). The astrologers say that during this period it is under the influence of the Moon. And when it has entered the eighth month hardship and trouble it befalls because of its great restlessness in the seventh month when it sought a way out. We have already mentioned that, if it is able to break through the membranes, it comes out, complete and perfect. But if it cannot (break through them) a dullness befalls it because of the frequent motion and the great restlessness in the eighth month: it is ill for forty days and when the trouble of birth afflicts it as well, its strength fades away completely and it lives only rarely and if it lives, it is with troublesome movements and for a short period. The astrologers say that it is *in the eighth month under the influence of Saturn and thus they have closed the circle*. When it has entered the ninth month its whole constitution is well-balanced and its spirit has become strong in it .. The actions of its animal soul become manifest. The astrologers say that it is in this period under the influence of Jupiter and God leads to what is right.

324.16

III Chapter on the formation of the membranes and their advantages.

They say that the first membrane²² is formed on the attachment surface of the fetus.²³ That membrane is the placenta and when the seven days have passed another thin cover comes into being within the placenta. It is formed just like the first one, namely by the power of heat and it is called the wrapping membrane (allantois). In it the fetus's urine and its stools assemble. Then another membrane is formed called the amnion: in this the fetus's sweat assembles. It surrounds the fetus as a skirt and absorbs its sweat so that the sweat remains in the amnion and the urine in the wrapping membrane until the moment of birth. The wrapping membrane is surrounded by the amnion and the placenta is surrounded by the wrapping membrane and the last one is connected with the womb. As to the advantage of those membranes: when the fetus excretes waste matter, the necessity arises to dispose of it, and then the amnion is there to absorb the sweat. If not, urine would mix with sweat and urine would contact the skin and it would irritate it because of its sharpness and it would harm it. And if there was no wrapping membrane, the excretion would heap up in the womb and would contact the vessels from which blood

22. We follow Ruska's correction (p. 55): after 'annahu a subject should follow, probably something like: 'al-ġiṣa' al-'awwal' or 'amma al-ġiṣa al-'awwal'.

23. Wüstenfeld has 'al-^cajin'. Ruska deems this impossible: it should be 'al-janin' (Ruska p. 55).

flows to the fetus and then the blood would become corrupted due to being mixed with the excretion. The advantage of the placenta is that it transports blood and pneuma to the fetus. The advantage of the stay of these excretions in these receptacles is that the fetus is carried in the midst of it so that the amnion does not get out of position through its discharge. The moisture which is in the wrapping membrane helps the fetus to get out. It makes its coming out easier.

324.29

IV Chapter on the nourishment of the fetus through the menstrual blood.

The menstrual blood runs from all parts of the body to the womb by rotation. The reason for it is that the blood gets into commotion and boils up every month, just like the waters of the sea. When the blood comes into motion and boils up, it is directed towards the womb. When it reaches the womb and finds the mouths of the veins closed it opens them suddenly, thus exposing women to pain through this opening up. As to pregnant women, they are not exposed to this pain because the mouths of their veins are open and because the blood does not appear in them suddenly nor in large quantities owing to the sperm impeding it and because of the wall of membranes and covers, (if not) pregnancy would be spoiled. Divine providence has prevented its sudden flow and has led it into the veins so that nothing flows out of them except that which the pulling power draws to the fetus according to its need. It issues from it little by little continuously. And when it appears it comes to a standstill around the placenta and within it in a circle so that nourishment reaches the fetus from all sides. And this happens in due proportion because the soul is (still) weak with respect to the quantity of nourishment: it should be little. Then the soul gets stronger. And each time when it wants its food, the amount of it increases because it gets stronger owing to its drawing the food via the openings of the veins which are connected with the placenta. The fetus only takes menstrual blood which is good because the pulling power draws nothing which is unsuitable for the one that is to be fed, that is: what the changing power has changed: pure blood. When the fetus moves and its shape and its limbs have been completed, the quantity of menstrual blood increases in accordance with its need and it rises in the direction of the breasts. Divine wisdom has provided for the preparation of food which is suited to it before it needs it just like a wise man prepares what he needs in the case of a banquet before the arrival of the guests. When the fetus is born, its limbs and powers are weak, it has a moist body and it is not capable to feed itself with strengthening food, because its powers fail to digest it. While at first in the womb it was used to feed itself with menstrual blood, the Exalted Creator

prepared for it a nourishment that is truly close to the food with which it was used to feed itself before. And also because of the formation of milk out of the blood which rose to the breasts, the rise of the blood and the widening of the vessels, Divine Providence has taken care of it to have the milk prepared at the moment of birth so that the food is prepared and ready at the arrival of the guest: it does not need to be cooked, nor brought, nor to be prepared in any other way. Praised be He, how great is His power, and how immense His benevolence!

325.24

V Chapter on the actions of the different powers in the fetus's body

All powers are present in the essence of the sperm. When they get into action at first they are very active and encompass it with flesh. Then, very actively, they form the membranes and the blood-vessels that appear in it with the appearance of the pneuma. Then all powers are set in motion in it, I mean: the power that changes; the power that shapes, that makes the tools, that makes the tracts; that joins; that separates. All powers are in motion and each exercises its special effect on it. All these powers cooperate during the same period of time. I mean that they all start to function together and not one of them gets worn out nor is the one finished later than the other. No, each one moves from one point to a single aim: the perfection of the shape. The divine powers do not act on the fetus in the way of for example the craftsman, who starts with the foundation, goes on with the wall and then with the roof. No, all parts come into being at the same time, even though this is not always visible to us. Subsequently, they exert themselves to make the limbs separate: they separate the head from both shoulders and form it on the neck. They separate the arms from the ribs and one leg from the other. They split the fingers from each other. Then, each part is given the adequate form that it requires. And when they have finished in thirty to forty days every organ is fed with the general food which is supplied to the fetus. Then it starts to move in the third or fourth month and that is because the fetus's limbs are soft and moist and if it had moved before this time not all of its parts would have become solid: they would have been folded. Its bones would have become crooked and it would have rolled out of the position in which it had been laid. Divine power has protected it and kept it safe against these things for a period: the period during which it became solid and strong. For in this period its limbs are small, its weakness very susceptible to damage. That is why it needs the power to feed itself to increase in size and in strength. Thus divine wisdom has provided for nourishment by way of its mother, just as plants are fed by the soil for their completion.

326.15

VI *Chapter on the position of the fetus in the womb.*

Hippocrates has said that it sits with its head on the knees and both its upper arms against its ribs, its hands carry its head and its head lies in the direction of the mother's head and its legs in the direction of her legs, the limbs pressed together as symmetrically as possible. Its face is turned to the pregnant one's spinal column and its spinal column to her weaker parts. Its being in this position is according to God's providence, because the head is heavier than the rest of the parts of the body so that it needs something to support it. So it is supported by the knees even though the knees are weak and moist. But their task is alleviated as the arms help them to prop it up because moreover the arms lay against it so that when it comes out or rolls over with its head down, arms and knees come out together with the head so that the birth is made easier. It has its face turned towards the spinal cord to be more protected against punches against the spinal cord. Its back is turned toward her weaker parts so that its back is further removed from damage. This position is very suitable for the facilitation of birth because if its head lay close to its legs and its legs in the direction of the opening of the womb and if its connection with the womb were undone then it would come to lie with its head down because its head is heavy so that it would fall down quickly. And: forms that are mostly round and curved are less susceptible to the infliction of damage. And because the heart, which is the well of life, must be protected and because it has no other choice than this form and because the fetus is in a confined space, divine wisdom has pressed together the other limbs and has made them like a ball so that it finds space in that narrow place, just like we press ourselves together and our form becomes like as fetus in the womb.

327.2

VII *Chapter on the origins of the male and female.*

One of them asserts that its origins lie in an increase of heat that God, the Exalted has created in the matter men are created out of, and a lack of heat in the matter out of which women are created: and that is why his reproductive organs protrude and hers are hidden. Further when at the basis of creation natural heat is perfect a male is the result, with complete limbs and with a strong masculinity; if the heat is not perfect, neither is his masculinity, and his behaviour and nature resemble that of a woman. Regarding femininity there are gradations as well because there are women whose behaviour resembles that of men and there are those who are very feminine. And if those

gradations descend equally on either side one may observe in between of them a strange, abnormal condition because then the newly born is neither a boy nor a girl but a hermaphrodite. This particular situation of the layers (cavities) of the womb will be shown in the (chapter on) anatomy; this will be mentioned with God's permission.²⁴ And one of them has said that in the semen of the male is a formgiving principle and that in the semen of the female is a formgiving principle. The shaping power which is in the semen of the male pours into the formation of something that is the like of the thing it (the semen) separated itself from except if something hinders it (the semen); and the shaping force that is in the semen of the female pours into the reception of a shape that is accepted by the like of it, of which it separated itself. And if one of the semens is stronger the child will be the like of (the parent of) the strongest semen.²⁵ And they maintain that the dominating principle in the creation of the male is its obtaining a position on the right side of the womb; and for the creation of the female its obtaining a position on the left side of the womb. And possibly a warm city, a hot season, a southern wind and an age of maturity contributes to the creation of a female whereas the opposite of these things is conducive to the formation of a male. An outstanding scholar has said that the origin of the male sex lies in the condition of the male sperm, its heat, sexual intercourse taking place at the moment that she (the woman) is (ritually) clean and the fact that the sperm appears on the most right side which is warmer and thicker and its arrival at the right side of the womb. And possibly a cold city, a cold season, a northern wind and an age of youth are conducive to this. Some people claim that the male sperm, if it flows from his (the male's) right side to her (the female's) right side becomes a male and that if it runs from his left side to her left side it becomes a female and that if it streams from his right side to her left side it becomes a feminine male such as the men with a behaviour and character like a woman's which one sometimes sees. And if it flows from his left side to her right side it becomes a masculine female such as the women with a behaviour and character like a man's which one sometimes sees.

24. Here (327.11) Wüstenfeld left out the following piece (to be found in Ruska p. 44 note f and p. 61-2) and inserted instead the line: '*wa-minhum man za'ima*', "*and one of them has said*" (taken from texts of the first variant).

25. Here the piece Wüstenfeld left out ends.

45.6

VIII *Chapter on the cause of twins:*

They say that the reason lies in the different ways in which the sperm may drop. Because when the sperm²⁷ is ripe with a fitting blend for a male, a male is begotten and when it is not ripe, and has a fitting blend for female, a female is bred and that which falls in the right cavity of the womb will be a male and that which falls in the left cavity of the womb will be a female and if both drops of sperm²⁸ are equal they will be two males or two females. And that is what they have called the natural, material cause and the metaphysical cause is God's providence "who gives girls to whoever He want and boys to whoever He wants, or gives them pairs of boys or girls. And He makes barren whom he wants. He is the Omniscient, the Able One" (sura 42:48-49). And about others than people: there are animals that give birth to many young ones like pigs and others. So God, the Exalted created them with many wombs and breasts. And the reason for that is that divine care is dedicated to the preservation of all animal species so that the offspring of no one of the kinds is cut off; so he made for the kind to whom death comes quickly and whose constitution is weak and whose time is short many young ones and he created for them wombs so that embryos can be formed in it. And he made the number of their breasts equal to that of their wombs so that there is sufficient nourishment for the fetuses that are formed. And it passed on from ash-Shāfi'ī,²⁹ God have mercy on him that in his lifetime a woman had a miscarriage of twelve fetuses. But God knows best how his creatures are made. Because these are issues for the one who claims that there are as many fetuses as there are cavities in the womb and that the cavities of the womb are equal in number to the breasts.

327.21

IX *Chapter on birth:*

The divine power, when it has completed the baby so far that it can stand the air outside, pushes it outside by setting in motion powers existing in the womb in order to drive it out. Because if it would stay in the womb after its completion it would feel the need for large quantities of nourishment and the

26. Wüstenfeld has left out of A the following chapter on the embryology on twins. Ruska gave it back to us (see Ruska pp. 45-6, 63-4).

27. Here we adopt Ruska's correction: 'zar^cat' instead of 'zarqatani') unlike Ruska's correction ('(Ruska p. 63). Here dropping is relevant.

29. ash-Shafi'ī, one of the four Islamic jurists (d. 820 AD).

mother's nourishment would not suffice any longer nor would her vessel be large enough to carry it and the size of the baby would increase so that it would become more difficult for it to come out, which would eventually lead to its death and that of its mother's. When the time of birth has come the retentive power brings its activity to an end, the pressing power starts moving, and the baby starts moving by itself as well, because the nourishment of its female bearer does not suffice for it any more as we have already said: that is why it is restless and is moving strongly and why it stretches. Because of the force of the movement with its arms and legs it breaks the amnion, the most delicate of the membranes that surrounds it. And when it tears apart the two membranes which come after this one first the wrapping membrane is torn because it is weaker than the placenta and because it receives the movements of the fetus before the placenta. And when this one is torn its connection to the womb is broken and when this connection is broken, the connection of the placenta to the mouths of the veins has become weak, and when this connection has become weak the placenta breaks and the bond with the fetus dissolves and it falls down just like an object falls down from a high place to a lower. The cavity of the womb contracts and its neck opens itself after it is moistened by the fluids that were in the membranes before the appearance of the fetus to make the passage smooth and thus to facilitate birth. Then birth itself: if it is natural it starts with the head because its upper parts are heavier than its lower parts: from the hilum to the head is heavier than from the hilum to the feet and thus the heavier part comes out first followed by the lighter in accordance with the power of the Benevolent and Omniscient.

352.12

The eleventh kind: the procreative organs.

They are equal in male and female although the designing power has extended the male organ because of its excess of heat and it has let the female organ be directed inward because of a lack of heat just like one can see for example in the eye of the mole, a kind of a blind yarboa. Nature has given it a complete eye, but because it failed to split open the skin which covered it, the eye stayed rudimentary and did not emerge. If it had put the male organ inside the scrotum which is the bag in which testicles are, would occupy the position of the womb and the urethra would be located in the position of the vulva but the testicles of the male lie within the scrotum and those of the female next to the womb on the outside, to make space for the fetus. The procreative organs are extensive. Folded veins belong to it, surrounded by swollen flesh where what remains of the food goes, coming from the spinal cord and they prepare it to become sperm and they are called the sperm vessels. To them belongs what

gives this matter creative power as well, like the testicles of the male and the female. They consist of solid, swollen flesh. In the male they are situated in two wrappings resembling a bag, which is called the scrotum. In the female they lie outside the womb. The testicle of the female is smaller than the testicle of the male and much flatter. From both of these the sperm of the female flows to the cavity of the womb and that of the male to the urethra. And to it belongs the penis, a body rich in nerves that originates from the public bone with many cavities and on the bottom of it run two arteries and many veins. From it two ducts penetrate the testicles through which the sperm flows from the testicles to the urethra; the latter takes the place of the vulva of the female. And sometimes the penis must be stretched and then again resting and relaxed. As to its stretched position: that is for the moments of procreation so that it can reach into the vulva and thrust the sperm into it without exposing to the air or a strange body that would affect its power; and it is also to open the flow of sperm in it so that it widens itself. Then the pushing power can throw it and push it with power and speed from the vessels to the cavity of the womb. About its relaxed condition: that is at moments when procreation is not aimed at probably because the body or other parts restrain some of its activity. The designing power has created it from a hard kernel with a cavity that when its cavity is filled with the pneuma it raises itself and obtains a vertical position. And if it is empty of the pneuma it returns to its resting position. It is not made of a bone core because then it cannot obtain a resting position. No, its core is made of a mixture of connective tissue and nerves: nerves to support the stretching, and connective tissue for the growth from the bone and the basis on it. It grows from the pubic bone in order to give it a solid and strong basis, and accordingly is better equipped to function properly, and does not bend when it raises itself and gets into a vertical position and does not incline towards other directions. It originates from the highest part of the bottom of the pelvis. It does not originate from the lowest part so that it is far away from the anus and thus not gets stained. It is not concentrated on a higher place than this just like he has made it higher than the pubic bone. For in that place there is no bone to attach itself to. Furthermore it is not created on the side of the body because a member that grows from one side needs a similar one opposite it. The single limbs are in the middle as one can conclude from the nose, the tongue, the heart, the stomach and so on. To these the womb belongs as well. It has a kernel with nerves so that it is very sensitive and has a pleasant property and so that it is capable of stretching and widening with the growth of the fetus and to pull itself together again after it has become empty. It is situated between the bladder and the large intestine because that is the most fitting place for the genesis of the fetus, its growth and its birth. It is fittest as regards its genesis, because it lies in the centre of the membranes so that it is the hottest and moistest place. It is fittest as to its growth, because this

place can stretch in proportion to the stretching out of the fetus. It is fittest regarding its birth, because of its weight and inclination downward and the support of the belly muscles to push it outside. The womb is created with two cavities: the right and the left cavity. The right cavity is made of a hotter composition and a greater strenght. This is caused by the blood and the spirit which come to it from the heart and the liver so that it is suitable for creating a male. The left cavity is different, in order to be fitting for the formation of the female. Moreover it possesses two protuberances which extend through two narrow passages until they reach the two testicles which lie outside the womb. These two protuberances are called the horns of the womb. The womb can pull the sperm that drips out of the testicles of the woman with them. It has a neck that ends in front and it has the same function as the urethra of the male. The vulva of a virgin is closed and rumped. These creases are interwoven with fine veins which break at the moment of penetration. When the woman gets pregnant the vulva is drawn together so that no inclination can enter. And when the moment of birth has approached or the fetus is injured it widens so that the body of the fetus passes through it. The womb draws the sperm of the male though its neck and it draws forth the sperm of the female through its horns. Further it has flexible ligaments that connect it to the spinal cord and to other parts of the body that surround it. This ligament exists to keep it in position and it is flexible so that it is able to stretch when pregnancy occurs and to shrink when it is empty again. And this belongs to what is right with the masters of anatomy and God knows the nature of his creatures best. He leads to the only right way.