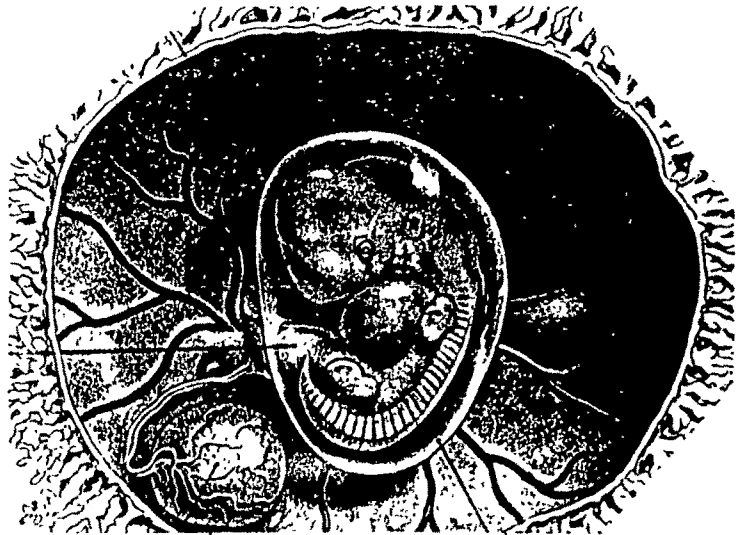




الدرس الرابع: توليد

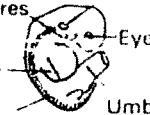
CHAPTER IV: REPRODUCTION



5 weeks

Three basic germ layers and organs are laid down

Gill structures
Ear
Eye
Limb bud
Backbone
Umbilical cord



7 weeks (embryo)



8 weeks (foetus)

Cartilage changes to bone, external genitalia visible, human facial features



16 weeks

Fingernails and fingerprints appear, movements felt by mother, rapid growth to about first size



Length 16 cm (6 in.)
Weight 113g (4 oz)
Heart beat 120–160 per min

32 weeks

Lungs and digestive system immature, but some foetuses able to survive if born prematurely; able to respond to stimuli



Length 33 cm (13 in.)
Weight 2.3–2.7 kg (4–5 lb)

38 weeks



Length 48–51 cm (19–20 in.)
Weight 2.7–3.6 kg (6–8 lb)

CHAPTER FOUR

REPRODUCTION:

In the previous chapter I have discussed about the 'food' and end product of food i.e. 'blood'. Since blood is responsible to provide 'heat' & 'energy'* to mobilise organs in human body. Therefore, blood also provide assistance to the 'Reproductive System' in the formation of 'sperm' & 'ovum', which I will discuss in details in the chapter of 'scientific' version.

Allah the Almighty briefs the complete human 'life cycle' in Qoran, "That I have created you from 'soil'**, then from نطفة i.e. 'gametes', then from 'clot of blood', then from 'chewed muscles' and then 'proper muscles' and this way keep you on changing with your mother's womb, where you remain there as an 'embryo' or 'foetus' for a particular period i.e. almost 'nine' months, as per Almighty Allah's will. Then you born as an 'infant' from your mother's womb. Then Allah The Almighty grows you from an infant to a 'youth' and then 'old age' and ultimately 'die'. Some of you die

earlier:

يَا أَيُّهَا النَّاسُ إِن كُنْتُمْ فِي رَيْبٍ مِّنَ الْبَيْضِ فَإِنَّا خَلَقْنَاكُمْ مِّن نُّرَابٍ ثُمَّ مِّن نُّطْفَةٍ ثُمَّ مِّن عَلَقَةٍ ثُمَّ مِّن مُّضْغَةٍ مُّخْلَقَةٍ وَغَيْرِ مُّخْلَقَةٍ لِّنُبَيِّنَ لَكُمْ وَنُقَرِّفَ الْأَرْحَامَ مَا مَشَاءُ إِلَىٰ أَجَلٍ مُّسَمًّى ثُمَّ نُخْرِجُكُمْ طِفْلًا ثُمَّ لِتَبْلُغُوا أَشْرَكَهُ وَمِنْكُمْ مَّن يَتَوَفَّىٰ وَمِنْكُمْ مَّن يَترُدُّ إِلَىٰ أَرْدَلِ الْغَمْرِ ... ٥ (١٦ - الحج - ٥)

* (١٤ - النحل - ٦)

**Allah The Almighty alives the dead earth when rain falls i.e. plants come out of earth, which ultimately produces flowers, fruits & cereals. Humen eat them as their food. After digestion food produces 'blood'. Blood supply vitalises Reproductive System to produce 'gametes'.

sub chapter i

Origin of Human Life:

Allah The Almighty says through the Qoranic Verses that the secret of 'origin of human life' is hidden in the 'sky' and the 'earth', since both provide water for 'vegetation'. Therefore, wise people ponder over the 'point' of existence of human life; means that Allah The Almighty rains water from sky, which causes earth to grow plants. These vegetation produce flowers, fruits & cereals, which human eat as food. Food produces blood in human body. Blood vitalise our Reproductive Systems to produce 'gametes'*.

إِنَّ فِي السَّمُوتِ وَالْأَرْضِ لَآيَاتٍ لِّلْمُؤْمِنِينَ ۝ وَفِي خَلْقِكُمْ وَمَا يَبُثُّ مِنْ ذَّابْحَةٍ آيَاتٍ لِّقَوْمٍ يُوقِنُونَ ۝ وَاخْتِلَافِ اللَّيْلِ وَالنَّهَارِ وَمَا أَنْزَلَ اللَّهُ مِنَ السَّمَاءِ مِنْ رِّزْقٍ فَأَحْيَا بِهِ الْأَرْضَ بَعْدَ مَوْتِهَا... ۝ (الباقية - 3-5)

Allah The Almighty short lists the importance of water in the following Qoranic Verse:

وَجَعَلْنَا مِنَ الْمَاءِ كُلَّ شَيْءٍ حَيٍّ ۖ فَخَرَجْنَا مِنْ حَتَّىٰ... ۝ (17-18 الانبياء-30)

Allah The Almighty has created all the living moving** creatures from water. Some of them creeps on its 'belly' i.e. 'Reptiles', some of them move on its two legs i.e. 'human' and some of them move on its 4 legs, i.e. almost all 'wild & domestic' animals; like lion, Tiger & Cow & Horse etc. Allah The Almighty creates as He likes:

وَاللَّهُ خَلَقَ كُلَّ رَآبٍ مِنْ مَّاءٍ ۖ فَمِنْهُمْ مَّنْ يَمْشِي عَلَىٰ بَطْنٍ ۖ وَمِنْهُمْ مَّنْ يَمْشِي عَلَىٰ رِجْلَيْنِ ۖ وَمِنْهُمْ مَّنْ يَمْشِي عَلَىٰ أَرْبَعٍ ۖ يَخْلُقُ اللَّهُ مَا يَشَاءُ ۚ ۝ (18-النور-45)

*Male & Female gametes unite to form 'zygote', which ultimately changes to human baby.

**Movement is one of the charecterstics of the living creatures.

Origin of Human Life ... contd...

Allah The Almighty has created human from 'water' and also created his/her blood related relatives from mother & father sides. This Qoranic indication is a sufficient 'evidence' that human is reproduced sexually, by the union of father & mother i.e. sperm & ovum. And Allah The Almighty has also fixed his/her 'spouse'; males v/s females i.e. opposite sexes - not necessarily the blood related, and also created husband's relatives for 'wife' and wife's relatives for 'husband':

وَهُوَ الَّذِي خَلَقَ مِنَ الْمَاءِ بَشَرًا فَبَعَلَهُ نَسَبًا وَصِمْرًا... ه (19- الفرقان- 54)

Allah The Almighty describes in the following Qoranic Verses that the 'human' has been created from 'soil':*

وَاللَّهُ خَلَقَكُمْ مِنْ تُرَابٍ... ه (22- فاطر- 11)

فَإِنَّا خَلَقْنَاكُمْ مِنْ تُرَابٍ... ه (17- الحج- 5)

أَكْفَرْتَ بِالَّذِي خَلَقَكَ مِنْ تُرَابٍ... ه (15- الكهف- 37)

هُوَ الَّذِي خَلَقَكُمْ مِنْ طِينٍ ثُمَّ قَضَىٰ أَجَلًا... ه (7- الانعام- 2)

إِذْ قَالَ رَبُّكَ لِلْمَلَائِكَةِ إِنِّي خَالِقٌ بَشَرًا مِنْ طِينٍ... ه (23- ص- 71)

هُوَ الَّذِي خَلَقَكُمْ مِنْ تُرَابٍ... ه (24- المؤمن- 67)

هُوَ عَلَّمَ بِكُمْ إِذْ أَنْشَأَكُمْ مِنَ الْأَرْضِ... ه (27- النجم- 32)

قَالَ أَنَا خَيْرٌ مِنْهُ خَلَقْتَنِي مِنْ نَارٍ وَخَلَقْتَهُ مِنْ طِينٍ... ه (23- ص- 76)

هُوَ أَنْشَأَكُمْ مِنَ الْأَرْضِ... ه (12- هود- 61) قَالَ أَسْبَغْتُ لِمَنْ خَلَقْتُ طِينًا... ه (15- بني إسرائيل- 61)

الَّذِي أَحْسَنَ كُلَّ شَيْءٍ خَلَقَهُ وَبَدَأَ خَلْقَ الْإِنْسَانِ مِنْ طِينٍ... ه (21- السجدة- 7)

هُوَ الَّذِي خَلَقَ لَكُمْ تَابِي الْأَرْضِ جَمِيعًا... ه (1- البقرة- 19)

(8- الامرات- 11)

*Since Allah The Almighty wanted to create 'human', the supreme creature, that is why 'He' added 'soil' as a token of pretigious sign for human, to the 'base of life' i.e. water. Almighty has water & soil pure & capable to purify

Origin of Human Life ... contd...

Since the origin of life is 'water', and human is especially made from soil. Therefore, the basic factor 'water' was mixed with 'soil' to create human. Here Allah The Almighty narrates in Qoran that Prophet Jesus* was created the way, first human 'Adam' was created:

إِنَّ مَثَلَ عِيسَى عِنْدَ اللَّهِ كَمَثَلِ آدَمَ خَلَقَهُ مِنْ تُرَابٍ ۝ (3- آل عمران- 59)

Allah The Almighty says in Qoran that 'Human' has been created from 'soil', which was already mixed with 'water' and also kept for a particular period for 'fermentation':

خَلَقَ الْإِنْسَانَ مِنْ صَلْصَالٍ كَالْفَخَّارِ ۝ (27- الرحمن- 14)

لَقَدْ خَلَقْنَا الْإِنْسَانَ مِنْ صَلْصَالٍ مِنْ حَمَإٍ مَسْنُونٍ ۝ (14- الحجر- 26)

وَلَقَدْ خَلَقْنَا الْإِنْسَانَ مِنْ سُلَالَةٍ مِنْ طِينٍ ۝ (18- المؤمنون- 12)

وَإِذْ قَالَ رَبُّكَ لِلْمَلَائِكَةِ إِنِّي خَالِقٌ بَشَرًا مِنْ صَلْصَالٍ مِنْ حَمَإٍ مَسْنُونٍ ۝ (14- الحجر- 28)

إِنَّا خَلَقْنَاهُمْ مِنْ طِينٍ لَازِبٍ ۝ (23- الصافات- 11)

.. لِبَشَرٍ خَلَقْنَاهُ مِنْ صَلْصَالٍ مِنْ حَمَإٍ مَسْنُونٍ ۝ (14- الحجر- 35)

Allah The Almighty has created 'human', the way 'plants' are being created from 'soil'. It means that human are also being created from soil. Their growth & development depend upon the sources from earth, like; water & mineral and from sky, like; sun & gases, which directly benefit the plants:

وَاللَّهُ أَنْبَتَكُمْ مِنَ الْأَرْضِ نَبَاتًا ۝ (29- نوح- 17)

وَمَرْيَمَ ابْنَتَ عِمْرَانَ الَّتِي أَحْصَيْنَا فَرْجَهَا فَنَنْفَخُ فِيهِ مِنْ رُوحِنَا... ۝ (28- التحريم- 12)

*Prophet Jesus was created from Mary, without father, the way Allah The Almighty had created 'Adam' without father & mother.

Origin of Human Life ... contd.

Human is the best amongst the entire creatures, as Allah The Almighty says in Qoran that He creates 'the best', whatever He creates and human has been created from soil:

الَّذِي أَحْسَنَ كُلَّ شَيْءٍ خَلَقَهُ وَبَدَأَ خَلْقَ الْإِنْسَانِ مِن طِينٍ (21- اسجدة-7)

In order to announce the superiority of human Allah The Almighty ordered to all the Angels to bow before 'Adam', all but one denied & replied that I will not bow before Adam, who is being created from 'fermented' soil:

قَالَ لَمْ أَكُنْ لَأَسْجُدَ لِبَشَرٍ خَلَقْتَهُ مِن مَّلَاحٍ مِّنْ حَمَإٍ مَّسْنُونٍ (14- المجر-33)

Allah The Almighty confirms in the following Qoranic Verse that human has been created the best structured:

لَقَدْ خَلَقْنَا الْإِنْسَانَ فِي أَحْسَنِ تَقْوِيمٍ (30- الشين-4)

This is the sign from The Almighty to glorify Him, that He has created all humen from 'soil', and then spread them throughout the world:

وَمِن آيَاتِهِ أَنْ خَلَقَكُمْ مِنْ تُرَابٍ ثُمَّ إِذَا أَنْتُمْ بَشَرٌ تَنْتَشِرُونَ (21- الروم-20)

Allah The Almighty has created all humen from a single 'man'; Adam. Adam was created from soil. Adam's spouse; Mother Eves was created from Adam by way of vegetative* reproduction. Now, rest of all humen are created by way of sexual** reproduction

رَبُّكُمُ الَّذِي خَلَقَكُمْ مِنْ نَفْسٍ وَاحِدَةٍ وَخَلَقَ مِنْهَا زَوْجَهَا وَبَثَّ مِنْهُمَا رِجَالًا كَثِيرًا وَنِسَاءً (4- النساء-11)
وَهُوَ الَّذِي أَنشَأَكُمْ مِنْ نَفْسٍ وَاحِدَةٍ - (7- الانعام-98)

*common in plants, but Almighty applied in human for the creation of Eves & Jesus.

**by union of Male & Female

sub chapter ii

Reproductive System:

After the creation of Mother Eves, creation of humen bases on 'sexual' reproduction. For which Allah The Almighty created Male & Female, bearing male & female reproductive organs; constituting Male & Female Reproductive Systems. Glorify The Almighty, Who has created Males & Females bearing all the male & female reproductive organs from what the earth grows i.e. 'plants' (since plants supply food, food is converted to blood & blood vitalises the reproductive organs) and from those things no one knows:

سُبْحٰنَ الَّذِيْ خَلَقَ الْاَزْوَاجَ كُلَّهَا مِمَّا تُنْبِتُ الْاَرْضُ وَمِنْ اَنْفُسِهِمْ وَمِمَّا لَا يَعْلَمُوْنَ ه (13- يس- 36)

Allah The Almighty has created the male & female reproductive systems/organs in humen. And created 'love' & attraction between Males & Females. The males & females satisfy the 'sexual' desires of each others. These creations are the signs from Allah The Almighty to glorify His existence: (9- الاحقاف- 18)

وَجَعَلَ مِنْهَا زَوْجًا لِّكَوَالْيَمٰه ه (9- الاحقاف- 18)
وَمِنْ اٰيٰتِهٖ اَنْ خَلَقَ لَكُمْ مِنْ اَنْفُسِكُمْ اَزْوَاجًا لِّتَسْكُنُوْا اِلَيْهَا وَجَعَلَ بَيْنَكُمْ
مَوَدَّةً وَرَحْمَةً اِنَّ فِيْ ذٰلِكَ لَاٰيٰتٍ لِّقَوْمٍ يَّتَفَكَّرُوْنَ ه (21- الروم- 21)

Allah The Almighty says in Qoran that human has been created from 'soil', the soil grows plants, the plants produce fruits & cereals. Human eats fruits & cereals as food and food is converted into blood in human body. The blood vitalises the reproductive organs, which produce male & female gametes. By union of male & female; female conceives & carries the 'embryo' in her uterus. Ultimately, female delivers human baby, who grows to young age and then to

over...

Reproductive System ... contd...

old age and at last dies. Some one dies earlier:

وَاللَّهُ خَلَقَكُمْ مِنْ تُرَابٍ ثُمَّ مِنْ نُطْفَةٍ ثُمَّ جَعَلَكُمْ أَزْوَاجًا وَمَا تَحْمِلُ مِنْ أُنْثَىٰ وَلَا تَضَعُ بِحِلْمِهِ ۖ وَمَا يُعَمَّرُ مِنْ مُعَمَّرٍ وَلَا يُنْقَصُ مِنْ عُمُرٍ إِلَّا فِي كِتَابٍ ۚ ... ٥
(22- فاطر- ١١)

Allah The Almighty has created you from one man i.e. Adam. His wife, mother Eves was created from him by way of 'vegetative'* reproduction. The generation of Adam is created by way of 'sexual' reproduction; indicates the existence of 'male & female' reproductive organs in humen:

هُوَ الَّذِي خَلَقَكُمْ مِنْ نَفْسٍ وَاحِدَةٍ وَجَعَلَ مِنْهَا زَوْجَهَا ... ٥ (٩- الاعراف- ١٨٩)
خَلَقَكُمْ مِنْ نَفْسٍ وَاحِدَةٍ ثُمَّ جَعَلَ مِنْهَا زَوْجَهَا ... ٥ (٢٣- الزمر- ٦)
وَخَلَقْنَاكُمْ أَزْوَاجًا (عم - النبا- ٨)

In the following Qoranic Verse, Allah The Almighty narrates the episode of Prophet Yahya's birth. "Prophet Yahya had become so old, when the reproductive organs become functionless, and his wife was a 'sterile' lady i.e. her reproductive organs were functionless right from age of puberty. When Allah The Almighty announced the happy news of Prophet Yahya's birth, the old lady cried that I am sterile & my husband become too old." This episode indicates that there is a system of reproductive organs in humen for the purpose of reproduction.

"And Allah The Almighty bestowed the couple with Prophet Yahya at the age of retirement by His Will":

يُذَكِّرُ إِنَّا بِشَيْءٍ عَظِيمٍ ۖ اسْمُهُ يَحْيَىٰ لَمْ نَجْعَلْ لَهُ مِنْ قَبْلُ سَمِيًّا ۚ قَالَ رَبِّ انِّي يَكُونُ لِي غُلَامٌ وَكَأَنِّي صَارَتِي عَاقِرًا وَقَدْ بَلَغْتُ مِنَ الْكِبَرِ عِتِيًّا ۚ (١٦- مريم- ٨-٦)
قَالَ رَبِّ انِّي يَكُونُ لِي غُلَامٌ وَقَدْ بَلَغْتُ الْكِبَرِ وَامْرَأَتِي عَاقِرٌ ۚ قَالَ كَذَّابٌ أَفْعَلُ مَا يُشَاءُ ۚ
وَكَأَنِّي صَارَتِي عَاقِرًا ... ٥ (١٦- مريم- ٥) (١٦- الانبياء- ٣)
... ٥ (٣- آل عمران- ٥)

*from the ribs of Hz Adam a.s. Pl. see text of Hadith on page # 13.

Reproductive System ... contd...

Allah The Almighty declared the happy news of Prophet Ishaque & Prophet Yaqoub birth to Prophet Ibrahim, when he had become too old and his wife 'Sara' was a 'sterile*' lady. Lady Sara reacted bitterly to hear the news "I am a sterile lady & my husband has become too old". But Allah The Almighty bestowed them with Prophet Ishaque & Prophet Yaqoub by His Will, indicates that reproductive organs are there in human body for the purpose of reproduction:

وَامْرَأَتُهُ قَائِمَةٌ فَضَمِكَتْ نَبَشَرْنَهَا بِإِسْحَاقَ لَوْ مِنْ وَرَاءِ إِسْحَاقَ يَمْقُوبَ ۖ قَالَتْ يَوُ
يَلْتِيءُ إِلَيَّ وَ أَنَا عَجُوزٌ وَ هَذَا بَطْلًا شَيْخًا ۚ إِنَّ هَذَا لَشَيْءٌ عُجِيبٌ ۝ (12-8 هود-72-71)
وَبَشَرُوهُ بِغُلَامٍ عَلَيْهِ ۖ مَا تَبَلَّتْ امْرَأَتُهُ فِي صَرْفٍ فَضَكَتْ وَ جَعَهَا وَ تَالَتْ عَجُوزٌ عَقِيمَةٌ ۝ (26-24 الذر-29-28)
قَالَ أَتَبَشَّرُ لِمُؤْنٍ عَلَى أَنْ مَتْنِي الْكِبَرُ فَبِهِمْ تُبَشِّرُونَ ۝ (14-13 الحجر-54)

Allah The Almighty indicates in Quran the existence of Reproductive Organs between chest & back and produce 'jumping' sperms:

لَنَنْظُرَ الْإِنْسَانُ مِمَّ خُلِقَ ۖ خُلِقَ مِنْ مَّاءٍ ذَافٍ ۖ لَا يَخْرُجُ مِنْ بَيْنِ الصُّلْبِ وَ التَّرَائِبِ ۝ (30-35 الطارق-7-5)

Glorify The Almighty Allah, who took out the generations of Adam from his back . One of the factors of this expression is the location of 'Testis'; the most important of the Male Reproductive System:

وَ إِذَا خَذَ رَبُّكَ مِنْ بَنِي آدَمَ مِنْ ظُهُورِهِمْ ذُرِّيَّتَهُمْ ۖ ۝ (9-10 الاعرات-172)

Allah The Almighty has created human by the union of males & females i.e. union of male & female gametes produced by their respective reproductive systems, and spread them throughout world to be recognized as different 'castes' & 'tribes':

يَا أَيُّهَا النَّاسُ إِنَّا خَلَقْنَاكُمْ مِنْ ذَكَرٍ وَ أُنْثَى وَ جَعَلْنَاكُمْ شُعُوبًا وَ قَبَائِلَ لِتَعَارَفُوا ۖ ۝ (26-13 الحجر-13)

*Sterility & Fertility in human depend on the Will of Almighty Allah:

يَخْلُقُ مَا يَشَاءُ ۖ يَعْصِي أَمْرًا ۖ وَ يَعْصِي أَمْرًا ۖ وَ يَخْلُقُ مَا يَشَاءُ ۖ الذَّكَرُ ۖ أَوْ يُزَوِّجُهُمْ ذَكَرًا وَ أُنْثَى ۖ وَ يَجْمَعُ مَنْ يَشَاءُ عَقِيمًا ۖ ۝ (25-25 الشورى-50)

Reproductive System ... contd...

Glorify the creator of Skies & Earth; The Almighty Allah, who created for you & from you 'males' & 'females' for the off-springs of your generations to be continued. Also, created 'males' & 'females' from animals to continue their generations. This Qoranic Verse indicates that 'mammals'* reproduce sexually:

جَعَلَ لَكُم مِّنْ أَنْفُسِكُمْ أَزْوَاجًا مِّنَ الْأَنْحَامِ أَزْوَاجًا يَذُرُّكُمْ فِيهَا فَمَا يَتَبَوَّاهُنَّ لَكُمْ لَئِيَسَ كَيْدُهُمْ شَيْءٌ ۖ ... هـ (25- اشورى- ١١)

Glorify The Almighty Allah (do not submit to false gods), who has created you from soil and grown you upto the 'maturity' and bestowed you with reproductive organs producing 'semen' or "نُطْفَةٍ":

أَكْفَرْتَ بِالَّذِي خَلَقَكَ مِنْ تُرَابٍ ثُمَّ مِنْ نُطْفَةٍ ثُمَّ سَوَّاهُ رَجُلًا هـ (١٥- الكهف- ٣٦)

Allah The Almighty emphasises to Muslim men & women to protect & avoid from the 'misuse' of their respective 'sexual organs':

قُلْ لِلْمُؤْمِنِينَ يَغُضُّوا مِنْ أَبْصَارِهِمْ وَيَحْفَظُوا فُرُوجَهُمْ ... هـ (١٨- النور- ٣٥)

وَقُلْ لِلْمُؤْمِنَاتِ يَغْضُضْنَ مِنْ أَبْصَارِهِنَّ وَيَحْفَظْنَ فُرُوجَهُنَّ ... هـ (١٨- النور- ٣١)

وَالَّذِينَ هُمْ يَغُضُّونَ هـ (١٨- المؤمنون- ٥)

Allah The Almighty has created your 'spouse/wife' amongst from you. And created your off-springs from your wife i.e. after the union of male & female gametes, the female partner is conceived & 'embryo' grows & remains in the mother's 'uterus', till she delivers a human baby. Again, your newly born baby grows to a young man bearing reproductive organs, who is married to a female bearing 'female' reproductive organs. By the union of male & female gametes, she is conceived & reproduces your grand-son. And pious things, like; soil & water are sources of your food: ... over...

Reproductive System ... contd...

وَاللَّهُ جَعَلَ لَكُمْ مِنْ أَنْفُسِكُمْ أَزْوَاجًا وَجَعَلَ لَكُمْ مِنْ أَنْفُسِكُمْ بَنِينَ وَحَفَدَةً
وَرَزَقَكُمْ مِنَ الطَّيِّبَاتِ ط... (14- النحل - 72)

In the following Qoranic Verses Allah The Almighty refers 'soil', the base of gametes or 'نطفة'. It means soil produces plants, plants bear fruits & cereals on maturity, which human eats as food. Food is converted to blood after digestion. Blood is assimilated and flows in the body through 'cardio vascular system' and helps in the formation of 'reproductive system'. Reproductive Systems; male & female produce male & female gameles respectively:

وَلَقَدْ خَلَقْنَا الْإِنْسَانَ مِنْ سُلَالَةٍ مِنْ طِينٍ ۖ ثُمَّ جَعَلْنَاهُ نُطْفَةً فِي قَرَارٍ مَكِينٍ ۝ (18- المؤمن - 13, 12)
هَؤُلَاءِ خَلَقَكُمْ مِنْ شُرَاطٍ ثُمَّ مِنْ نُطْفَةٍ ۝ (24- المؤمن - 67)
وَجَدَ الْإِنْسَانَ مِنْ طِينٍ ۖ ثُمَّ جَعَلَ نَسْلَهُ مِنْ سُلَالَةٍ مِنْ مَاءٍ مَمِينٍ ۖ (21- السجدة - 8, 7)

Allah The Almighty may bestow you either son or daughter or both*, by way of 'sexual' reproduction. Allah The Almighty may provide you a healthy & functioning 'reproductive' system, by His Mercy or may provide you non-functioning** 'reproductive system' or without the reproductive system at all.

يَهْبُ بِمَنْ يَشَاءُ إِنَّا ذَا بَعْبٍ لِمَنْ يَشَاءُ الذَّكَوْرَ ۖ أَوْ يَزْوَاجَهُمْ ذَكَرَانًا وَانثَاءً
وَيَجْعَلُ مَنْ يَشَاءُ عَقِيْمًا ۚ إِنَّهُ عَلِيمٌ قَدِيرٌ (25- الشورى - 50-49)

*This is Qoranic indication towards the play of 'chromosomes' regarding the fixation of 'male' or 'female' sex.

**When existing 'reproductive system' is not capable to produce proper healthy male or female or 'gametes', termed as 'sterility'.

Reproductive System ... contd...

When Adam & Mother Eves ate the product of the 'plant', prohibited by The Almighty, their respective 'sexual' organs started to appear. They tried to cover them with the leaves of the trees from Paradise, due to shame:

فَأَكَلَا مِنْهَا فَبَدَتْ لَهُمَا سَوَاتُهُمَا وَطَفَعَا خِصْفَيْنِ عَلَيْهِمَا مِنْ زَرْقِ الْبَيْتَةِ ۖ هَـ (١٦-١٧ طه)
فَلَمَّا ذَاقَا الشَّجَرَةَ بَدَتْ لَهُمَا سَوَاتُهُمَا وَطَفَعَا خِصْفَيْنِ عَلَيْهِمَا مِنْ زَرْقِ
الْبَيْتَةِ ۖ هَـ (٨-١١ الاعراف-٢٢)

The above Qoranic Verse informs us that: i) Tree is source of food for human, ii) ingestion of food helps to develop the reproductive organs/systems, iii) 'shame' is a natural human instinct & iv) basic human needs, like; food, clothes & shelter.

Qoran emphasises again & again to wear tangible clothes to hide your sexual parts & sexual exitements and to improve your personality.

And to wear 'intangible' clothes to cover the piosness:

يَبْنِيْ اٰدَمَ قَدْ اَنْزَلْنَا عَلَيْكُمْ بَيَاسًا يُوَارِيْ سَوَاتِكُمْ وَرِيْشًا وَّ لِباسًا تَقْوٰى زِيْكَ خَيْرٌ ۖ هَـ
(٨-١١ الاعراف-٢٦)

The following Qoranic Verse indicates that the 'food' is responsible to develop the sexual organs. It means that food is converted to blood and blood is responsible to develop the sexual organs; male and female, as happened with Adam & Mother Eves:

فَمَا اَخْرَجَ اَبْوِيْكُمْ مِنَ الْجَنَّةِ يَنْزِعُ عَنْهُمَا لِبَاسًا مِنْهُمَا سَوَاتِهِمَا ۖ هَـ (٨-١١ الاعراف-٢٧)

Allah The Almighty has created the 'female'; the opposite sex of male human to enjoy 'sex' lawfully, and strictly prohibits 'homo-sexuality'. Homo-sexuality* leads you to the darkness:

۞ اِنَّكُمْ لَتَآئِبُونَ الرِّجَالَ سَٰخِمَةً ۖ هَـ (١٩-١١ النمل-٥٥)
۞ اَتَاْتُوْنَ الذُّكْرَانَ مِنَ الْعُلَمِيْنَ ۚ وَكَانَ رُؤُوسُهُمْ لَكُمْ رُجُلًا ۖ هَـ (١٩-١١ الشعراء-١٦٦)

*It scientifically established that homo-sexuality is the main source of 'AIDS'.

Reproductive System ... contd...

Allah The Almighty describes in the following Qoranic Verses that human has been created either males or females; the opposite sexes. Males & females are differentiated on the basis of their respective opposite sexual organs, constituting a system:

وَمَا خَلَقَ الذَّكَرَ وَالْأُنثَىٰ ۚ (30 - النحل - 3) وَمِنْ كُلِّ شَيْءٍ خَلَقْنَا ذَوْجَيْنِ لَعَلَّكُمْ تَذَكَّرُونَ ۝
(27 - الذرریت - 49)
فَجَعَلَ مِنْهُ الزَّوْجَيْنِ الذَّكَرَ وَالْأُنثَىٰ ۚ (29 - القیمة - 39)
وَأَنَّهُ خَلَقَ الزَّوْجَيْنِ الذَّكَرَ وَالْأُنثَىٰ ۚ (27 - النجم - 45) وَالَّذِي خَلَقَ الْأَزْوَاجَ كُلَّهَا ۚ
(25 - الزمر - 7)
وَخَلَقْنَاكُمْ أَزْوَاجًا ۚ (30 - النبا - 8) وَإِذَا النُّفُوسُ زُوِّجَتْ ۚ (30 - التکویر - 7)

The following Qoranic Verse indicates that sexual fluids or 'gametes' are created from 'blood'. And RBC are produced in the Red Bone Marrow of Vertebra, situated in the back of human:

وَإِذَا خَنَ رَبُّكَ مِنْ بَنِي آدَمَ مِنْ ظُهُورِهِمْ ذُرِّيَّتَهُمْ وَأَشْهَدَهُمْ عَلَىٰ أَنفُسِهِمْ ۖ (9 - الأعراف - 171)

Both male & female reproductive organs become capable to produce male & female gametes on 'maturity':

خَلَقَ الْإِنْسَانَ مِنْ نُطْفَةٍ فَإِذَا هُوَ خَصِيمٌ مُبِينٌ ۝ (14 - النحل - 4)
أَوَلَمْ يَرِ الْإِنْسَانُ أَنَّا خَلَقْنَاهُ مِنْ نُطْفَةٍ فَإِذَا هُوَ خَصِيمٌ مُبِينٌ (23 - يس - 77)
إِنَّا خَلَقْنَا الْإِنْسَانَ مِنْ نُطْفَةٍ أَسْوَاجٍ ۖ (29 - الدھر - 2)
فَلْيَنْظُرِ الْإِنْسَانُ مِمَّ خُلِقَ ۚ خُلِقَ مِنْ مَّاءٍ رَافِقٍ ۚ (30 - الطارق - 6 - 5)
ثُمَّ جَعَلْنَاهُ نُطْفَةً فِي قَرَارٍ مَكِينٍ ۚ (18 - المؤمنون - 13)
ثُمَّ جَعَلَ نَسْلَهُ مِنْ سُلَالَةٍ مِّنْ قَاءٍ مُّهِينٍ ۚ (21 - السجدة - 8)
هُوَ الَّذِي خَلَقَكُمْ مِنْ شَرَابٍ ثُمَّ مِنْ نُطْفَةٍ ۖ (24 - المؤمن - 67)
مِنْ أَيْ شَيْءٍ خَلَقَهُ ۚ مِنْ نُطْفَةٍ خَلَقَهُ فَقَدَّرَهُ ۚ (30 - عبس - 19 - 18)

sub chapter iii

Fertilization & Conception:

Allah The Almighty has created Female, the opposite sex of Male. Male & Female satisfy sexual desire of each other. During 'coupulation' at the 'coitus' point, 'Testis' of male reproductive system discharges seminal fluid containing 'sperm' and 'Ovary' of female reproductive system discharges female fluid containing 'ovum'. Both the fluids discharge inside the uterus of female during coupulation. Normally, one of the sperms unite with one functional ovum. This process is called 'fertilization'. Zygote is formed due to fertilization. Next to fertilization is 'conception'; the fixation of zygote inside the uterus.

Qoran describes the sexual desire, the process of coupulation, discharge of sexual fluids, fertilization & conception inside the uterus of female:

هُوَ الَّذِي خَلَقَكُمْ مِنْ نَفْسٍ وَاحِدَةٍ وَجَعَلَ مِنْهَا زَوْجًا يَسْكُنُ الْبَيْتَ فَلَمَّا تَغَشَّاهَا حَمَلَتْ حَمْلًا خَفِيًّا فَمَرَّتْ بِهِ ۖ (و- الاعراف- ١٨٩)

Allah The Almighty discriminates in the following Qoranic Verse, the creation of human into male & female individuals, bearing male and female reproductive systems respectively. The sexual discharges from male & female reproductive organs unite to form new individual:

وَأَنَّهُ خَلَقَ الذَّكَرَ وَالْأُنثَىٰ مِنْ نُطْفَةٍ إِذَا تُمْنَىٰ ۚ (٢٧- البقر- ٤٥, ٤٦)

Ejaculation of semen from male testis inside the uterus of female, leads conception. Male & female human are created when a woman is conceived: (٢٧- الواقعة- ٥٩)

Fertilization & Conception ... contd...

Allah The Almighty say in the following Qoranic Verse that human has been created from fertilized sexual fluids:

إِنَّا خَلَقْنَا الْإِنْسَانَ مِنْ نُطْفَةٍ أَمْشَاجٍ ۖ ثُمَّ بَدَّلْنَاهُ سَمِيقًا بَاصِرًا ۚ
لَا يَجِدُ النَّاسُ إِلَّا خَلْقَكُمْ مِنْ ذَكَرٍ وَأُنْثَىٰ وَجَعَلْنَاكُمْ شُرُوبًا وَرَبَابًا ۚ لَقَدْ أَرْسَلْنَا نُوحًا وَإِبْرَاهِيمَ وَمُوسَىٰ وَهَارُونَ بِآيَاتِنَا فَكَفَرُوا ۚ وَجَعَلْنَا لِكُلِّ شَيْءٍ مِزَانًا ۚ (26-27-28-29-30-31-32-33)

Allah The Almighty has ^{created} 'sex desire' in man for woman. This desire creates a 'force of attraction', between male & female human, which leads to sexual courtship and co-pulation between male & female:

زَيْنَ النَّاسِ حُبُّ الشَّوَابِ مِنَ النِّسَاءِ... (3-4-5-6-7-8-9-10-11-12-13-14)

Qoran says that human is created from 'blood', which is converted to 'sexual fluid' during copulation, and male 'fluid' is discharged inside the 'uterus' of female, where fertilization takes place and 'zygote' is formed in such a way that zygote* may grow male embryo or as female embryo and ultimately male child or female child is born:

أَلَمْ يَكُنْ نُطْفَةٌ مِنْ مَتْنٍ يُمْنَىٰ ۚ لَمْ يَكُنْ عَلَقَةً فَطَلَقَ مَسْوًى ۚ فَجَعَلَ مِنْهُ الزَّوْجَيْنِ الذَّكَرَ
وَالْأُنْثَىٰ ۚ (29-30-31-32-33-34-35-36-37-38-39-40-41-42-43-44-45-46-47-48-49-50-51-52-53-54-55-56-57-58-59-60-61-62-63-64-65-66-67-68-69-70-71-72-73-74-75-76-77-78-79-80-81-82-83-84-85-86-87-88-89-90-91-92-93-94-95-96-97-98-99-100)

Qoran reveals that Allah The Almighty knows when a woman is conceived & what she carries in her womb; male or female:

وَمَا تَخْرُجُ مِنْ نَمْرَتٍ مِنْ أَكْمَامِهَا وَمَا تَحْمِلُ مِنْ أُنْثَىٰ وَلَا تَضَعُ إِلَّا بِوِلَافٍ ۚ (25-26-27-28-29-30-31-32-33-34-35-36-37-38-39-40-41-42-43-44-45-46-47-48-49-50-51-52-53-54-55-56-57-58-59-60-61-62-63-64-65-66-67-68-69-70-71-72-73-74-75-76-77-78-79-80-81-82-83-84-85-86-87-88-89-90-91-92-93-94-95-96-97-98-99-100)

Allah The Almighty has created you from male & female sexual fluids, fertilized & conceived within female uterus:

أَلَمْ نَخْلُقْكُمْ مِنْ مَاءٍ مُهِينٍ ۚ فَجَعَلْنَاهُ فِي قَرَارٍ مُكِينٍ ۚ إِلَىٰ قَدَرٍ مَعْلُومٍ ۚ (29-30-31-32-33-34-35-36-37-38-39-40-41-42-43-44-45-46-47-48-49-50-51-52-53-54-55-56-57-58-59-60-61-62-63-64-65-66-67-68-69-70-71-72-73-74-75-76-77-78-79-80-81-82-83-84-85-86-87-88-89-90-91-92-93-94-95-96-97-98-99-100)

*XY chromosomes determines male off-spring, while XX chromosomes determines female.

sub chapter iv

Embryology:

After the 'ovum' of female is fertilized with the 'sperm' of male; the 'zygote' thus created, try to fix itself in-side the 'uterus' of female. The zygote starts to grow to 'embryo'; embryo grows to 'foetus' and foetus ultimately grows to a full-fledged 'human' baby. These all changes from conception to the formation of human baby, take place within the uterus of female. The period of growth in side the female uterus is almost nine months. And the process of growth from zygote to human baby is termed as 'embryology':

Qoran says that Allah The Almighty has created you within the uterus of your mother. Your full growth within the mother womb takes place nine months. He creates your parts of body in different stages:

خَلَقَكُمْ مِنْ نَفْسٍ وَاحِدَةٍ ثُمَّ جَعَلَ مِنْهَا زَوْجَهَا... يَخْلُقُكُمْ فِي بُطُونِ أُمَّهَاتِكُمْ خَلْقًا تَيْنَ بَعْدَ خَلْقٍ

فِي ثَلَاثِ ثَلَاثٍ ۖ (23- الزمر- 6)

أَلَمْ تَخْلُقْهُمْ مِنْ مَاءٍ مُجَمِّينَ ۚ فَجَعَلْنَاهُ فِي قَرَارٍ مَكِينٍ ۚ إِلَى قَدَرٍ مَعْلُومٍ ۚ (29- المرسلت- 20-21)

Allah The Almighty creates you from 'soil'. "It means foods obtained from the plants/trees are grown from soil. Food provide us blood after degestion". 'نطفة' or the sexual fluids are created from blood. Male & female sexual fluids containing sperm and ovum unite together to form zygote. Zygote fixes & grows within the uterus of female, where zygote is converted to 'علق', "clot of blood". The Clot of Blood is converted to the 'مُضْغَةٌ', "chewed muscles". Then bone is created. Bone is covered with the

over..

Embryology ... contd...

proper 'muscle' "لَحْمًا", supplied with blood vessels & nerves network. The He creates different shapes & sizes of the Embryo. Glorify The Almighty Allah, who is The Best Creator.

وَلَقَدْ خَلَقْنَا الْإِنْسَانَ مِنْ سُلَالَةٍ مِنْ طِينٍ ۖ ثُمَّ جَعَلْنَاهُ نُطْفَةً فِي قَرَارٍ مَكِينٍ ۖ ثُمَّ خَلَقْنَا النُّطْفَةَ عَلَقَةً فَخَلَقْنَا الْعَلَقَةَ مُضْغَةً فَخَلَقْنَا الْمُضْغَةَ عِظْمًا مَكْسُوتًا

الْعِظْمَ لَحْمًا ثُمَّ أَنشَأْنَاهُ خَلْقًا آخَرَ فَتَجَرَّبَ اللَّهُ أَحْسَنُ الْخَالِقِينَ ۝

(18- المؤمنون - 14-12)

وَرَأَى كُمْ فِي الْخَلْقِ بَصِطَةً ۖ ۝ (8- الاعراف - 69)

A man is created by the contribution of male/father and female/mother sexes. The mother becomes pregnant or conceived, when male sperm unites with the female ovum in side the uterus. Now, mother carries & feed the developing embryo through her blood, that is why she becomes weaker & weaker during pregnancy:

وَوَصَّيْنَا الْإِنْسَانَ بِوَالِدَيْهِ حَمَلَتْهُ أُمُّهُ وَهْنًا عَلَى وَهْنٍ وَفِضْلُهُ فِي غَامِضٍ أَنْ اشْكُرْ لِي وَلِوَالِدَيْكَ ۖ إِنَّي الْمَصِيرُ ۝ (21 - لقمن - 14)

Allah The Almighty describes in Qoran, the creation of human from 'blood clot' i.e. 'علق'. علق is the Embryonic stage in mother's womb. When zygote develops, it appears like a clot of blood:

إِقْرَأْ بِاسْمِ رَبِّكَ الَّذِي خَلَقَ ۖ خَلَقَ الْإِنْسَانَ مِنْ عَلَقٍ ۖ (30- علق - 2, 1)

How a man is unthankful to The Almighty Allah. He does not ponder over the base of her existence. Allah The Almighty creates human from the union of male & female sexual discharges, which unite inside the female uterus to form zygote. Zygote develops to embryo & embryo ultimately becomes a full fledged baby. Allah The Almighty makes the passage easy for baby to come out of her mother's womb:over....

*This Qoranic Verse indicates that Growth occurs due to cell division.

Embryology ... contd...

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

مِنْ أَيْ شَيْءٍ خَلَقَهُ ۖ مِنْ نُطْفَةٍ خَلَقَهُ فَقَدَرَهُ ۖ ثُمَّ السَّبِيلَ يَسْرُهُ ۚ
وَاللَّهُ أَخْرَجَكُمْ مِنْ بُطُونِ أُمَّهَاتِكُمْ ۖ (14-الغل-78)
(عم-عبس-20-18)

Allah The Almighty says in Qoran that human has been created from male & female sexual fluids, which are discharged inside the uterus of female. Where they unite to form zygote. Zygote develops to 'clot of blood' عَلَقٍ. Which keeps on changing till Allah The Almighty creates a 'complete' human; male or female:

أَلَمْ يَكُنْ نُطْفَةً مِنْ مَتْنٍ يُمْنَى ۖ ثُمَّ كَانَ عَلَقَةً فَخَلَقَ نَسَوَى ۖ فَبَعَلَ مِنْهُ
الرَّوْجَيْنِ الذَّكَرَ وَالْأُنثَى ۚ (29-القيامة-39)

Allah The Almighty knows about what a female carries in her uterus i.e. male or female foetus. Also, He knows each & every changes and developments during different embryonic stages, inside the uterus:

اللَّهُ يَخْلُقُ مَا يَحْمِلُ كُلُّ أُنْثَىٰ وَمَا تَغِيضُ إِلَّا رَحَامٌ وَمَا تَزَادُ وَلَا تَنْقُصُ شَيْءٌ
عِنْدَهُ بِعِقْدَارِهِ ۚ عَلِيمُ الْغَيْبِ وَالشَّهَادَةِ الْبَاسِطُ الْمُتَمَالِكُ ۚ (13-الرهر-9,8)

O! the mankind, how Merciful is The Almighty Allah, Who creates you inside your mother's womb. During the embryonic stage, a number of changes take place till a complete human baby is created having got body parts for rightful uses to fulfill human requirements. Allah The Almighty creates the systems & features of your faces as per His likeness:

يَا أَيُّهَا الْإِنْسَانُ مَا غَرَّبَكَ بِرَبِّكَ الْكَرِيمِ ۚ الَّذِي خَلَقَكَ مَسْرُوكًا فَقَدَرَكَ
فِي أَيْ مُؤَرَّةٍ مَأْشَاءَ رَكْبِكَ ۚ (30-الانفطار-8)

Embryology ... contd...

Allah The Almighty describes the complete human life cycle in the following Qoranic Verse; from 'soil' to 'soil'. Allah The Almighty creates human from soil*, then from 'نطفة' i.e. male & female sexual fluids. Sexual fluids from testis of male & ovary of female are discharged inside the uterus, where they unite to form zygote. Zygote is converted into 'blood clot' or 'علق'. The Blood Clot is converted into 'chewed muscles'. Chewed Muscle is converted into proper 'muscle'. The development continues inside the uterus till embryo is converted into a full-fledged human baby. When the 'embryonic period' completes, the human baby is born as per Allah's wish. Now external growth continues till baby becomes a youth, who ultimately becomes old. Some one dies earlier and someone dies after old-age:

يَا أَيُّهَا النَّاسُ إِن كُنتُمْ فِي رَيْبٍ مِّنَ الْبَيْتِ فَإِنَّا خَلَقْنَاهُ مِن شُرَابٍ ثُمَّ مِّن نُّطْفَةٍ ثُمَّ مِّن عَلَقَةٍ ثُمَّ مِّن مُّضْغَةٍ مُّخَلَّقَةٍ وَغَيْرِ مُّخَلَّقَةٍ لِّنُبَيِّنَ لَكُمْ وَنُقَرُّ فِي الْأَرْحَامِ مَا نَشَاءُ إِلَىٰ أَجَلٍ مُّسَمًّى ثُمَّ نُخْرِجُكُمْ طِفْلًا ثُمَّ لِيَبْلُغُوا أَشَدَّكُمْ وَمِنْكُمْ مَّن يُتَوَفَّىٰ وَمِنْكُمْ مَّن يُرَدُّ إِلَىٰ أَرْذَلِ الْعُمُرِ... ه (١٧- الحجج - ١٥)

هُوَ الَّذِي خَلَقَكُمْ مِن شُرَابٍ ثُمَّ مِّن نُّطْفَةٍ ثُمَّ مِّن عَلَقَةٍ ثُمَّ يُخْرِجُكُمْ طِفْلًا ثُمَّ لِيَبْلُغُوا أَشَدَّكُمْ ثُمَّ يَسْكُونُوا شُيُوخًا وَمِنْكُمْ مَّن يُتَوَفَّىٰ مِن قَبْلُ وَلِيَبْلُغُوا أَجَلَ مُّسَمًّى وَخَلَقْنَاكُمْ نَفَقِلُونَ ه (٢٤- المؤمن - ٦٧)

وَرَضَيْنَا الْإِنسَانَ بِوَالِدَيْهِ إِحْسَانًا خَلَقْتَهُ أُمَّةً كَرِيمًا وَوَضَعْنَاهُ كَرِيمًا وَخَلَقْنَاهُ وَفَضَلْنَاهُ ثَلَاثُونَ نَحْمَرًا ه (٢٦- الاحقاف - ١٥)

سُبْحَنَ الَّذِي خَلَقَ الْأَزْوَاجَ كُلَّهَا مِمَّا تُنْبِتُ الْأَرْضُ وَمِنَ الْأَنْسَابِ وَمِمَّا لَا يَعْلَمُونَ ه (٢٣- يس - ٣٦)

*The seeds hidden beneath the earth start germinating as soon as rain falls from sky. Germinating seeds grow into plants/trees, which produce fruits & cereals. Fruits & cereals are eaten by human as food. Food is converted to blood & blood is responsible to produce sexual fluids.

Embryology ... contd...

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ وَاللَّهُ خَلَقَكُمْ مِنْ تُرَابٍ ثُمَّ مِنْ نُطْفَةٍ ثُمَّ جَعَلَكُمْ أَزْوَاجًا
وَمَا تَحْمِلُ مِنْ أُنْثَىٰ وَلَا تَضَعُ إِلَّا بِعِلْمِهِ وَمَا يُعَمَّرُ مِنْ مُعْمَرٍ وَلَا يَنْقُصُ مِنْ عُمرِهِ
إِلَّا فِي كِتَابٍ إِنَّ ذَٰلِكَ عَلَى اللَّهِ يَسِيرٌ (22 - فاطر - ١١)
وَمَا نُخْرِجُ مِنْ بُطْنٍ مِّنْ أَكْثَرٍ مِّمَّا نَحْمِلُ مِنْ أُنْثَىٰ وَلَا نَضَعُ إِلَّا بِعِلْمِهِ... (25 - هـ - 47)

Allah The Almighty creates all the things 'the best'. He started the creation of human from 'soil', then He continues the creation of human generations from sexual fluids. Then He properly creates the human within mother's uterus & blows 'spirit' within the embryo. Allah The Almighty bestows human with two ears & a heart. But, O! mankind, you are least thakful to The Almighty:

الَّذِي أَحْسَنَ كُلَّ شَيْءٍ خَلَقَهُ وَبَدَأَ خَلْقَ الْإِنسَانِ مِن طِينٍ ثُمَّ جَعَلَ نَسْلَهُ
مِنْ سُلَالَةٍ مِّنْ مَّاءٍ مَّهِينٍ ثُمَّ سَوَّاهُ وَنَفَخَ فِيهِ مِن رُّوحِهِ وَجَعَلَ لَكُمُ السَّمْعَ وَ
الْأَبْصَارَ وَالْأَفْئِدَةَ قَلِيلًا مَّا تَشْكُرُونَ (21 - السجد - 5 - 9 - 7)
وَهُوَ الَّذِي أَنشَأَ لَكُمُ السَّمْعَ وَالْأَبْصَارَ وَالْأَفْئِدَةَ قَلِيلًا مَّا تَشْكُرُونَ (18 - المؤمنون - 78)
وَاللَّهُ أَخْرَجَكُمْ مِنْ بُطُونِ أُمَّهَاتِكُمْ لَا تَعْلَمُونَ شَيْئًا وَجَعَلَ لَكُمُ السَّمْعَ وَالْأَبْصَارَ
وَالْأَفْئِدَةَ لَعَلَّكُمْ تَشْكُرُونَ (14 - النحل - 78) لَهُمْ قُلُوبٌ لَا يَفْقَهُونَ بِهَا وَلَهُمْ
أَعْيُنٌ لَا يُبْصِرُونَ بِهَا وَلَهُمْ أُذُنٌ لَا يَسْمَعُونَ بِهَا... (9 - الأعراف - 179)

Allah The Almighty describes here that He bestows human with two eyes, two lips and one tongue during embryonic stage. And when baby is born, Allah The Almighty provides senses & guides the baby towards mother's breast to satisfy his/her hunger** during which baby utilises eyes to see, lips & tongue to suck & taste the milk:..over.

* →

(7-1 الانعام - 46) (15-1 بني اسرائيل - 36)

**hunger indicates that food is basic needs of human.

Embryology ... contd...

أَلَمْ نَجْعَلْ لَهُ عَيْنَيْنِ لَا بَصِيرَةَ لَهِمَا وَشَفَتَيْنِ لَا وَهَدَ يَنَّهُ الْبَحْدَ يِينِ (30- البقرة- 8)
فَانْظُرُوا كَيْفَ بَدَأَ الْخَلْقَ ثُمَّ اللَّهُ يُنشِئُ الشَّيْءَ الْآخِرَةَ... (20- العنكبوت- 20)

Allah The Almighty develops, two ears, two eyes & one heart while human is in embryonic form in side mother's womb. But, unfaithfuls donot utilize their eyes* (& brain) to view the creations of Almighty, particularly Qoran & Holy Prophet's foot-steps. And 'ears'** (& brain) to listen, particularly Qoran, Holy Prophet's sayings, and 'heart'*** to 'love' for good things & 'hate' for bad things. But all these gift from The Almighty went useless for those who were unfaithful to Allah & could not understand the Verses of Qoran:

وَلَقَدْ خَلَقْنَاهُمْ نِعْمًا إِنَّا مَلَكْنَاهُمْ فِيهِ وَجَعَلْنَا أَعْيُنَهُمْ وَابْصَارًا وَآفِيدَةً رَّحْمَةً لِّمَنْ أَغْنَى عَنْهُمْ سَمْعُهُمْ وَلَا أَبْصَارُهُمْ وَلَا آفِيدَتُهُمْ مِنْ شَيْءٍ... (26- الاحقاف- 26)
قُلْ هُوَ الَّذِي أَنْشَأَكُمْ وَجَعَلَ لَكُمُ السَّمْعَ وَالْأَبْصَارَ وَالْأَفِيدَةَ قَلِيلًا مَّا تَشْكُرُونَ (29- المائدة- 23)

Allah The Almighty has created the structures of your faces as per His likeness, while you were an embryo in your mother's womb:

هُوَ الَّذِي يُصَوِّرُكُمْ فِي الْأَرْحَامِ كَيْفَ يَشَاءُ... (3- النحل- 3)

وَلَقَدْ خَلَقْنَاكُمْ ثُمَّ صَوَّرْنَاكُمْ... (8- الاعراف- 11)

وَصَوَّرَكُمْ فَأَحْسَنَ صُوَرَكُمْ... (28- التغابن- 3)

*Qoranic Verse indicates that eyes are connected with brain. Eyes sense the vision and brain decides & responds.

**Qoranic Verse indicates that ears help the brain to listen and brain responds according to the message received. (12- الحاقة- 29)

***Qoranic Verse indicates that heart controls the brain during the decisions that brain performs. Scientifically it is established that brain becomes unconscious, if blood supply to the brain is stopped for five seconds.

Embryology ... contd...

In the following Qoranic Verses Allah The Almighty describes about The Spirit or 'الروح' that alives the human embryo and remains inside human body till whole life. 'الروح' is an order from The Almighty Allah:

قُلِ الرُّوحُ مِنْ أَمْرِ رَبِّي وَمَا أُوتِيتُمْ مِنَ الْعِلْمِ إِلَّا قَلِيلًا (١٥- بقى اسرائيل - ٨٥)

When all body parts of embryo come to existence, Allah The Almighty blows the 'spirit' inside the embryo. And Allah The Almighty created two ears, two eyes and one heart, but O! mankind, you are least thankful:

ثُمَّ سَوَّاهُ وَنَفَخَ فِيهِ مِنْ رُوحِهِ وَجَعَلَ لَكُمُ السَّمْعَ وَالْأَبْصَارَ وَالْأَفْئِدَةَ ۖ قَلِيلًا مِمَّا تَشْكُرُونَ (٢١- السجدة - ٩)

Allah The Almighty blown 'الروح' inside the statue of Adam, and Adam become alive:

وَإِذَا سَوَّيْنَاهُ وَنَفَخْنَا فِيهِ مِنْ رُوحِنَا فَقَعُوا لَهُ سَجِدِينَ (١٤- الحجر - ٢٩)
وَ (٢٣- ق - ٧٢)
وَأَيَّدَهُم بِرُوحٍ مِنْهُمْ ۚ (٢٨- المجادلة - ٢٢)

Allah The Almighty in the following Qoranic Verse briefs the existence of human; when male 'semen' is dropped and mixes with female sexual fluid in the female uterus i.e. your mother's womb. This way you are created, therefore, remember your existence & donot boast:

هُوَ أَعْلَمُ بِكُمْ إِذْ أَنشَأَكُم مِّنَ الْأَرْضِ وَإِذْ أَنْتُمْ بِطُؤُنٍ مُّطْمَئِنِّينَ ۚ فَلَا تَزْكُؤْا
أَنفُسَكُمْ ۚ هُوَ أَعْلَمُ بِمَنِ اتَّقَىٰ (٢٧- النجم - ٣٢)

Allah The Almighty indicates in this Qoranic Verse that 'Ear' is an important organ and hearing stimulates the brain and thus learning differentiate the human from animal:

إِنَّ شَرَّ الدِّينِ عِنْدَ اللَّهِ الصُّمُّ ۚ الَّذِينَ لَا يَسْمَعُونَ (٩- الانفال - ٢٢)

Embryology ... contd ...

POST NATAL STAGE:

When human is born, primarily he/she is weak*, then grows and gains energy and becomes powerful**. Again he/she loses his/her energy and becomes weak*** & weaker**** day by day:

اللَّهُ الَّذِي خَلَقَكُمْ مِنْ ضَعْفٍ ثُمَّ جَعَلَ مِنْ بَعْدِ ضَعْفٍ قُوَّةً ثُمَّ جَعَلَ مِنْ بَعْدِ قُوَّةٍ ضَعْفًا وَشَيْبَةً ۖ يَخْلُقُ مَا يَشَاءُ ۚ وَهُوَ الْعَلِيمُ الْقَدِيرُ (21- الروم- 54)

Allah The Almighty says that old age is almost similar to the childhood, since during both the stages human is physically & mentally weak:

وَمَنْ نَقْوَِرُهُ نُكَسِّهِ فِي الْخَلْقِ ۖ أَفَلَا يَعْقِلُونَ (23- يس- 68)

Human has been created from soil, then from semen (male & female sexual fluids are fertilized within female uterus. During different stages of pregnancy 'zygote' develops to fullfledged human embryo, ultimately baby is delivered then dies or grows to old age and then dies and put to grave to be mixed with soil. Thus human life cycle completes from soil to soil.

مِنْ أَيْ شَيْءٍ خَلَقَهُ مِنْ نُطْفَةٍ ۖ خَلَقَهُ فَقَدَرَهُ ۖ ثُمَّ السَّبِيلَ يَسْرُهُ ۖ ثُمَّ أَمَاتَهُ فَأَقْبَرَهُ (30- عبس- 21- 18)

The next continued same chapter IV, which covers the scientific details of sexual reproduction in human.

*baby or childhood

**youth age

***old age

****towards death

CHAPTER FOUR

REPRODUCTION: . . . contd. . .

Now, let me review scientifically the process of 'Reproduction' in human.

Living organisms reproduce their identical off-springs in two ways:

a) Asexual b) Sexual.

ASEXUAL REPRODUCTION:

Many plants & Micro Organisms reproduce 'asexually'. In this process any body part of the organism, if cut-off systematically from the parent's body, may produce a new off-spring identical to its parent. Before going in details, I would like to take-up 'sexual reproduction'.

SEXUAL REPRODUCTION:

The off-springs produced by way of sexual reproduction may differ from the parents, because they are combination of the parental characteristics. Here a 'cell' combines from each of the male & female parents, so that two sets of Genetic material i.e. 'chromosomes' are combined. The cells contributed by each parent are called 'sex-cell' or 'gametes' and are produced in a special sex organs called 'gonads'. The male Gonad is Testis and produces Spermatozoa; the male gamete and the male sex hormone; 'Testosterone'.

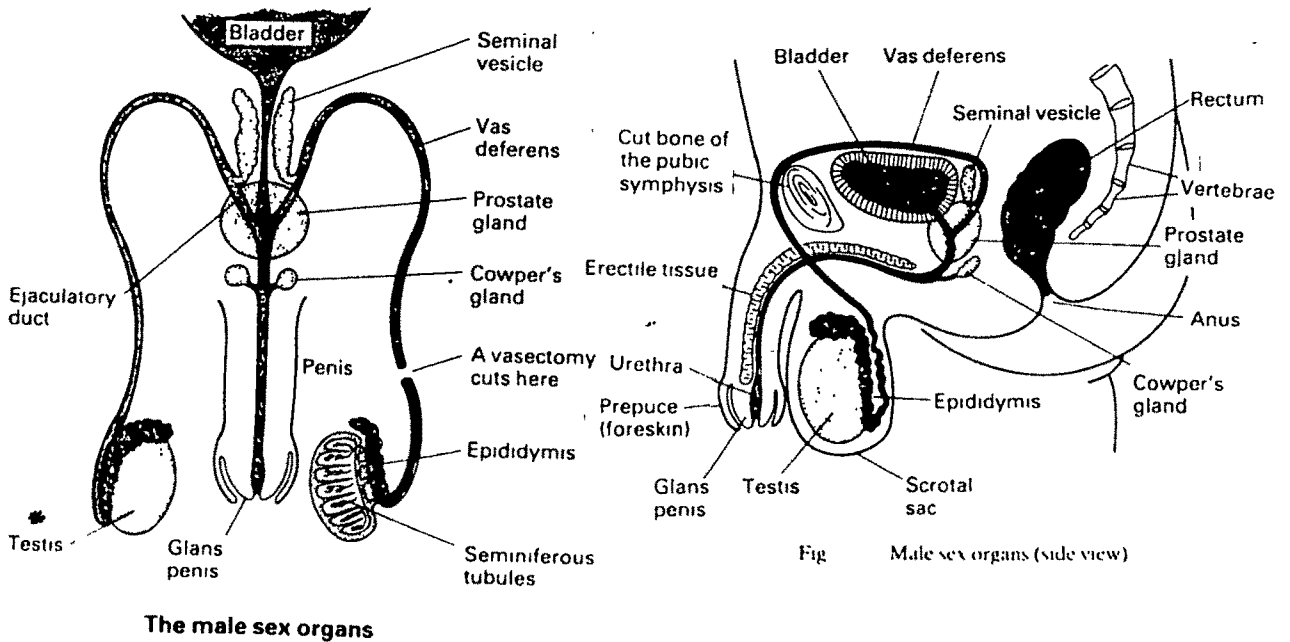
Male Reproductive System:

Male reproductive system contains the following organs, arranged in a systematic way:

Testis: There is a pair of Testis. Each Testis is divided

Reproduction ... Testis ... contd...

into 'lobules' containing 'seminiferous tubules'. Spermatozoa are produced in Seminiferous Tubules by way of a process called 'spermatogenesis'. Sertoli Cells supply nutrients to the sperms. Sertoli Cells are found amongst the sperm producing cells.



In between the Seminiferous Tubules, there are group of cells secret-
ing male hormone 'Testosterone'.

Epididymis: Epididymis is extremely long coiled tube, where Spermatozoa are released from Testis and pass through a series of ducts. Spermatozoa are stored in Epididymis till they are propelled during sexual activity. There is a lining of smooth muscles around the Epididymis, which contracts to ejaculate the 'sperm' carrying fluid.

* خَلَقَ مِنْ مَّاءٍ دَافِقٍ ۖ يَخْرُجُ مِنْ بَيْنِ الصُّلْبِ وَالتَّرَائِفِ ۖ (30 - الطارق - 6,7)

Reproduction ... Testis ... contd...

Vasdeferens: Epididymis leads into 'Vasdeferens', a muscular tube. Sperms are propelled through Vasdeferens and enter into 'Urethra' behind the bladder.

In Vasdeferens Veins, Arteries & Nerves together with muscles form a 'Spermatic Cord'. Spermatic Cord pulls up the Testis during cold weather or sexual activity. Two Vasdeferens join together behind the bladder after passing through 'Ejaculatory Ducts'.

Seminal Vesicles: Seminal Vesicles are a pair of glands located behind the bladder and produce nutrients & viscous fluid, in which Spermatozoa are transported.

Prostate Gland: This single ring like structure surrounds the upper part of Urethra and swells to close the exit for urine from bladder during the sexual activity.

The secretions from Prostate Gland is alkaline i.e. pH is 7.5, which neutralises the activity of Female Reproductive passage-way and thus protecting the sperms.

Cowper's Gland: Cowper's glands are of pea-sized and secrete lubricating alkaline fluids that contribute the existence of Seminal Fluid.

Seminal Fluid: Seminal Fluid is the mixture of Spermatozoa and secretions Cowper's gland. There are 400-500 million sperms in 3-4ml ejaculated Seminal Fluid. Only one sperm is needed to fertilize with one 'ovum'. Acrosome of each sperm produces an enzyme called 'Hyaluronidase'.

Penis: Penis is an external male organ to introduce sperms to Female Reproductive System.

Reproduction ... contd...

Female Reproductive System:

The Female Gonad is a pair of 'ovary', which constitutes a system with other organs, and produces female gamete or 'ovum' & female hormones Oestrogen & Progesterone.

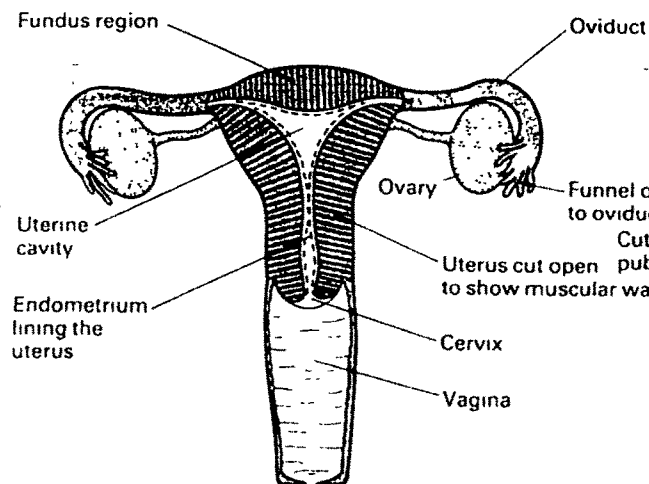


Fig Female sex organs (front view)

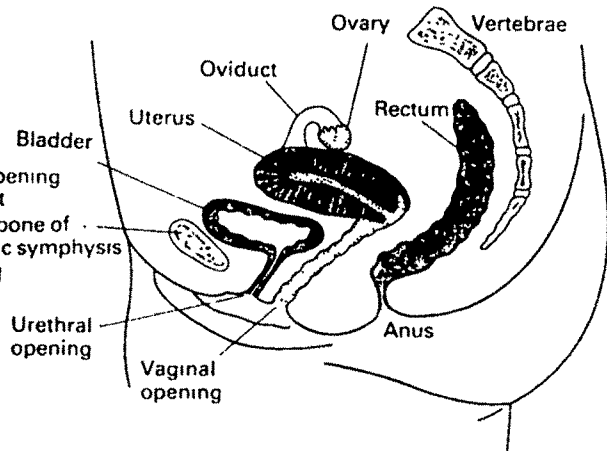


Fig Female sex organs (side view)

The Female Reproductive System contains the following organs:

Ovary: A pair of ovaries suspended by ligaments on each side of the Uterus. Uterus is situated in the mid of Pelvic Girdle.

There is blood & nerve supply to each 'ovary'.

The eggs originate from the outer Germinal Epithelium. The process of egg formation is called 'Oogenesis'. Oogenesis starts from the age of puberty and continues upto 30 years. Egg production ceases at Menopause . Inside the ovary developing eggs are embedded in connective tissue. The eggs are enclosed in 'Ovarian Follicle'.

Uterine/Fallopian Tube: Uterine Tube or Oviduct connects the ovaries with the Uterus. The release of a mature 'Ovum' from ovary each month, is called 'Ovulation'. In Uterine ...

Reproduction ... Oviduct ... contd...

Tube, egg may fertilize with sperm, upto two days after Ovulation. Fertilized or unfertilized egg passes down into Uterus over the next 3 days. The Oviduct is 10cm in length. Zygote normally implants into Uterus, but sometimes in the Uterine Tube. This type of pregnancy is called 'Ectopic' and has to be terminated.

Uterus: or Womb is located in front of the Rectum & behind the bladder; is a 'pear' shaped hollow organ. The virgin uterus is 3 inch long & 2 inch wide. The Uterine Cavity is lined by 'Endometrium'. The outer part of this mucous membrane sheds monthly during 'menstruation'.

Uterus has its blind end facing forward in the body cavity, while narrower portion of Uterus 'Cervix' faces the vertebra column. The Cervix opens into the 'Vagina'.

Vagina: Vagina is a muscular tube of about 4 inch, located between bladder & rectum. Its mucous membrane secretes Acid, that keeps off micro-organisms. Sometimes 'Hymen'; a membrane that totally or partially blocks the exit of Vagina and needed to be removed to allow the first menstruation.

Vulva: The Vulva is a female external genitalia consists of pairs of 'labia majora' & 'labia minora' & 'Clitoris'. Majora & Minora are skin's folds covering Vagina, while Clitoris resembles with male penis & serves the sexual excitement.

Mammary Gland: Milk is supplied from Mammary Glands, situated in Breast, after birth of baby. Milk volume increases by way of stimulation of 'Pituitary Gland'. Lactation or milk production is caused by 'Prolactin' hormone - an anterior Pituitary Gland secretion.

Reproduction ... contd...

Fertilization.

Union of haploid Male Gamete and haploid Female Gamete in the upper part of Oviduct to form diploid Zygote, is called fertilization.

A single sperm is needed to fertilize, but millions of sperms must be present to produce enough 'Hyaluronidase' enzyme to breakdown the egg membrane. The sperm have to stay in female passageway for six hours, before it gains entry to the 'Ovum'.

Haploid Spermatozoan + Haploid Ovum === Diploid Zygote

23 chromosomes 23 chromosomes 46 chromosomes

Zygote divides i.e. cleavage into 2, 4, 8 and so on until a ball of cells is produced. This ball is called 'Morula'. As a result of further division, a hollow ball of cells is formed called 'Blastocyst'.

On the 5th day after fertilization, Blastocyst enters the Uterus and on 7th or 8th day it attaches to the Endometrial lining of Uterus. This process is termed as 'implantation'.

Pregnancy.

The implantation of Blastocyst into uterine lining heralds the 'Pregnancy'. The implantation coincides with the prepared state of Endometrium, during premenstrual or postovulatory period. Blastocyst generally implants in the 'Fundus' region of Uterus. Blastocyst eats its way into uterine lining by enzymic activity, until becomes fixed to the Uterus wall.

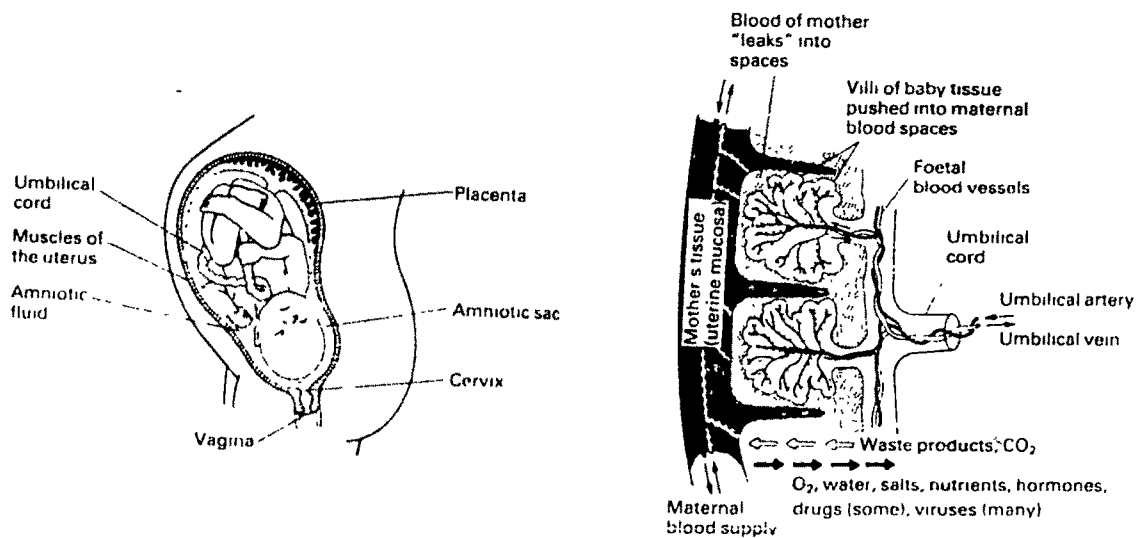
For the first two months or so, when main organs are developing, the baby is called 'Embryo'. Next to Embryo is 'Foetus', which is enclosed in Embryonic Membrane. Embryonic Membrane nourishes and protects the foetus.

Reproduction ... Pregnancy ... contd...

The Amniotic Membrane forms Amniotic Sac, which contains Amniotic Fluid. The foetus suspends in this fluid, receiving nourishments and protection from shocks. Another membrane Chorion is modified to form 'Placenta' during the end of 3rd month.

Placenta.

The developing foetus obtains nutrients from mother through Placenta. The foetus is attached with Placenta by Umbilical Cord. This cord contains veins and arteries.



Diagrammatic section through placenta

Fig The placenta

Mothers blood flow is not continued to the foetus, instead, Glucose, Amino Acids, Salts and Oxygen pass from mothers blood to the foetal blood across the Placenta by way of Active Transport or Diffusion. Also, the waste products from foetus move into the mothers blood across the Placenta.

Placenta is an efficient filter, but Carbon Mono Oxide from smoking and Alcohol may pass through the Placenta. Also, chemicals or agents like 'Teratogens and Virus Rubella' may pass across the Placenta and cause genetic effects.

PLACENTA

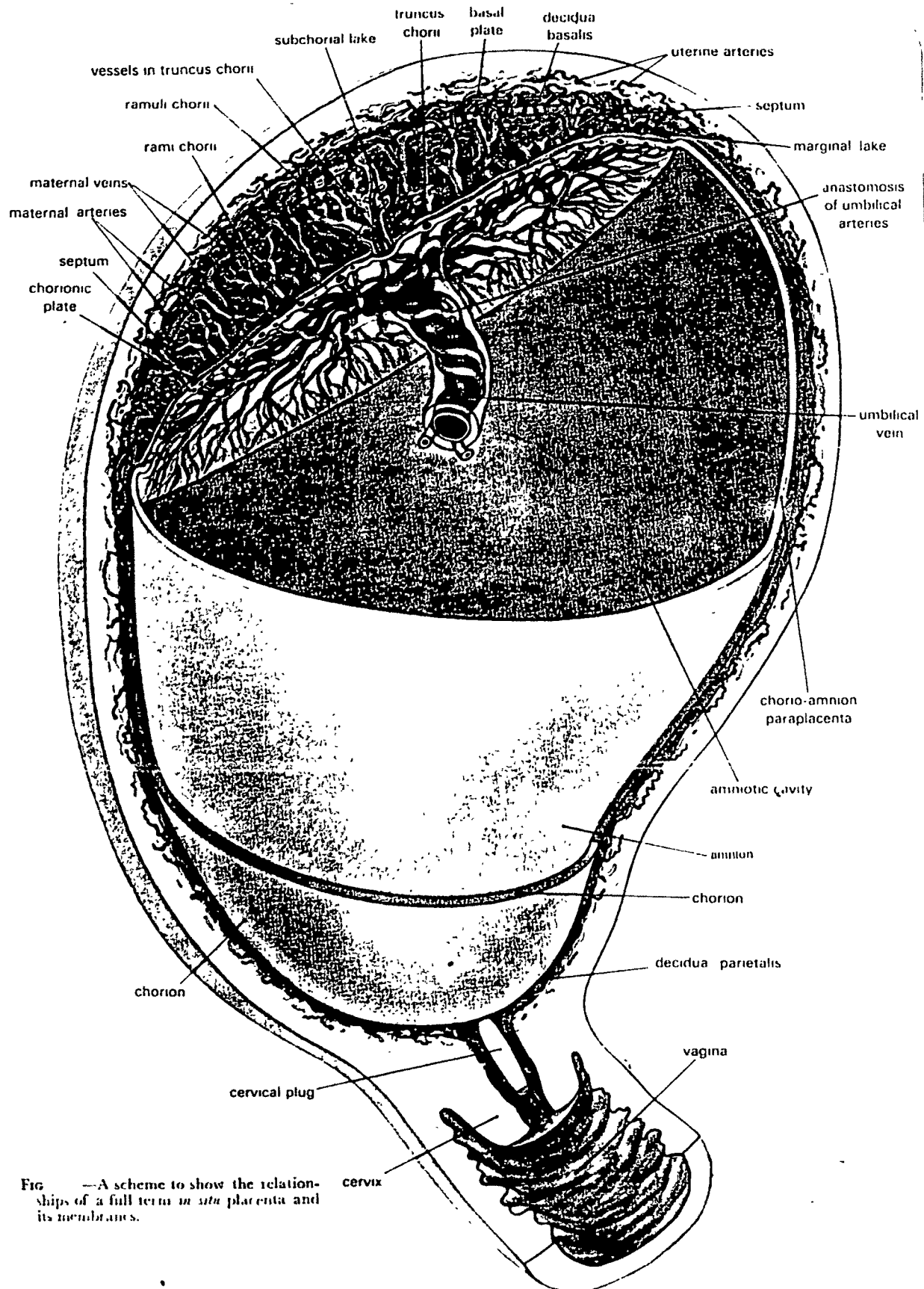


FIG. —A scheme to show the relationships of a full term *in situ* placenta and its membranes.

Reproduction ... Pregnancy ... contd...

Pregnancy Hormones:

Placenta not only acts as a 'blood filter', but also as an 'Endocrine' organ. Pregnancy is maintained and lactation is initiated by 'Oestrogen' & 'Progesterone' hormones, secreted by Placenta.

Another hormone HCG or Human Chorionic Gonadotrophin, is produced by the Chorion membrane of Placenta and can be detected in Urine of a pregnant woman, upto 3 months of pregnancy and gradually reduces until birth. HCG keeps 'corpus luteum' active to produce Progesterone hormone to maintain the pregnancy.

At 4th month, level of HCG falls and Placenta supplies enough Oestrogen & Progesterone, and corpus luteum begins to disintegrate.

Child Birth: *

Before Child birth or Parturition, mother carries foetus for about 9 months or 280 days from beginning of last 'menstrual' period. This time is called 'Gestation Period'. In the next couple of months, foetus almost doubles its weight and ultimately ready to be delivered as a baby for external growth.

This chapter is further subdivided into two sub-chapters; i) Functions of Reproductive Organs & ii) Embryology.

Therefore, let me review the scientific details regarding the functions of reproductive organs.

* هُوَ الَّذِي خَلَقَكُمْ مِنْ نَفْسٍ وَاحِدَةٍ ثُمَّ يَخْرِجُكُمْ مِنْ بَطْنِ امْرَأَةٍ ثُمَّ يَضَعُكُمْ عَلَى الْأَرْضِ ثُمَّ يَكُونُ مِنْكُمْ شَرَابٌ ثُمَّ يَكُونُ مِنْكُمْ نَفْسٌ ثُمَّ يَكُونُ مِنْكُمْ نَفْسٌ ثُمَّ يَكُونُ مِنْكُمْ نَفْسٌ (24-المؤمن)

Reproduction ... contd...

sub chapter i

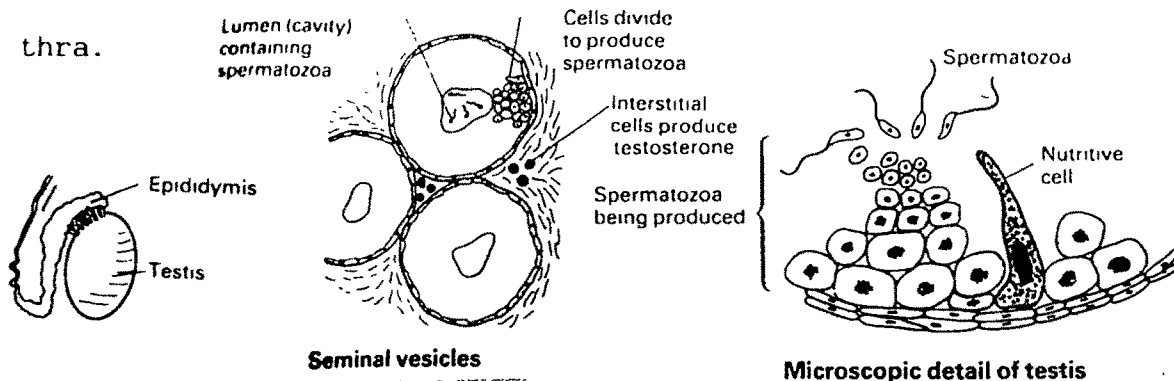
Functions of Reproductive Organs:

Blood which human body obtains from foods, circulates and reaches to each & every parts of the body. This blood is converted to Male Gamete or Spermatozoa through Testis in male human and Female Gamete or Ovum through Ovary in Female Human.

Structure of Testis:

There is a pair of Testis or male gonad* within 'Scrotal Sac'. This sac maintains Testis at lower temprature, because at higher temprature Spermatogenetic tissue degenerates.

Numerous 'Seminiferous Tubules' are essential structural units of Testis. Each S. Tubule, if uncoiled is about 50cm long & .25mm in diameter. Each coil of S. Tubule opens into 'Rete Testis'*** through straight tubules. Rete Testis continues into 'Efferent Ductule'. The Efferent Ductule, in turn, disposed into numerous coils to form 'Epididymis'. Epididymis is attached to the posterior surface of Testis. Epididymis later becomes thick-walled and called as 'Vas-deferens'. Vasdeferens joins the duct of Seminal Vesicle to form 'Common Ejaculatory Duct'. C. E. duct opens into posterior part of Urethra.



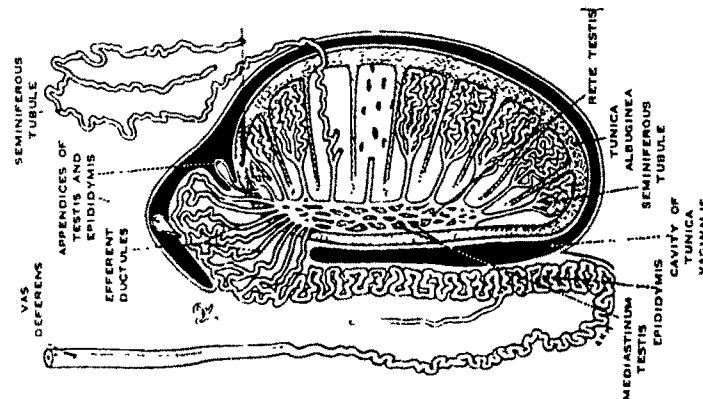
*Primary sex organs i.e. Testis & Ovary are gonads

**a net-work of channels lying in Mediostinum Testis

Reproduction ... Testis ... contd...

Seminiferous Tubules:

Seminiferous Tubules are important since it produces 'Spermatozoa' and 'Interstitial Gland' produces Testosterone hormone, which maintains the male behaviour.



The epithelium of seminiferous tubule consists of two types of cell:

i) Sertoli Cells & ii) Germ Cells.

Sertoli Cells: Sertolic Cells are tall pyramidal cells scattered from Basement Membrane to the Lumen. Sertoli cells provide mechanical support, protection & nutrition to the developing Germ cells. Sertoli cells are also active in releasing the mature Spermatozoa. Sertoli Cells of a mature testis do not divide.

Germ Cells: The Germ Cells are irregular shaped and found in contact with the Basement Membrane and divide 'mitotically' to give rise to 'spermatogonia'. Spermatogonia convert into spherical nucleated cells called 'Spermatocyte Primary'. The spermatocyte primary moves to the middle zone of seminiferous epithelium & divides meiotically i.e. reduction into smaller 2ndary 'Spermatocyte'. 2ndary spermatocyte divides to form the smallest cells; 'Spermatids'. Spermatids convert to Spermatozoa via metamorphosis. Spermatozoa are found free in lumen.

Reproduction ... Testis ...contd...

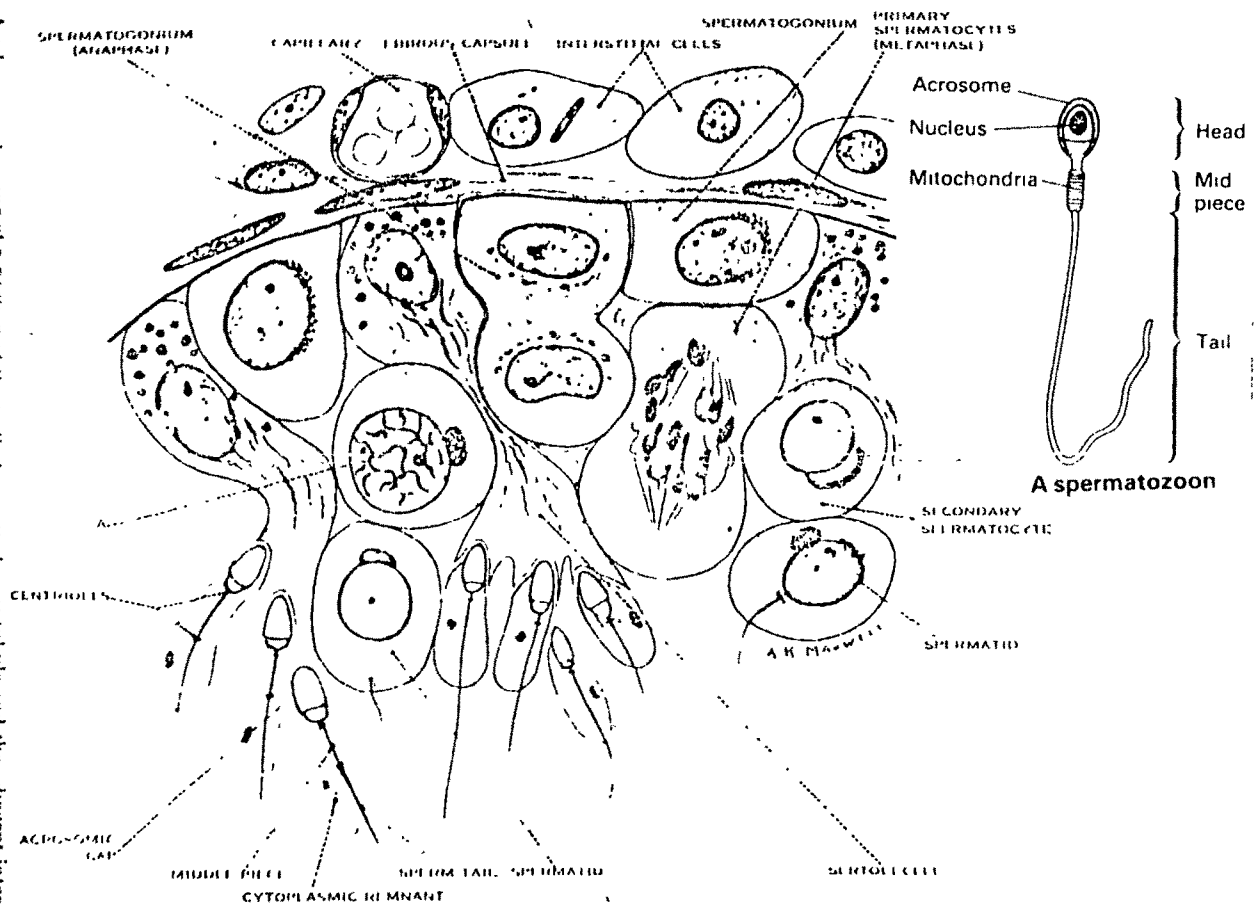
Spermatogenesis:

Formation and maturation of Spermatozoa is called Spermatogenesis.

Spermiogenesis:

Metamorphic period of Spermatogenesis is called Spermiogenesis. Metamorphosis of Germ Cell starts, when Spermatids come in contact with Sertoli Cells. Changes during Metamorphosis are: i) loss of spermatid's cytoplasm, ii) concentration of nuclear material & dense sperm head, neck, middle piece & tail appear & iii) ultimately becomes a motile organism capable to swim & fertilise an ovum.

FIG. —A schematic drawing of a portion of the wall of a seminiferous tubule and the adjacent interstitial area showing stages in spermatogenesis. The metamorphosis of the spermatid into a spermatozoon is shown. A—the mass of the Golgi material which later forms the acrosome and tail, on acrosome, cap. (Golgi material appears in the spermatogonia as grey or black patches). / C. H. 50



MATURATION OF SPERMS IN MALE GENITAL TRACK:

Exact length of Spermatogenesis period is not certain, but development of a 'sperm' from Primary Spermatocyte takes a few days. When fully formed, Sperm becomes free in Tubule lumen and reaches to Com-

Reproduction ... Testis ...contd...

mon Ejaculatory Duct via straight tubules, rete testis, efferent ductules, epididymis & vas deferens. During ejaculation, sperms are forced into Urethra, where sperm mixes with the secretion of accessory glands & becomes 'semen'.

Sperms become mature at the time of leaving 'sertoli' cells. They mature further while pass through Epididymis & Vas deferens. This increase the vigour & fertilizing power. If sperms are not ejaculated after formation, they soon degenerate and are absorbed within the tubule of Epididymis.

Testicular Endocrine Tissue:

Adult Testis consists of 'Interstitial Gland Cells or Leydig Cells, which secrete 'Testosterone'. Secretion is controlled by Anterior Pituitary or Gonadotrophic hormone - called as Interstitial Cell stimulating hormone.

Ovary:

A pair of 'ovary' is primary female sex organ. Ovary serves dual purpose; i) production of 'ovum' & ii) secretion of hormone, which controls the 2ndary sex characters.

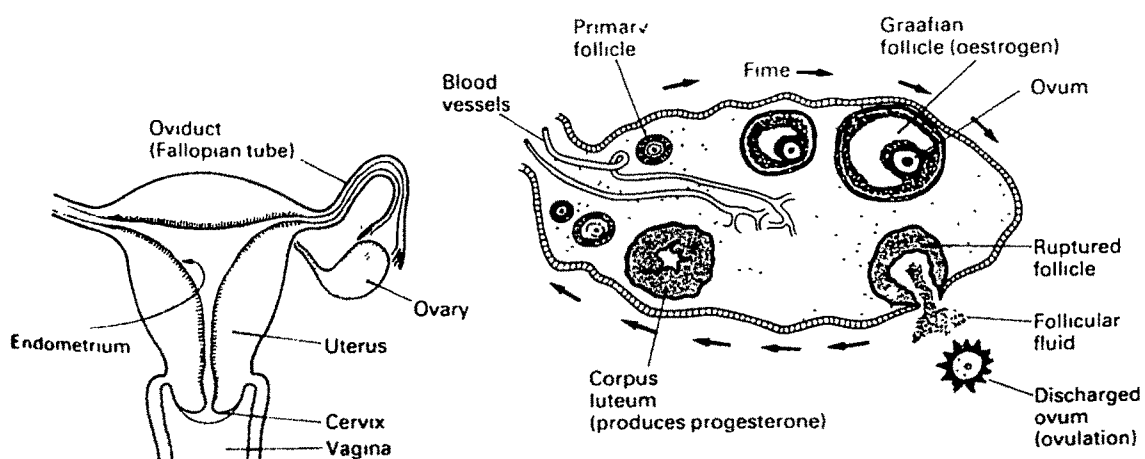


Fig The ovary

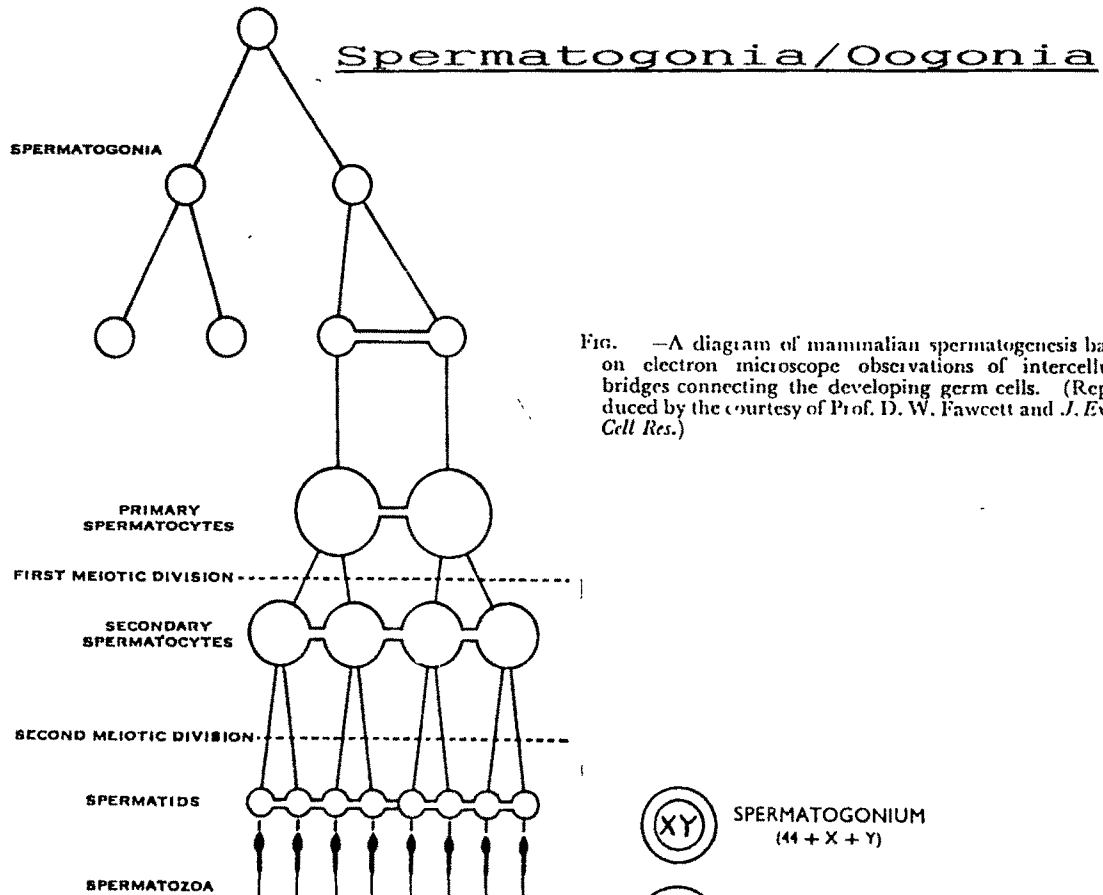
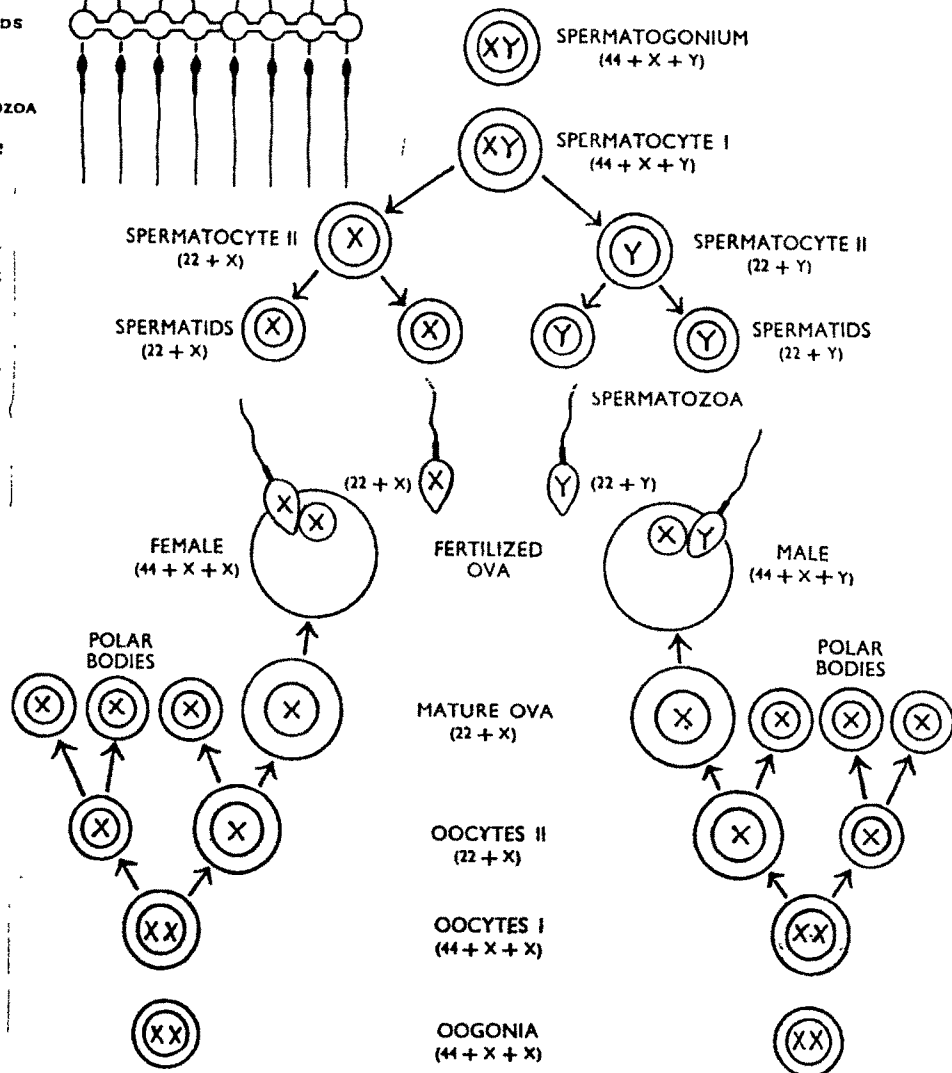


Fig. —A diagram of mammalian spermatogenesis based on electron microscope observations of intercellular bridges connecting the developing germ cells. (Reproduced by the courtesy of Prof. D. W. Fawcett and *J. Exper. Cell Res.*)

Fig. —A diagram of gametogenesis and fertilization, with particular reference to chromosome distribution and an approximate comparison of cell size relationships. Note that in most mammals the secondary oocyte gives off the secondary polar body only if a sperm has penetrated it; hence ovum maturation and fertilization overlap. If the ovum is fertilized by a sperm containing an X chromosome, the resulting individual is a female; if the ovum is fertilized by a sperm containing a Y chromosome, the resulting individual is a male.



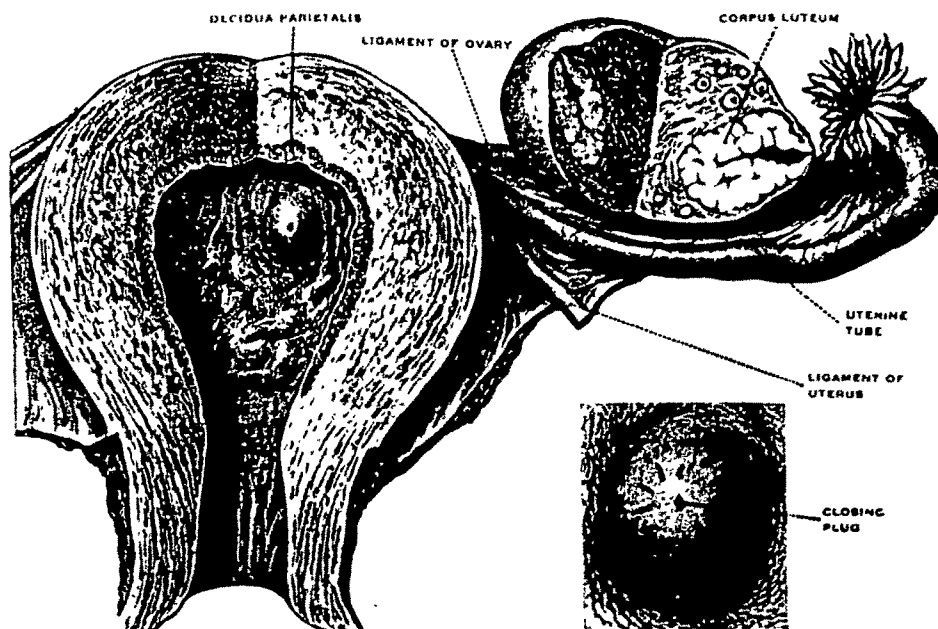
Reproduction ... Ovary ...contd...

Ovary continuously undergoes complex changes in structure during mature sexual life. Adult ovary is 3-5g in weight, 3-5cm in length, 2cm in breath & 1.5cm thick.

On section, ovary is seen to posses an outer 'cortex' & inner 'medulla'. During child bearing period, the Cortex becomes thick & contains functional Germ Cell, embedded in 'Embryonic Tissue'. During mature sexual life Cortex is the seat of complex cyclic changes in transformations of oogonia into oocytes and the formation of Ovarian/Graafian follicle. The Medulla consist of richly vascularised connective tissue with 'Lymphatic' vessels. The Ovarian hormones are: 1) Oestrogens, ii) Progesterone, iii) Relaxin & iv) Androgens.

A woman normally, sheds only 300-400 mature 'ova' in her life time, while male emits 200-300 million 'sperms' during single ejaculation.

The cells destined to become Ova corresponds to Spermatogonia are called 'Oogonia'. Oogonia multiply by Mitosis, which ultimately increase in size & its 'Nuclear Chromatin' changes their arrangements, thus Primary Oocytes are formed.



Reproduction ... Ovary ...contd...

Maturation of female Germ Cells & Follicle formation begins early in 'foetal' life. Toward the end of 3rd month, human ovary contains Primary Oocytes in the early Prophase of Meiosis. By 4½ month, some Oocytes are enclosed in Primordial Follicle. At 6th month, there are many Primary Follicles, few 2ndry & small Vascular Follicles. Infact the first Primary, Secondary & Vascular Follicles are in the Medulla of Foetal Ovary. It has been shown that during the Mitosis of Oogonia, intercellular bridges may connect 2-4 Oogonia*.

As Oocyte grows, amount of Cytoplasm increases. A Golgi Apparatus & Mitochondria are found in Cytoplasm. Fat globules are almost disappeared in mature Ovum. In early Oocyte, Nucleus located in centre of cell is called Volk**. Volk is complex of Centrosome, Golgi Vesicle & Annulate Lamellae sorrounded by Mitochondria.

Ovulation:

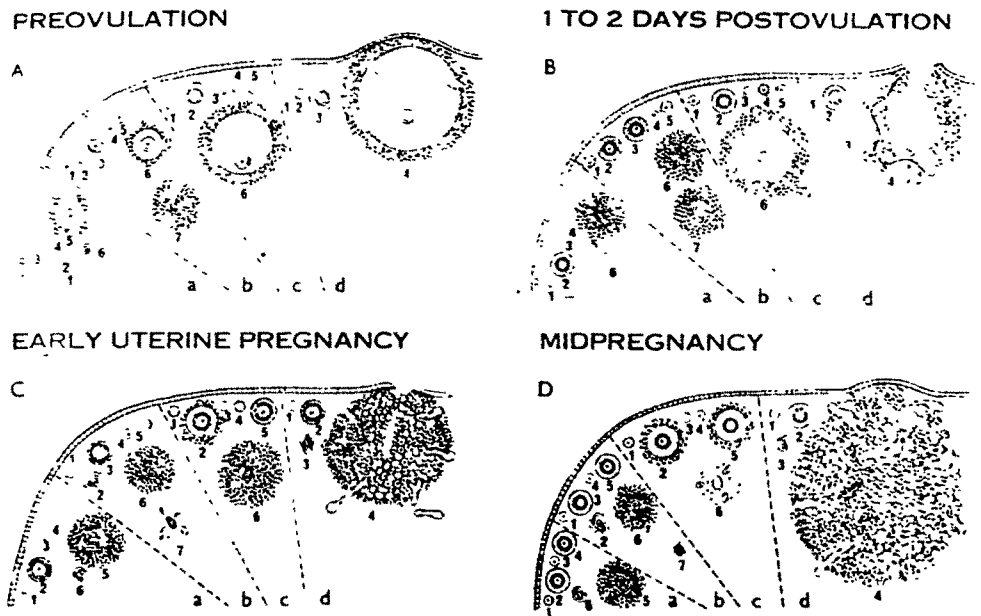
Ovarian Follicles are situated in various positions in the Cortex of Ovary. Before Oocyte can be shed, a maturing Follicle must reach the surface of Ovary. As the Follicle approaches the surface, the Cumulus Cells become loosened from one another & separate readily from Follicular wall & together with enclosed 'Ovum' are shed with Follicular fluid. This process is called Ovulation.

The Cumulus Cells round the shed ovum, now called 'corona-radiata'. 'Stigma' is a specific 'target area' for hormones controlling Ovulation. Ovulation rarely occurs before puberty or after Menopause.

*Stenger & Wartenberg 1963.

**Balbani's Viteline Body.

Reproduction ... Ovulation ...contd...



At a stage when a cavity is appeared in the Ovarian Follicle, the Primary Oocyte grows to its full size & important changes occur in the nucleus of Oocyte and thus Oocyte becomes mature.

The formation of first 'Polar' Spindle, initiates the first maturation or reduction division, dividing Oocyte into a larger '2ndry-Oocyte' and a much smaller 1st Polar Body. In this division, number of chromosomes are reduced to half. A 2nd Polar Spindle is now formed & Ovulation occurs at this stage. This development occurs in the Utrine Tube. The 2nd Polar Body is not separated until after fertilization*.

Diploid number of chromosomes in human Somatic Cell, is known to be 46**. These 46 chromosomes consist of '22' pairs of 'xx' chromosomes in females and 'xy' in males. Female Mammals are Homogametic i.e. 44-x-x, while male mammals are Heterogametic i.e. 44-x-y. During the division of Somatic Cell, chromosomes split longitudinally, this way daughter cell receives its full components i.e. 44-x-x/44-x-y. This normal mitotic div.

*Hamilton in 1944.

**Tijo & Levan in 1956.

Reproduction ... Oogonia/Spermatogonia ...contd...

As the Oogonia & Spermatogonia of the Gonads are indentical in the chromosomes constitution, as they multiply by 'Mitotic' division, like-wise. In each cell of Primary Spermatocytes & Primary Oocytes, there are 22 pairs of 'somatic' chromosomes and one pair of 'sex' chromosomes; xy in male & xx in female.

In male during Meiotic or Reduction division^{*}, bivalent chromosomes separate longitudinally, so that '22-x' chromosomes go to one 2ndry Spermatocyte & '22-y' go to other 2ndry Spermatocyte. Each 2ndry Spermatocyte divide to form two Spermatids containing '22-x' chromosomes and two spermatids containing '22-y' chromosomes. Therefore, Somatic Cells & Primary Spermatocytes are 'diploid', while 2ndry Spermatocytes & Spermatids are 'haploid'..

Inspite of extensive investigations, it has not been possible to distinguish between 'spermatozoan' containing 'x' or 'y' chromosome.

In female, during Meiotic or Reduction division^{*}, '22-x' chromosomes move to 2ndry Oocyte & '22-x' move to 1st Polar Body. As in females, second maturation division longitudinally split chromosomes, therefore, '22-x' chromosomes move to 'ovum' and '22-x' move to 2nd Polar Body. The 1st Polar body may also divide. All 'ova' are alike, having '22-x' chromosomes. Primary Oocytes give rise to 3 or 4 cells one of which retains most of the 'cytoplasm', becomes 'ovum', other having less 'cytoplasm' become 'polar' body. Both; ovum & polar body have got the same chromosomal value.

^{*}This type of cell division commonly takes place in the reproductive cells of Gonads.

Reproduction ... contd...

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Fertilization:

At fertilization, the 'sperm' with half of the 'somatic' chromosomes enters the 'ovum' containing half of the 'somatic' chromosomes i.e. '22-x', to give rise a 'female' zygote i.e. '44-x-x'. On the other hand, if 'sperm' with '22-y' chromosomes unite with an 'ovum' with '22-x', a 'male' zygote with '44-x-y' chromosomes is produced.

Genetically sperm & ovum, both are capable of transmitting character of 'race' to future generations. Zygote contains 'genes' in duplicate derived from mother & father.

Fertilization is the act of 'fusion' of male & female gametes to form 'Zygote'. In human, semen is deposited in female Genital Tract by a special organ 'penis'. The process is called 'insemination'. Fertilization usually takes place in the 'ampulla' of Uterine Tube. Semen is a complex mixture derived from Testis, Seminal Vesicles & Prostate Gland. 'Bulbo-Urethral' gland provides small amount of pre-ejaculatory lubricating fluid. The amount of semen is about 3ml containing 200-300 million Spermatozoa. The number, mobility & abnormalities in shape & size of sperm, accounts the 'fertility' of male partner.

On the other hand, female ovum is capable of being fertilized for only a short time after 'ovulation', otherwise, ovum degenerates. After fertilization, ovum is called 'zygote' and undergoes 'cleavage' during its passage along the Uterine Tube.

The female gamete in the form of Oocyte, surrounded by 'corona-radiata' is shed from the 'ovary' with 1st Polar body extruded and 2nd Maturation 'Spindle' is formed. At this stage fertilizing sperm-
...over.

Reproduction ... Zygote ...contd...

penetrates the ovum* in the Cephalic portion of the Utricle. Out of many, only one sperm enters & passes into the cytoplasm of ovum. After the entry of sperm, 2nd Polar body is extruded and the chromosomes, which remains in ovum, reconstitute themselves into a Vesicle or 'Nucleus'; the female 'pro-nucleus'. The head of sperm, after entry, transformed into 'Male Pro-Nucleus'.

After fertilization, Male Pronucleus approaches the Female Pronucleus, in the centre of 'ovum'. A 'centrosome', derived from Proximal Centriole of Sperm, now becomes distinct and divide into two parts, each of which is attached to a pole of spindle. Each Pronucleus resolves itself into it. Chromosomes & Nuclear Membrane disappear. Chromosomes of both Pronuclei, arrange themselves on 'spindle' and split longitudinally into two cells.

Therefore, the main result of fertilization are; i) restoration of diploid number of chromosomes, ii) determination of sex & iii) initiation of cleavage. During the development of 'zygote', contribution of egg is greater than the sperm.

Parthenogenesis: The production of an 'embryo' from a female gamete, without concurrence of male gamete and with or without eventual development into an 'adult'**.

The next sub-chapter ii, contains the scientific details regarding Human Embryology.

*Hamilton in 1944

**Beaty 1957 & Balfour-Lynn 1956.

Reproduction ... contd...
sub chapter ii

Embryology:

Embryology is the process of development of 'zygote' within the female uterus, till baby is mature enough to be delivered.

Cleavage:^{*} Cleavage is the 1st embryonic stage, consist of rapid succession of 'mitotic' division, resulting in the formation of larger number of increasingly smaller cells, called Blastomeres. There is no data of precise time taken by human ova to reach the uterus, nor is the exact interval between 'ovulation' & implantation. In human, partial implantation is achieved between 7th & 8th day of ovulation**.

A provisional estimate by Lewis & Hartman 1933, during the cleavage stage of egg in human:

<u>NO. OF CELLS</u>	<u>DURATION</u>
One	from ovulation up to 24 hours
Two	24-36 hrs
3-4	36-48 hrs
5-8	48-72 hrs
9-16	72-96 hrs

Morula: Morula is 2nd embryonic stage after 'Blastomere' and the latest technique of 'in vitro growth' of human egg from 2 cell to 32-cell 'morula'.

In most mammals, 'morula' undergoes modifications, as soon as

*cleavage of human eggs is described by Hertig et al 1954.

**Hertig & Rock 1945.

Reproduction ... Morula ... contd...

reaches into Uterus. Where fluid passes from Utrine Cavity via 'zona-pellucida' & a cavity is formed, called 'Blastocyst' cavity & Blastocystic 'Trophoblast' plays a part of embryonic nutrition. At this stage embryo is termed as Blastocyst. Zona Pellucida disappears as Blastocyst expands. The fluid permits the movement of substances within cavity, creating tension within Blastocyst, which cause the mechanism of implantation.

Blastocyst: Up to this stage Zona Pellucida has kept the Blastomere together during cleavage, also prevent the adherence of sticky Blastomere to the epithelium of Utrine Tube. The disappearance of Zona Pellucida permits the proliferating Trophoblastic Cells to be attached with Utrine Epithelium. The Trophoblastic Cells remain as an inert layer throughout development and form out Embryonic Membrane, known as Chorion & Placenta.

The inner cell mass develops into tissue of Embryo, also contribute the formation of Embryonic Membrane, called Amnion & Yolk Sac.

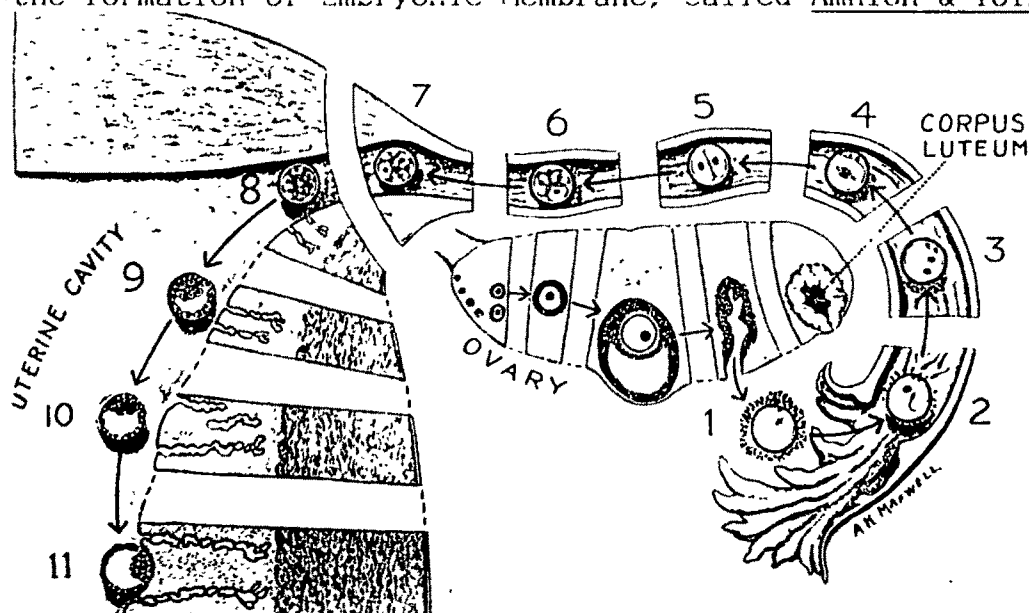


FIG. —A schematic representation of the development of the ovarian follicle, its growth, maturation and rupture. Successive stages in the passage of the ovum into the tube and its fertilization, subsequent development and implantation are depicted. (Based on Dickinson.) (1) Unsegmented oocyte at the 2nd maturation spindle. (2) Fertilization. (3) Eccentrically placed pronuclei and polar bodies. (4) 1st spindle of division. (5) Two-cell stage. (6) Four-cell stage. (7) Eight-cell stage. (8) Morula. (9) and (10) Free blastocyst in uterine cavity. (11) Early phase of implantation (approximately at the seventh day after ovulation).

Embryology ... contd...

Formation of Germ Layers:

The inner surface of Inner Cell Mass of Blastocyst group to form a single layer; Primary 'Endoderm', and remaining cells of inner mass become source of Embryonic 'Ectoderm'. These cells also give origin of Intra Embryonic 'Mesoderm'. A space appears between Ectoderm & covering of Trophoblast, called 'Amniotic Cavity', while Endoderm initially forms a larger cavity, called 'Primary Yolk Sac'. Cells of Primary Yolk Sac are of two types: i) cuboidal roof cell or Embryonic Disc Endoderm & ii) Flattened cells enclosing the remainder of the cavity. During development, Amnion with attached Primary Yolk-Sac is suspended in suspended 'Chorionic Sac', by that mass Mesoderm into which Extra Embryonic Coelom has not extended. This is the stage of 12th day Embryonic development.

Primitive Streak: This is an area of Ectoderm at the caudal edge of Embryonic Disc, which appears at 15th day into Amniotic Cavity. Later, Embryonic Disc looks like pear shaped. Endoderm Yolk Sac extends and comes in contact with Embryonic Ectoderm, behind Primitive Streak to form 'Bilaminar' membrane; called 'Cloacal' Membrane. Now, Primitive Streak diminishes into relative size.

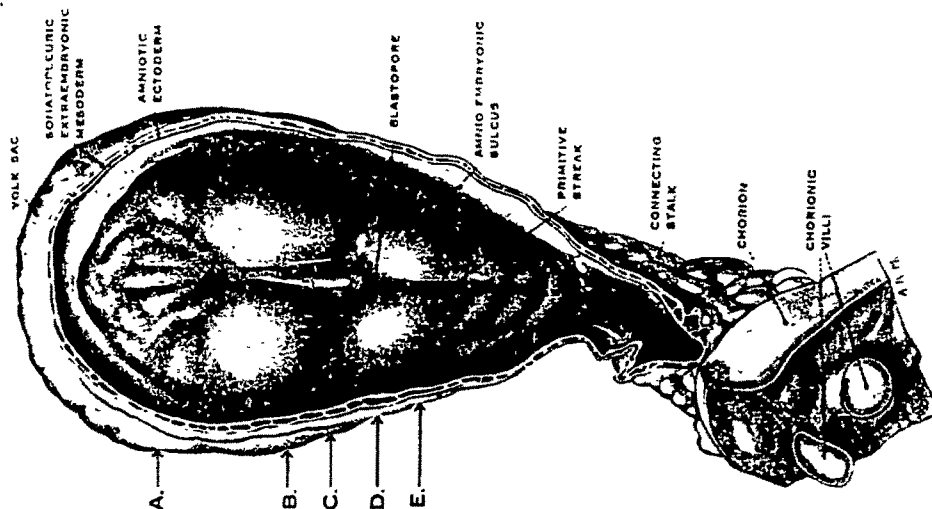


Fig. —A drawing of the dorsal aspect of a model of an 18-day presumptive embryo. The letters A, B, C, D and E indicate the levels of the sections A, B, C, D and E of Fig. 62. < c. 55.

Embryology ... contd...

Notochord:

During the formation of Intra Embryonic Mesoderm, there is thickening of of Ectoderm at the Cephalic end of Primitive Streak, known as 'Primitive Knot'. At the centre of this knot, a pit is formed, known as 'Blastopore'.

In the midline of Embryonic Disc, a cord of cells migrate forward from Primitive Knot, between Ectoderm & Endoderm, known as Notochord or Head Process. Later Notochordal Canal continues upto Amniotic Cavity. In the roof of Yolk Sac, Notochordal Plate is formed of 'Columnner Cells'.

At the end of 4th week, when embryo is about 4mm long, Notochord is almost in final position.



FIG. —A photograph of the left side of a 25-somite human embryo of 3-4 mm. C.R. length (estimated age, 28 days). \times c. 22. This figure and Figs. 151-157 are reproduced from photographs made available by the courtesy of Dr. G. L. Streeter, of the Carnegie Institution of Washington.



FIG. —A photograph of the left side of a 28-somite human embryo of 4 mm. C.R. length (estimated age, 30 days). The embryo is now more elongated and markedly curved than the embryo in Figure 150. The third pharyngeal arch is further developed and the pericardial swelling is now a feature. \times c. 20.

Embryology ... contd...

Differentiation of the Germ Layers:

Ectoderm: During Notochordal Process, Axial Ectodermal Band known as 'Neural Plate' is formed. Thin band of Ectoderm on either sides of Neural Plate is termed as 'Neural Crest'. Later, Neural Plate changes to 'Neural Grooves', where 'Neural Tube' is formed containing 'Neural Canal'. From Neural Tube, Central Nervous System arises, while Neural Crest forms some important parts of Peripheral Nervous System and Mesectoderm i.e. an Intra Embryonic Mesoderm. The remaining part of Ectoderm become general covering or Epi-dermis of Embryo.

Mesoderm: By 21st day of development Paraxial Mesoderm on each side of Notochordal Process, forms paired cubical masses, called 'Somites'. No Somites are formed from Mesoderm Cranial to Notochord.

Somite Stage: From 21st day to 30th day is the duration of Somatic formation, while 15th day to 20th day of Embryo development is termed as Presomite Mesodermal stage. 42-44 pairs of Somites are formed in human embryo. A continuous longitudinal tract is attached to the ventro-lateral angle of each of the Somite, called Intermediate Mesoderm. Intermediate Mesoderm undergoes changes to form Nephrogenic Cord. From the Somite region Lateral Plate Mesoderm of each side extends cranially to form Buccopharyngeal Membrane.

Lateral Plate Mesoderm later splits to form Intra Embryonic Coelom, where Heart develops later, and that part of Mesoderm is known as Cardiogenic Mesoderm.

Embryology ... contd...

Endoderm: The appearance of Intra Embryonic Mesoderm results in the separation of Endoderm from Ectoderm throughout the greater part of Embryonic Disc. Thus Endoderm undergoes changes to form Embryonic Gut.

The Primitive Yolk Sac shrinks due to increase of Extra Embryonic Coelomic Spaces and converts into Secondary Yolk Sac. Due to formation of Intra Embryonic Mesoderm, Embryonic Disc becomes thicker & bulges into Amniotic Cavity. There are clear marks of Head & Tail folds at the cranial & caudal margins of Embryonic Disc. The formation of Head & Tail folds result in the sub-division of Gut into 3 parts: i) Foregut within Head fold, ii) Hindgut within Tail fold & iii) Midgut; remaining free part of Secondary Yolk Sac or Vitelline Sac.

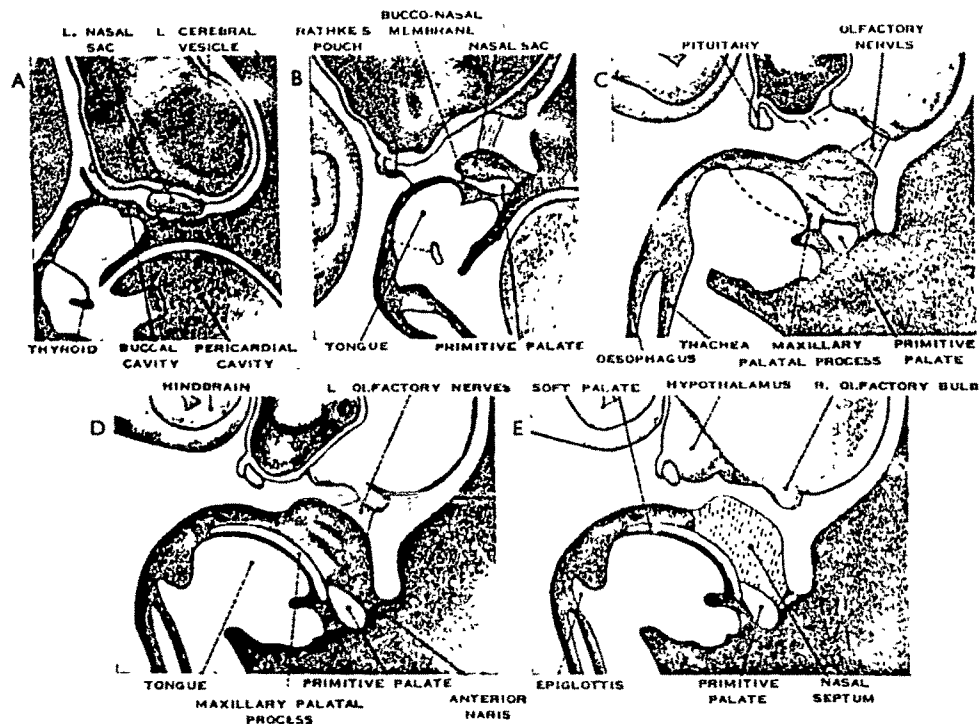
INTRA EMBRYONIC COELOM: There is formation of horse shoe-shaped cavity known as Intra Embryonic Coelom or Body Cavity. The cranial portion of Intra Embryonic Coelom, which passes transversely across the midline of Embryonic Disc in front of the Buccopharyngeal membrane is Primordium of Pericardium and in its Splanchnopleuric Mesoderm, Cardiogenic Plate develops. In this plate Endothelial Heart Tube soon appears.

SEPTUM TRANSVERSUM: The Mesoderm mass develops the Foregut. Due to growth of Foregut, the Coelomic duct becomes longer & develops Lung Bud. The Pericardio Peritoneal canals can now be called Pleural-Cavities. The Pericardio Pleural opening connects Pericardial & Pleural Cavity. Later, Peritoneal Cavity completely closed off from Extra Embryonic Coelom at the Umbilicus.

Embryology ... contd...

PROCHORDAL PLATE & BUCCOPHARYNGEAL MEMBRANE: The Prochordal Plate now forms the cranial limits of Foregut and together with overlying Ectoderm, constitute Buccopharyngeal Membrane.

CLOACAL MEMBRANE & CLOACA: At the caudal end of the Embryonic Disc, where Ectoderm & Endoderm remain in contact and no Intra Embryonic Mesoderm inter passes. This is the Cloacal Membrane. At the skirt of Cloacal Membrane, the Mesodermal cells raise the overlying Ectoderm to form Genital fold, shows shallow depression called 'External-Cloaca'.



Sagittal sections through the head region to show successive stages (A-E) in the development of the nasal and buccal cavities. In A the nasal sac is shown in relief.

The next page 251, contains the Pre-implantation period and Implantation Period of Blastocyst.

Embryology ... contd...

The Implantation of Blastocyst:

Pre-Implantation Period:

Fertilization occurs in lateral, ampullary region of Utrine Tube & several cleavage divisions occur during next 3-4 days. At 4th or 5th day, when Morula enters the Utrine Cavity, it is covered by the film of Protein, Muco-poly-saccharide, glycogen & lipids secreted from glands & transformed into spherical Blastocyst. During this period Zona Pellucida* is lost.

Implantation Period:

The human Blastocyst normally implants in the Endometrium of Uterus body, most frequently on the upper part of anterior or posterior wall & near the Mid-Sagittal plane.

Decidua: The Utrine mucosa is highly modified during 'Pregnancy' & is called 'Decidua'. After the implantation of Blastocyst & until 4th month of gestation, 3 topo-graphical parts of Decidua can be recognized: i) Deciduo Basalis at the base of Placenta, ii) Decidua Capsularis at the superficial surface of implanted Chorionic Sac/Lumen ward & iii) Decidua Parietalis lining the rest of Uterus.

Embryonic or Fetal Membranes: Any tissue or structure developed from Zygote that does not form part of Embryo proper, termed as Fetal Membrane e.g. Placenta & Umbilical Cord.

Umbilical Cord:

By 12th day, Amniotic Cavity is fully formed. With all round development of Head & Tail ends of Embryo, there is formation of Umbilicas, which transmits the narrow Vitelline Duct with Blood Vessels & Connecting Stalk flanked by the communication between Intra & Extra

*structureless membrane but looks granular layer under E.M.-Dickmann, 1965

Embryology ... Umbilical Cord ... contd...

Embryonic Coeloms. Later, Mesoderm constitute the basis of Umbilical Cord. At a time definitive Yolk Sac comes to lie between Amnion & Chorion.

Experiments with De-Uterium & Tritium in later pregnancy, showed extremely rapid exchange of water molecules between Maternal & Fetal circulation and Amniotic Fluid*. Certainly, the Fetal Kidney, Intestine & Placenta are involved in this exchange.

Placenta:

A full term human Placenta is flattened cake shaped of about 500g, 3cm thick & 15-20cm in diameter. During 2nd half of pregnancy, Placenta less increases in weight than Fetus, but increases in efficiency of transmission. The fetal surface of Placenta is completely covered by Vascular Mesoderm of Chorion with its large Umbilical Vessels. Amnion & non Placental portion of Chorion are normally fused during the latter half of gestation.**

Transport across Placenta:

The whole problem of permeability of the Placenta is linked with Enzymatic System present in it. These constitute a very wide range of enzymes including Alkaline & Acid Phosphate, Cholinesterase, Proteolytic & Glycolytic enzymes***.

The first group containing Oxygen, water & essential electrolytes for life, are rapidly transferred across the Placental barrier by way of Diffusion.

*Plentl 1958

**carrying of young in womb between conception & birth is gestation

***Page & Glen

Embryology ... Placenta ... contd...

The 2nd Group containing Glucose, Amino Acids, Lipids & Vitamins are transferred by way of 'Active Process'.

The 3rd Group is hormones; Thyroxin, hydrocortisone & Gonadotropin, regulating the Metabolic Process - diffuse slowly across the barrier

The 4th Group containing 'Macro' molecules of immunological importance.

It has been established that many substances are present in higher concentration in the fetal blood than that of mother. Therefore, there is considerable variation in the transport of reverse direction i.e. from fetus to mother.

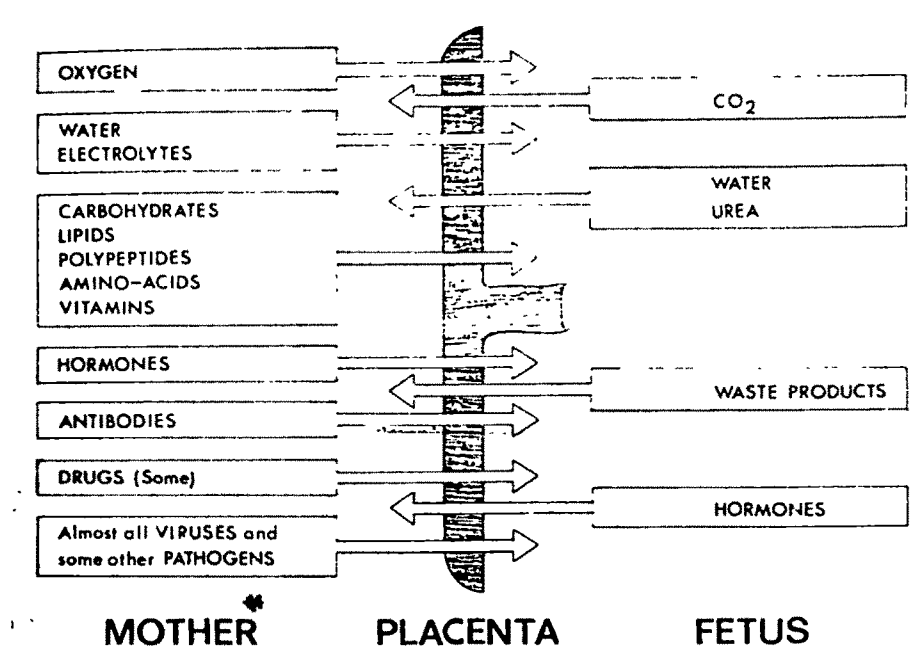


FIG. —Scheme to show the interchange of substances between the mother and fetus.

وَوَصَّيْنَا الْإِنْسَانَ بِوَالِدَيْهِ إِحْسَانًا حَقَّ لِنَا إِلَهُهُ كَرِهًا وَأَوْضَعْتُ كُرْهًا وَحَمْلُهُ
وَفَضْلُهُ كُنْتُونَ شَهْرًا ٥ (26- الاحقاف 15)

Embryology ... contd...

Formation of Tissues & Blood:

In the late pre-somite stages Embryo consist of outer 'ectoderm', inner 'endoderm' & intermediate 'mesoderm & notochord', which form tissues, blood & organs:

ECTODERM: Embryonic Ectoderm is an epithelia layer, which is continuous peripherally with flattened Amniotic Ectoderm and give rise the following:

- 1) Hair, Nail, epithelia cells of sweat, sebacious & Mammary Glands etc are derivatives of 'epithelium' of skin i.e. epidermis.
- 2) The Epithelium of Mucous Membrane and glands of Lips, Cheeks, Gums, Mouth/Nasal Cavity.
- 3) The Epithelium of lower parts of Anal Canal & terminal parts of Urino Genital Tract.
- 4) Primary Dental Laminae, which give rise to Enamel Organs of Teeth
- 5) Lense of Eyes, layer of Cornea & Tympanic Membrane.
- 6) Central Nervous System, Retina, Iris & Optic Nerve etc.
- 7) Peripheral Nervous System.
- 8) Sensory Epithelium of Olfactory & Auditory Organs.

ENDODERM: The Embryonic Endoderm, which forms the roof of Volk Sac in early Somite Stage, gives origin to:

- 1) The Epithelium of Alimentary Canal, except terminal parts and Parechyma of Glands; Liver, Pancreas, Thyroid, Para-Thyroid and Thymus.
- 2) Linings of Epithelium of Pharyngo-Tympanic Tube & Middle Ear Cavity

Embryology ... formation of Tissues & Blood ... contd...

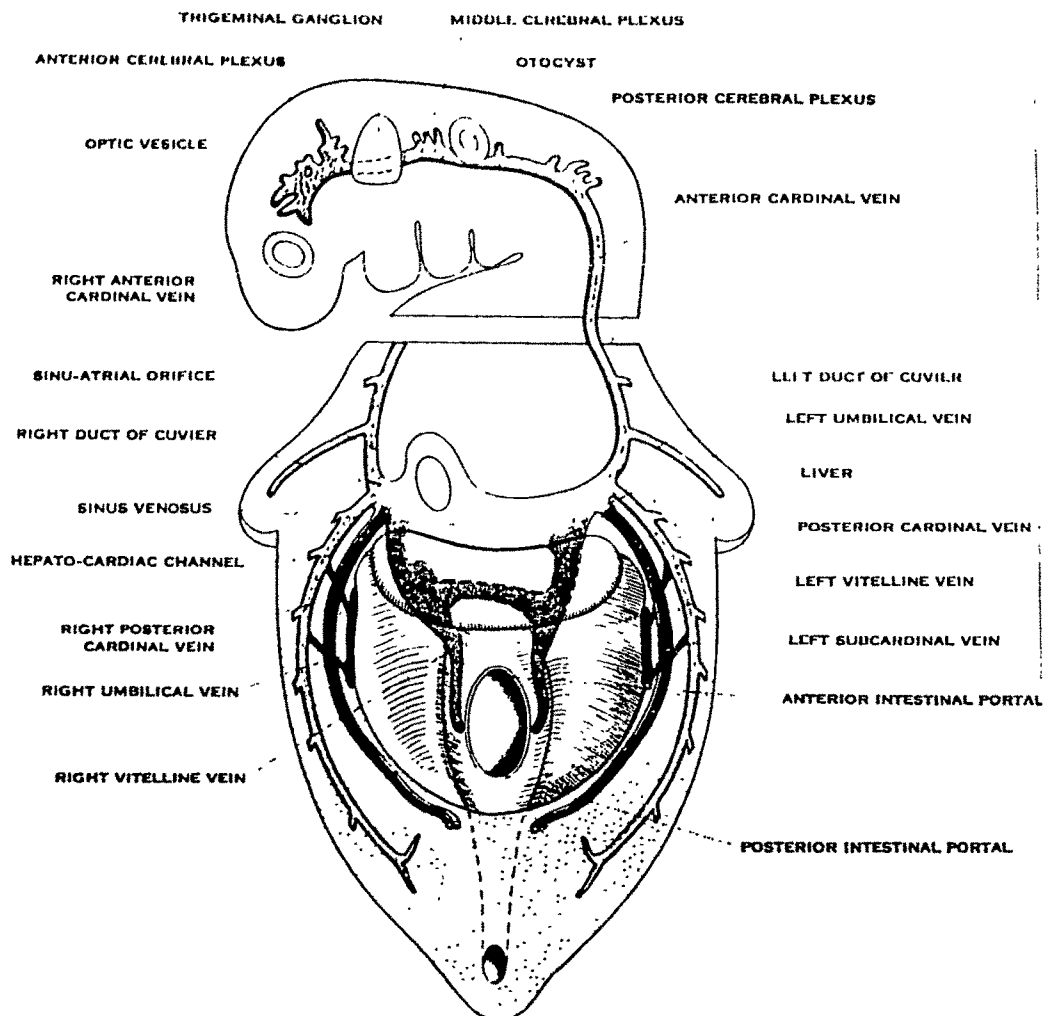
3) Linings of Epithelium of Larynx, Trachea, Bronchi & Alveoli of Lungs.

4) The Epithelium of Bladder, Female Urethra, parts of Male Urethra with Prostate Gland and lower part of Vagina.

The derivatives of Embryonic Endoderm retain their Epithelial characters throughout life, except in certain specialised regions e.g. Liver, Islet Tissue of Pancreas & Thymus Gland.

MESODERM: The Embryonic Mesoderm gives origin to the remaining Tissues of Embryo.

A most important & highly specialised group of Mesenchymal Cells, give origin to the Blood, Vascular & Lymphatic Systems.



Embryology ... contd...

Growth of Embryo & Fetus:

The human embryo grows from a single cell to a full time Fetus, composed of many millions of cells of different types, 50cm long & 3kg of weight. Total duration of human pregnancy is 10 lunar months i.e. 280 days, may vary 250-310 days, from last menses. The growth rate of embryo is controlled by genes.

PRE-NATAL PERIOD:

Pre-Natal development of human body may be divided into 3 main periods:

1st Period: Period culminating with Implantation of Blastocyst, but before the establishment of Intra Embryonic Circulation. Fetal Membranes are established & Germ layers are laid down in Embryonic Disc.

2nd Period: 4th-8th week period; rapid growth & establishment of all main systems & organs.

3rd Period: 2nd month until birth. Relatively quite slow growth of various segments & parts of body*.

External Form of Embryo:

PER-SOMITE PERIOD:

This period extends from appearance of Primitive Streak until differentiation of 1st Somite. At this, none of the human structure forms.

SOMITE PERIOD:

This period starts with the formation of somites i.e. 20th-30th day. No. of somite increases with development. There are 42-44 pairs of somites, out of which 4 occipital, 8 Cervical, 12 Thoracic, 5 Lumbar, 5 Sacral & 8-10 Coccygeal. Somites are base of skeleton & muscular

*Scammon-Calkins - 1929.

Embryology ... Somite Period ... contd...

development. Somite Embryo soon shows the formation of face & neck.

By 7-somite/22nd day; Neural Canal, Head & Tail folds are prominent.

By 10-somite/23rd day; Neural fold becomes Mid-Brain.

By 14-somite/25th day; Head & Tail are more clear & Otic placode is clear.

By 20-somite/26th day; Anterior Neuropore is closed & Fore-Brain region is clear, while posterior Neuropore is still open.

By 25-somite; both Neuropores closed, Umbilicus & Umbilical cord is recognised. Optic vesicle projecting from forebrain.

By 28-somite/30th day; Otic depression form Otic vesicle. Two Olfactory placodes are present.

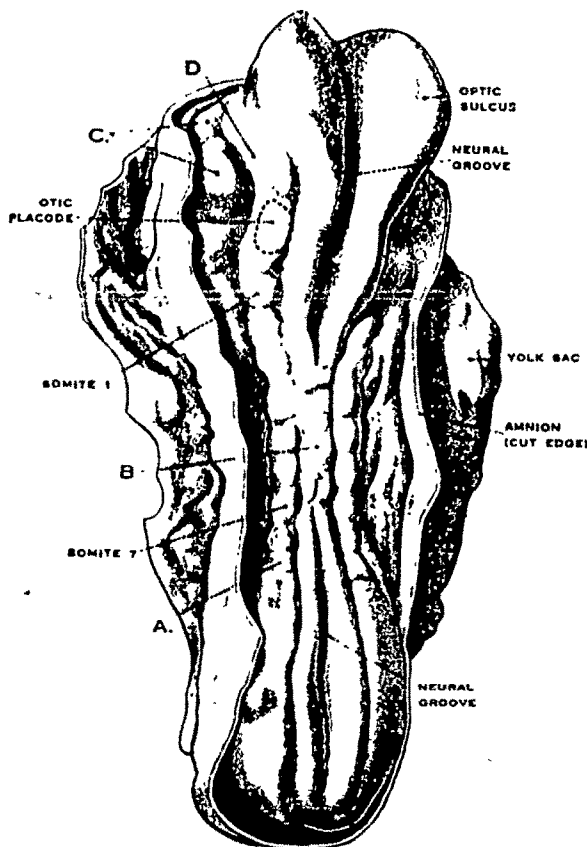


FIG. —The dorsal aspect of a reconstruction of a 7-somite human embryo of about the 22nd day. Modified from Payne. The early optic sulcus is seen in the prosencephalic region. A—partially segmented paraxial mesoderm; B—roof of neural tube; C—pericardial area; D—branchial arch region. *x c. 47*.

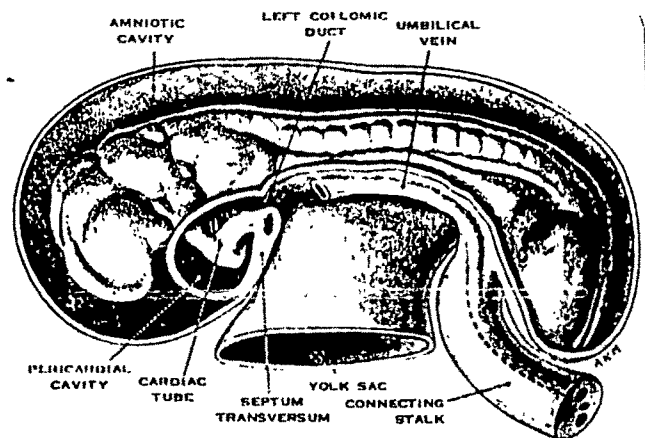


FIG. — A drawing of a 14-somite human embryo to show the continuity between the pericardial cavity, left coelomic duct and intra-embryonic coelom. A portion of the left umbilical vein has been removed.

Embryology ... contd...

Development of Embryo: 2nd Month.

During 2nd month, embryo size vary from 5mm/32nd day to 30mm/55th & 56th day. At the beginning, Head & Trunk regions are well established. Somites are seen & continue to be formed until 11mm stage, but no longer conspicuous as surface contours. Paired paddle shaped Fore & Hind Limb Buds soon appear. The tip of Head region bends towards Pericardium.

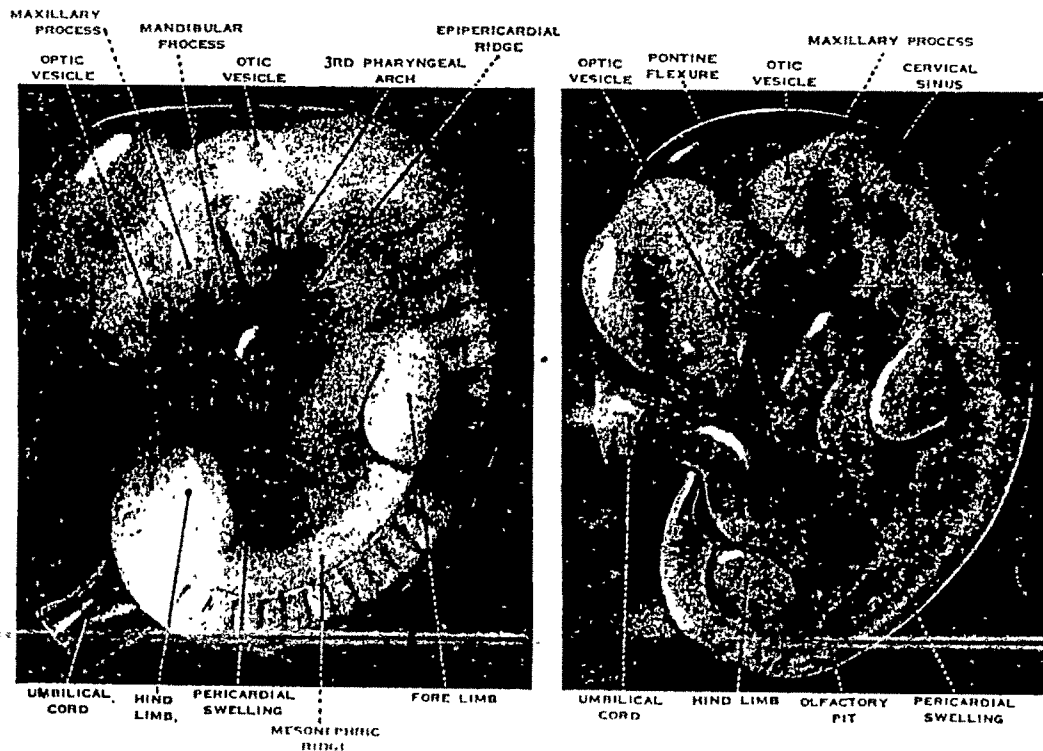


Fig. 1. A photograph of the left side of a 5 mm C.R. length human embryo (estimated age, 32 days). \times c. 16.

Fig. 2. A photograph of the left side of a 6.7 mm C.R. length human embryo (estimated age, 34 days). \times c. 12.

At 10mm/37th stage, 1st Pharyngeal groove modifies & develops to External Ear.

The upper Limb Bud now sub-divides to Arm, Fore-arm & Hand, while Hind Limb Bud remains bud shaped. The Cranial somite no more recognized externally. Later Hind Limb Bud sub-divides to Thigh, Leg & Foot. Liver & Heart can be seen in Pericardial area.

Embryology ... contd...

BY 46th day/17mm stage, Head region increases, Neck is clear, Eyelid starts to form & External Ear establishes round the Auditory Meatus. At the end of 2nd month, tail disappears & embryo becomes human shaped of 30mm size.



Fig. A photograph of the left side of a 10.5 mm. C.R. length human embryo (estimated age, 37 days). A line of fusion between maxillary process and lateral nasal fold. \times c. 8.



Fig. —A photograph of the left side of a 13.4 mm C.R. length human embryo (estimated age, 40 days). The supra-umbilical swelling of the ventral body wall is produced by the liver and the pericardium. The heart can be seen within the latter. \times c. 6.5.

Development of Face*

During 2nd month, Nose is formed from Alfactory/Nasal Placode, then Upper Lip, Cheeks & Lens Placode from Ectoderm. Lens placode, soon separates from Ectoderm to form Lens. Pigment, which appears in 10mm 37th day embryo, now seen clearly through covering Ectoderm. At 18mm stage, eyelids develop from Ectoderm & underlying Endoderm. Lower Lips too develop by the end of 2nd month.

* هُوَ الَّذِي يُصَوِّرُكُمْ فِي الْأَرْحَامِ كَيْفَ يَشَاءُ ۚ لَآ إِلَهَ إِلَّا هُوَ الْعَزِيزُ الْحَكِيمُ (3-ال عمران)

Embryology ... contd...

Fetal Period.

From 3rd month upto end of gestation is 'feta' period. It is custom to use Fetus for Embryo from 55th day, when size is 30mm & shape is of human.

In early part of 3rd month, 1st rudiment of hair appears, scattered in eye-brow region, upper-lip, carpal & tarsal regions, and later on the skin of lower lip. External Genitals undergo marked changes & sex can be identified by external inspection. Nail impression is seen on tips of fingers & toes.

By the end of 4th month, sitting height of fetus is 100mm. Eyes widely separated & face is relatively broad. A few ture hair present in lower frontal region, but carpal & tarsal hair/vibrissae retrogress.

By the end of 5th month, fetus sitting height is 150mm & total length is 228mm. Lower limbs increases, but still shorter than upper limb. Mother experiences fetal movement. Fine hairs found all over body.

By end of 6th month, eyebrows & eyelids are more clear & face looks infant like.

By the end of 7th month, due to deposition of subcutaneous 'fats', skin is no more wrinkled. The hair on head are longer & eyelids are no longer fused. Child born at this age may survive.

At 8th & 9th month, head hair become thicker & longer. Finger nail reaches upto tips. Lanugo/Fine hair begins to disappear. Left Testis may be in scrotum.

Embryology ... Fetus ... contd...

During 10th month, nail of finger reaches beyond tips & in toes upto its end. Thorax becomes wider.

The last two months, fetus devotes more to general 'build-up' of tissues, than formation of New Tissues or Organs.

Full term child is about 3kg & 20" long. The circumference of chest is less than head, but equal to abdomen at umbilical cord. Arms & Trunk, longer than legs. In male infant, both Testis are in Scrotum at the time of birth.

SUMMARY OF DEVELOPMENT DURING EMBRYONIC PERIOD:

<u>Ovulation Age</u>	<u>Approx size</u>	<u>Development in Embryo</u>
23 Days	10 Somites	Mandibular Process appears
24 "	12 "	2nd Pharyngeal Arch appears
25 "	14 "	Optic/Otic Placodes present
28 "	03mm	3rd Pharyngeal Arch appears
30 "	04mm	Fore Limb Bud "
32 "	05mm	Hind Limb Bud "
33 "	06mm	Maxillary Process "
37 "	10mm	Hand differentiation begins Cervical Sinus present Nasal Process appear
41 "	14mm	Foot differentiation begins
47 "	18mm	Fusion of Maxillary Process

Embryology ... contd...

Cardio-Vascular System.

Heart & Blood Vessels develop from Endothelium reinforced by outer coat of connective tissue. The Pericardium of Heart is derived from Protocardiac Mesoderm cells, which constitute part of Angiogenic Tissue. Angiogenic Tissue gives origin to Heart & Blood Vessels In late pre-somite Embryo.

Myoblast cells develop from primitive cardiac muscle. Endothelial Tube & Myo Epicardial collectively mantle primitive Heart, from where full term heart develops.

SUMMARY OF CARDIO VASCULAR SYSTEM DEVELOPMENT:

<u>Ovulation Age</u>	<u>Approx Size</u>	<u>Development</u>
18 Days	Pre-Somite	Angiogenic Tissue & Vitelline Veins appear
19-20 "	1-2 Somite	Endothelial Heart Tube & Umbilical Veins appear
21 "	4 "	Fusion of Endothelial Heart Tube
22 "	6 "	Differentiation of Atria, Ventricle & Bulbus Cordis
25 "	14-16 "	Fusion of Primitive Atrio & formation of Bulbo Ventricular loop
26-27 "	20 "	Pharyngeal Arch Arteries appear
28 "	26 "	Anterior Cardial Vein appears
29 "	2.5mm	Posterior " " "
32 "	05mm	Septum Primum appear
33 "	06mm	Interventricular Septum appears
34 "	07 "	Right Umbilical Vein disappear
35 "	08mm	Foramen Secundum present

Embryology ... contd...

Summary of Cardio Vascular....

<u>Ovulation Age</u>	<u>Approx Size</u>	<u>Development</u>
36-37 "	9-10mm	Atrial Cusion fuses
43 "	15mm	Bulbar Ridges fuse
46 "	17mm	Interventricular Foraman closed
47 "	18mm	Septum Secundum appears

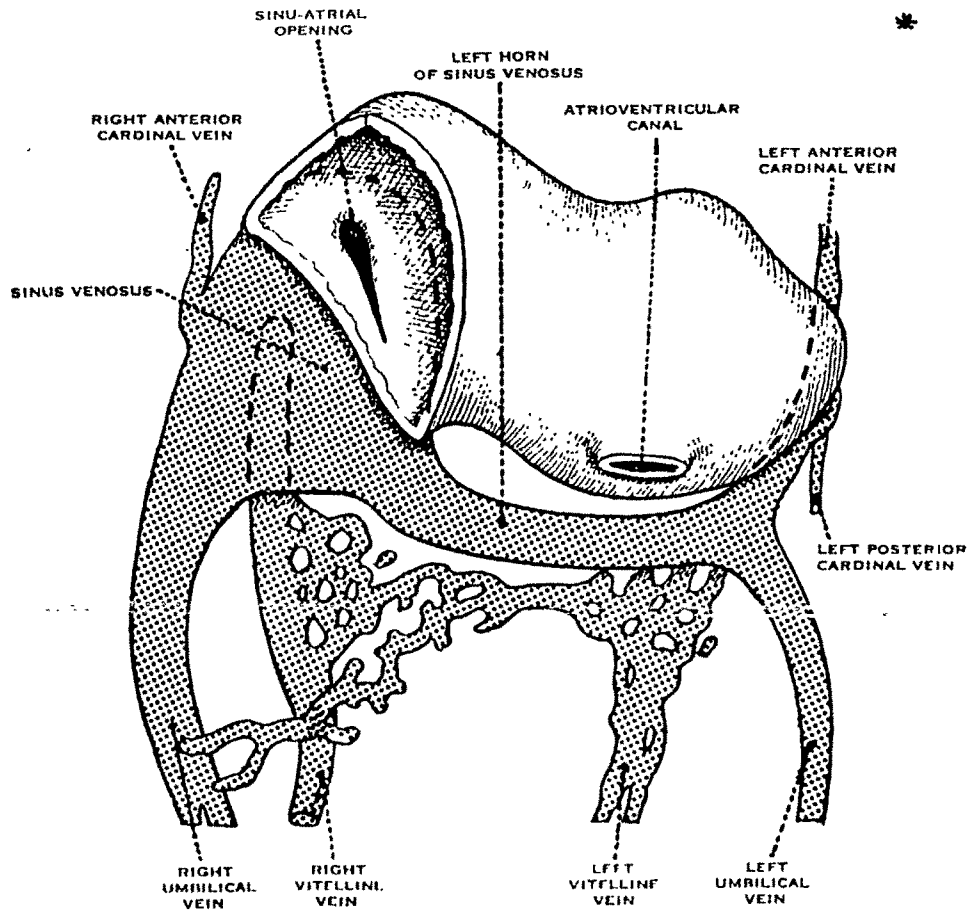


FIG. 1. Drawing of the venous portion of the heart in a 20-somite (26th day) human embryo. The ventricular part of the heart has been removed at the atrioventricular junction. The broken line on the dorsal wall of the opened part of the atrial cavity indicates the extent of the sinus venosus. (Modified from Streeter, 1912.)

فَهُوَ الَّذِي أَنشَأَ لَكُمُ السَّمْعَ وَالْأَبْصَارَ وَلَا تَذْكُرُونَهُ (١٨-١٩ المؤمنون ٧٨) *

Embryology ... contd...

Digestive System*

Greater part of Alimentary Track together with Parenchyma of Liver & Pancreas are derived from Endoderm. Muscular & Connective Tissue components are developed from Mesoderm. Epithelium at the Cranial & Caudal ends is derived from Ectoderm, while Spleen from Mesoderm.

The Caudal portion of Foregut gives origin to Oesophagus, stomach & Duodenum, while endodermal part of Liver & Pancreas originates from Duodenal.

CRANIAL PARTS OF FOREGUT:

MOUTH: In an Embryo of 30-32 day/4-5mm, floor of mouth appear.

Epithelium of Mandibular Process gives origin to Teeth, while Enamel is of Ectodermal origin, as the Epithelium lining of Cheek & Parotid Gland is derived from it. From the Undulating Ectodermal floor of primitive Buccal Cavity & associated Mesoderm give origin to Tongue, Epiglottis, Sub-mandibular & sub-lingual Salivary Glands.

TONGUE: Anterior part of Tongue develops from Tuberculum Impar, while posterior paired part develops from Ventro Medial ends of 2nd Hyoid Arches.

The Epithelial Nerve supply to Ventral portion of 1st & 2nd Pharyngeal Endodermal Grooves derived from 3rd Arch Nerve. Extreme posterior part of tongue receives Epithelial Nerve supply from 4th Arch Nerve. Greater part of Mesodermal underlying the tongue epithelium is derived from Ventromedial Extremities 1st & 3rd Pharyngeal Arches.

* أَلَمْ نَجْعَلْ لَهُ عَيْنَيْنِ ۚ وَبِسَانٍ ۚ وَشَفَتَيْنِ ۚ وَهَرِيْنًا لِّجَدِّ يْنِ ۚ (البلد- ١٥- ٨)

Embryology ... contd...

EPIGLOTTIS: Epiglottis is derived from Hypobranchial Eminence, which lies between posterior part of tongue & Tracheal Groove. Elastic Cartilage develops in Epiglottis at the start of 2nd half of Fetal life.

LIPS, CHEEKS & GUMS:

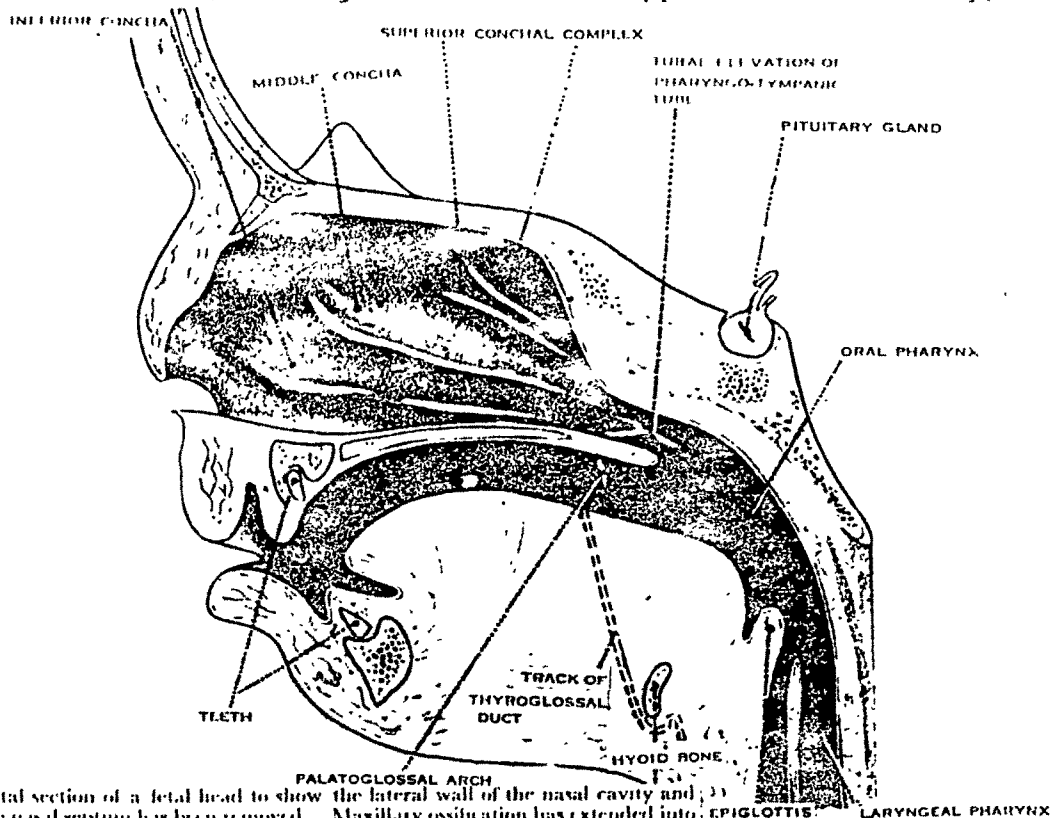
Lower Lip is formed from free edge of Mandibular Process. Upper Lip is formed from Maxillary Process. Whole of the central portion of upper lip develops from the lower part of Fronto Nasal Process.

The primitive Gums develop from Mandibular Process between lower lip & tongue. The Epithelial covering of both lips & gums are Ectodermal

Cheeks: Incomplete fusion of Mandibular & Maxillary Process cause very large mouth, while excessive fusion produces very small mouth.

SALIVARY GLANDS: The Salivary Glands arise from Buccal Epithelium.

The sub-mandibular gland makes its appearance in 42 day/15mm Embryo.



A sagittal section of a fetal head to show the lateral wall of the nasal cavity and the palate. The nasal septum has been removed. Maxillary ossification has extended into the anterior two-thirds of the maxillary palatal process and the palatal process of the premaxilla is extending into the primitive palate.

Embryology ... contd...

CAUDAL PORTION OF FORE-GUT:

This portion covers Oesophagus, Stomach, Duodenum & derivatives of these structure i.e. Liver & Pancreas.

Endoderm forms Epithelial lining of above parts & secretory cells of Associated Glands, Liver & Pancreas. The muscular & connective tissue of these parts are derived from Visceral Mesoderm. Connective Tissue of Liver is derived from Mesoderm of Septum Transversum.

MIDGUT:

Midgut of Intestinal Track develops from the Roof of 2ndry Yolk Sac, covering Duodenum, Jejunum, Ileum, Caecum, Appendix, Ascending Colon, Right & Middle 3rd of Transverse Colon.

HINDGUT:

The Hindgut is formed from 2ndry Yolk Sac, develops the Tail Fold. Hindgut gives origin to left 3rd of Transverse Colon, Descending & Pelvic Colon, Rectum, upper Anal Canal & considerable part of Genito Urinary System. In 5mm Embryo primitive Cloaca is formed.

SUMMARY OF ALIMENTARY SYSTEM DEVELOPMENT:

<u>Ovulation Age</u>	<u>Approx Size</u>	<u>Development</u>
24 Day	14 Somite	Head Fold appears
25 "	18-19 "	Liver Primordium present
32 "	5mm	Tounge appears
34 "	7mm	Stomach dialatation begins
60 "	42-44mm	Return of Gut
67 "	46mm	Tounge is formed

Embryology ... contd...

Respiratory System.

NASAL CAVITY:

Nasal Placodes appear as convex thickening of Ectoderm surface.

Nasal Placodes form Alfactory Pits, which become deeper to form

Nasal Sac or Nasal Cavity. Nasal Sac later forms Nasal Folds.

Mesodermal junction just behind the Nasal Pit forms opening of Anterior Naris. Each Nasal Cavity is separated by Nasal Septum. Later, bone appears in Mesoderm of Septum.

LARYNX, TRACHEA, BRONCHI & LUNGS:

Respiratory System arises as a Median Ventral Diverticulum of Foregut, called Tracheo Bronchial Groove. This Groove may represent Fused Pharyngeal Pouches or Terrestrial Respiratory Apparatus*.

The Ventral Diverticulum gives origin to Lining Epithelia & associated glands of Larynx, Trachea, Bronchi & Respiratory Epithelium of Alveoli.

PHARYNX:

After separation of Pharynx from Oesophagus, the Tracheal portion of Respiratory Track grows rapidly. Cartilaginous rings develop in the Mesoderm of segmental Bronchi during 11th/12th Embryonic week**.

Each terminal lobe of Endodermal outgrowth constitute Lung Bud.

These Buds are arranged systematically in the main Bronchi. Stem Bronchi with Lung Bud Mesenchyme give origin to Lobes of Adult Lungs

*Hjortsjo 1950

**Emery 1969

Embryology ... contd...

PULMONARY ALVEOLI & RESPIRATORY EPITHELIUM:

Bronchial Tree of Fetus is of Endodermal origin. Cilia appear on the Epithelial cells of Trachea & main Bronchi during 5th month.

Lungs develop in 3 stages:

- 1) Glandular Period: 4th-5th month, during which Bronchial divisions are established.
- 2) Canalicular Period: 4th-5th month, during which Respiratory portion is delineated.
- 3) Alveolar Period: 6th month to full term, during which alveoli are formed. Capillary loops establish in developing Alveoli & develop well by 7th month. The Blood Air Barrier is formed by Endothelial & Epithelial Cells of Capillary.

Respiration is detected in Embryo by the end of 3rd month. First breath is initiated by Respiratory Centres in Brain Stem.

SUMMARY OF DEVELOPMENT OF RESPIRATORY SYSTEM:

<u>Ovulation Age</u>	<u>Approx Size</u>	<u>Development</u>
30 Days	04mm	Olfactory placode appears Tracheo-Bronchial Grooves appear
32-33 "	5-6mm	Lung Buds present
35 "	08mm	Nasal cavities appear

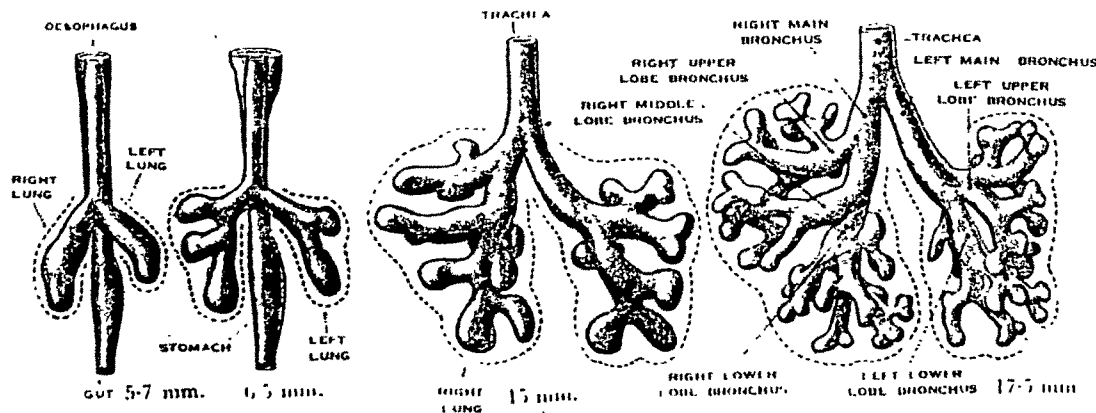


Fig. Drawings to show four stages in the development of the endodermal lung primordia in human embryo (based on Wells & Boyden 1954)

Embryology ... contd...

Uro- genital System.

Uro- genital System is developed from Intermediate Mesoderm & adjacent Coelomic Epithelium. Urinary & Gental Systems are closely linked in Embryological History.

URINARY SYSTEM:

Embryo is separated into Medial, Paraxial & Mass, which later form Somites. A lateral plate which remains unsegmented, forms the lining of Coelom. The Intermediate Mesoderm connects Somites & Coelom. The Intermediate Mesoderm produces a Nephrogenic Cord. This Cord forms most of the Excretory System.

GENITAL SYSTEM:

Sex glands/Genital Ridges appear in 4-5mm Embryo. Mesodermal Cells Coelomic Epithelium constitute Gonads. There develop special Primordial Germ Cells/Gonocytes, also participate in Gonad formation. Therefore, Gonads develop from 3 components: i) Primordial Germ Cell, ii) Coelomic Epithelium & iii) Mesonephric Ridge.

Only after six weeks of development, Gonadal Ridges distinguish into two sexes. From Mesodermal Thickening/Inguinal Fold, Gubernaculum of Testis/Ovary develops*.

TESTIS: Testis is identified firstly in 17mm Embryo. Seminiferous Tubules develop, when Sex Cord becomes canalised. Uncanalised Sex-Cord forms Interstitial Cells of Testis.

OVARY: Ovary develops from Primordial Germ Cells in late Somite stage Sex Cord groups to form Primordial Ovarian Follicles, where Primordial Ova are encapsulated**.

*Hamlett 1935 & Wolff 1965

**Gillman 1948.

UROGENITAL SYSTEM

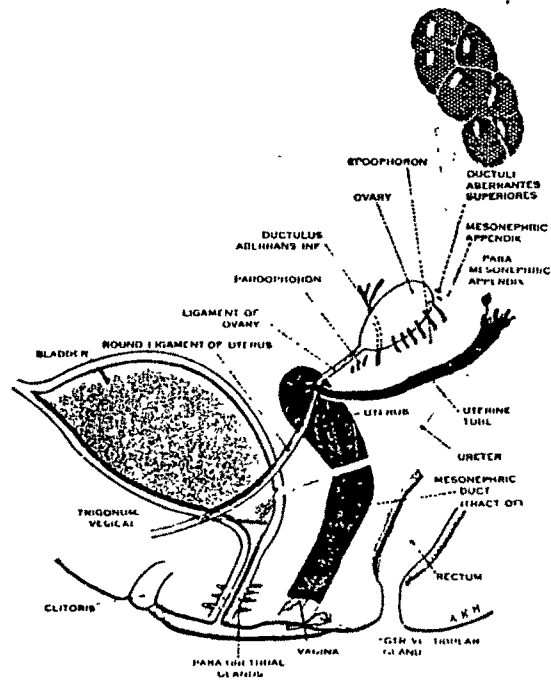


FIG. —A schematic lateral view of the definitive genito-urinary system in the female. The development of the vagina in this Figure is based on Koll's interpretation. (For colour scheme see Fig. 35b.)

SUMMARY OF DEVELOPMENT OF UROGENITAL SYTEM:

<u>Ovulation Age</u>	<u>Approx Size</u>	<u>Development</u>
Fertilization	Zygote	Genetic/Chromosomal Sex established
10-12 Days	Blastocyst	Sex Chromatin in Conceptus Cells
19-23 "	01-10 Somites	Pronephros present
22 "	07 "	Mesonephros appear
30 "	04mm	Uteric Bud appears
30-32 "	4-5mm	Primordia of Gonads
37 "	10mm	Para Mesonephric ducts appear
39 "	12mm	Primordia of Supra Renal Cortex
42-47 "	15-20mm	Differentiation in Male Gonad begin Growth Phase in Male Gonad
56-60 "	30-35mm	Histological sings of specializa- tion in Interstitial Cell of Testis
56-60 "	30mm	Male Gonad on posterior abdominal wall, Mesonephros degenerate
63-70 "	35-40mm	Divergence in Male & Female Genital Ducts.

Summary Urogenital System ... contd...

<u>Ovulation Age</u>	<u>Approx Size</u>	<u>Development</u>
75-90 Days	50mm	Divergence of external Genitalia
90 "	55mm	Sinu Vaginal & Sinu Utricular bulbs appear, Primordium of Prostate Gland Male Gonad in false pelvis, Meatus undersurface of Penis Proximal of
100-105 "	60mm	Meatus encroaches undersurface of Glans Penis
105-120 "	70mm	Meatus confines to Glans Penis
120-150 "	100-140mm	Formation of Fetal Stroma & Primary Follicles in Ovaries, Definite form of External Genitalia
150	150mm	Collecting Tubules continue to form until birth
180-240 "	200mm-	Male Gonad passing through Inguinal Canal to reach Scrotum.

Embryology ... contd...

Nervous System.

Nervous system & Neuro Epithelium are organs of special sense derived from Embryonic Ectoderm. It is possible that some of Taste Buds are of Endodermal origin. Van Campenhout 1948 suggested that Nervous System of Intestinal Track are formed of Endodermal Placodes.

The Central Nervous System i.e. Brain & Spinal Cord come out from elongated Ectoderm; the Neural Plate, situated in the Axial Region of Embryo in front of Hensen's Node & Primitive Streak.

The Peripheral Nervous System arise from the cells, which are partly derived from Neural Plate & partly from Neural Crest i.e. specialised band of Ectoderm.

Summary of Development of Nervous System:

<u>Ovulation Age</u>	<u>Approx Size</u>	<u>Development</u>
18 Days	Pre Somite	Neural Groove
21 "	4 Somite	Neural Tube
22 "	7 "	Rathke's Pouch
24 "	14 "	Optic Evagination
25 "	16 "	Otic Pit
26 "	20 "	Neural Tube closure, Anterior Neurophore closure
27 "	23 "	Optic Vesicle appears
28 "	25 "	Posterior Neuropore closure, formation of Lens/optic placode
29 "	3-5mm	Mesencephalic flexure appear, Cervical flexure appear
30 "	4mm	Cerebral Vesicle appear

Summary Nervous System ... contd...

<u>Ovulation Age</u>	<u>Approx Size</u>	<u>Development</u>
32 Days	5mm	Optic Vesicle Invagination, Prosen- cephalic flexure appears, <u>Otic</u> Vesicle closes & separates
35 "	8mm	Lens separate, Vitreous appears
36 "	9mm	Pontine flexure appears
37 "	10mm	Differentiation of <u>Retina</u> , Thalamus appears, Infundibulum present, Pineal Gland/ <u>Cerebellum</u> appears
39 "	12mm	Pinna appears
40 "	13mm	Semicircular canals appear, Cochlear Duct appears
46 "	17mm	Closure of Fetal Fissure Eyelids appear
48 "	20mm	Development of <u>Cornea</u> , Cerebral Commisure appear
53 "	25mm	Lens Cavity obliterated
55 "	30mm	Semicircular Canals established Pinna well established
63 "	35mm	Eyelids fused, <u>Iris</u> appears
70 "	60mm	Corpus Callosum formed
100 "	110mm	Rupture of IVth Ventricle Eyelids separate
186 "	180-220mm	Cerebral Sulci

NERVOUS SYSTEM

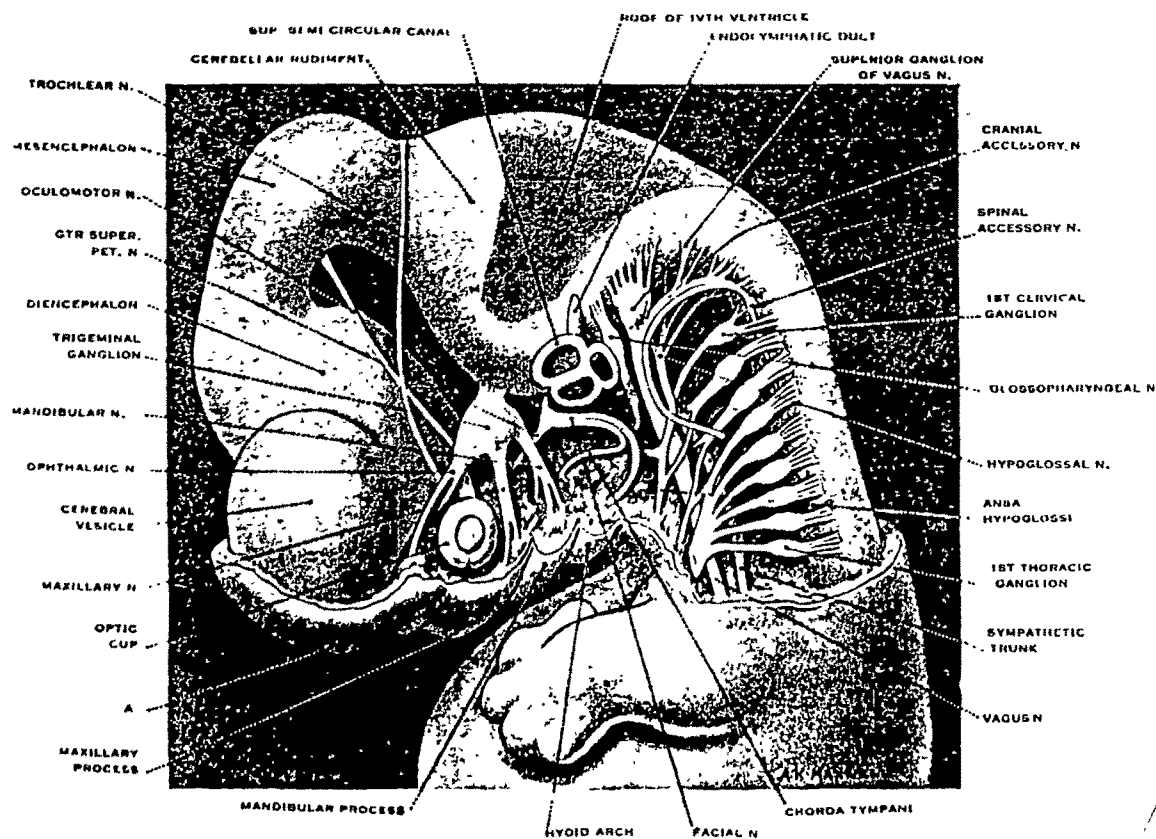


Fig. -- Dissection of the head region and cranial and upper spinal nerves in a 15 mm. human embryo. A - groove between maxillary and fronto-nasal process. \times c. 10.

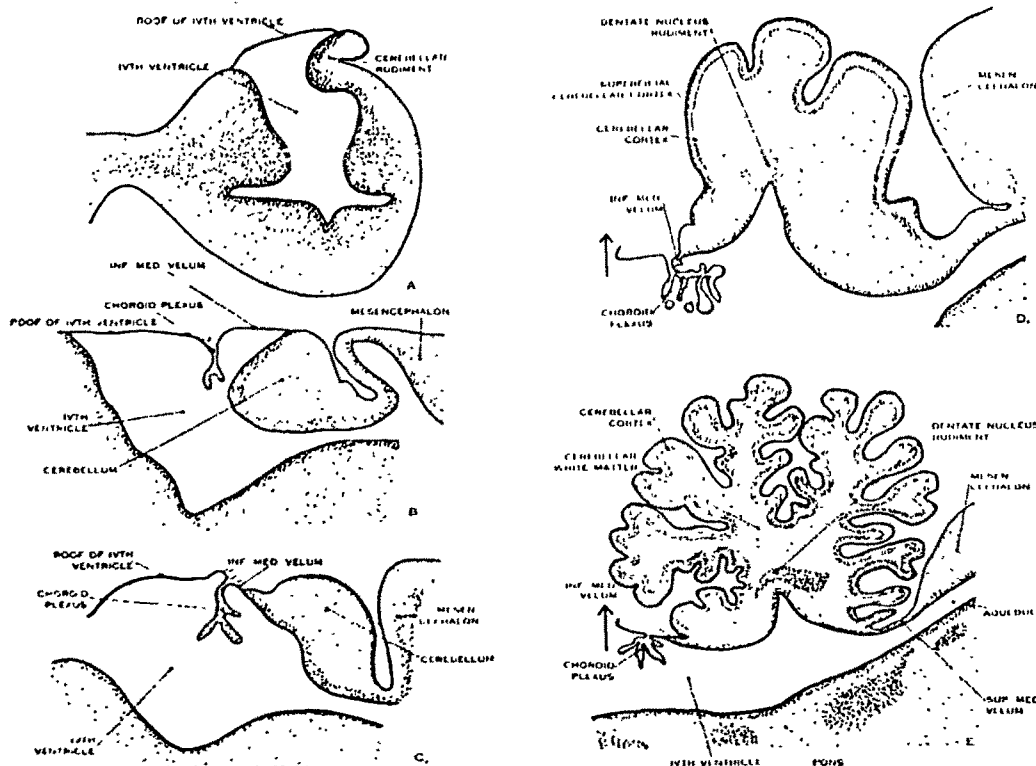


Fig. -- Sagittal sections of the developing cerebellar region in a series of human fetuses (modified from Jakob). A - 13 mm.; B - 15 mm.; C - 30 mm.; D - 100 mm.; E - 150 mm. The arrows in D and E represent the position of the median aperture.

Embryology ... contd...

Skeletal System.

One of the most important derivatives of Embryonic Mesenchyme is skeletal system, including bone, cartilage & connective tissue.

The Endo-Skeleton is formed from the transformation of Mesenchyme in to specialised skeletal tissue. Specialised Skeletal Tissue consists of Callogenous Tissue, in which small groups of rounded cells are embedded. It is still doubtful, whether this specialised tissue was initially cartilaginous or bony in nature. Many investigators now, consider that bone may have antedated cartilage in phylogeny.

DEVELOPMENT OF CERTAIN BONES IN HUMAN EMBRYO/FETUS:

<u>Bone</u>	<u>Embryo/Fetus age</u>
Humerous	145mm
Cartilaginous Skull	21mm
Bony skull	40mm
Vertebral Column	09mm (By Bardeen)
Well developed	
Ilium, Femur, Tibia	
& Fibula & Meta-	
Tarsal	

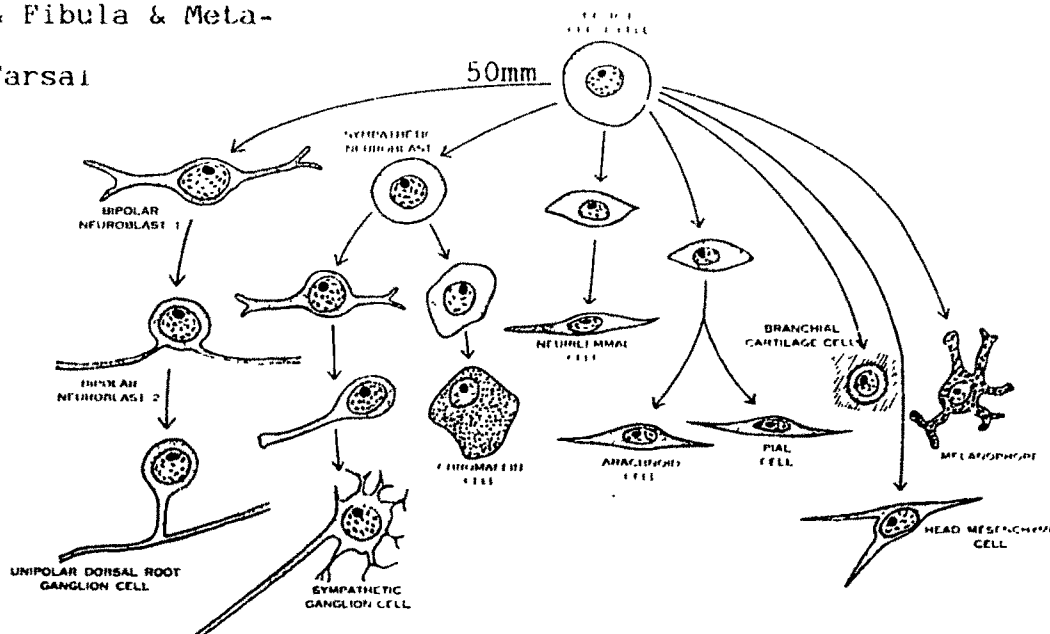


FIG. —A schematic representation of the possible developmental fates of a neural crest cell.

Embryology ... contd...

Muscles.

The muscular tissue of the body with exception of muscles of Iris & Myoepithelial cells of Sweat Glands, is derived from Mesoderm. There are important differences in the origin & Histogenesis* of i) Voluntary i.e. striped, skeletal or segmental, ii) Involuntary i.e. smooth visceral or non-segmental & iii) Cardiac muscles.

VOLUNTARY MUSCULATURE:

Voluntary Musculature is mainly derived from the Paraxial Mesoderm by way of segmentally arranged Somites, but muscles of certain important parts like limbs, tounge & orbit & segmental musculature associated with Branchial Arches (rise independently of Somites).

INVOLUNTARY MUSCULATURE:

All Smooth & Cardiac Muscles arise independently of Segmental Structure i.e. Somites & Visceral Arches. Most of the muscles are derived from Visceral Mesoderm. The derivatives of this Mesoderm include, Longitudinal & Circular Muscles & Muscularis Mucosae of Intestine & muscles of Trachea & Bronchi.

As the Embryonic Heart, Aortae, Vitelline & Allantoic Vessels, also develops from this Mesoderm. Muscular Coat of Heart & Aortae are of Mesodermal origin. Smooth Muscles of Embryonic & Adult Urogenital Track i.e. V. D. & Uterus muscles are of Mesderm.

DEVELOPMENT OF MUSCLES IN EMBRYO/FETUS:

<u>Types of Muscles</u>	<u>Age</u>
Muscles Masses i.e. Somatic & Branchialm Musculature	10-11mm
Arrangement of Muscle Sheets & Distribution of Spinal Nerve, Arrangement of Muscle Group	15mm
Trunk Muscle	17mm
RECTUS Muscles	45mm

Embryology ... contd...

Skin* & Derivatives.

Skin is fundamentally divisible into Dermis/Cutis & Epidermis/Corium develop from two sources: Embryonic Ectoderm & under-lying Mesenchyme

NAIL: Nail of fingers & toes appear at end of 3rd month/50-60mm, due to thickness of Epidermis.

HAIR: First hair of human Embryo appears in early 3rd month, is actually a derivative of skin. The growth of hair results from continued multiplication of Epidermal cells around Papilla. The muscles of hair follicles develop from Mesenchymal cells.

Sebaceous Glands: The Sebaceous Glands arise as Epidermal Buds from the Cuboidal Cells of Hair Follicles, during 5th month of Fetal life

Sweat Glands: The sweat glands begin to develop in 12th-13th week from Palmar & Plantar Epidermis.

Mammary Glands: The first stage of Mammary Glands develop in the form of a pair of external thickening i.e. Mammary Lines during 7mm Embryo. A full term Mammary Glands are similar in male & female.

Additional Nipples/Polythelia can be found at any point along the Mammary Line. Extra Mammary Gland/Polymastia or absence of Mammary Glands/Amastia are much rare.

Teeth: Teeth are fundamentally derivative of Dermal Skeleton. Each tooth has a basis of Dentine, which is Mesenchymatous in origin. Dentine is covered by Enamel formed by specialised Ectodermal Cells.

* مَشِيمَ عَلَيْهِمْ سَمْعُهُمْ وَابْصَارُهُمْ وَجُلُودُهُمْ بِمَا كَانُوا يَقْتُلُونَ ۝ وَقَالُوا الْجُلُودُ دِهْنٌ
لَمْ يَكُنْ لَنَا عَلَيْهَا ۝ (24 - لَم - 22-20) ... سَمْعُكُمْ وَلَا أَبْصَارُكُمْ وَلَا جُلُودُكُمْ ... ۝

THE FATE OF THE GERM LAYERS

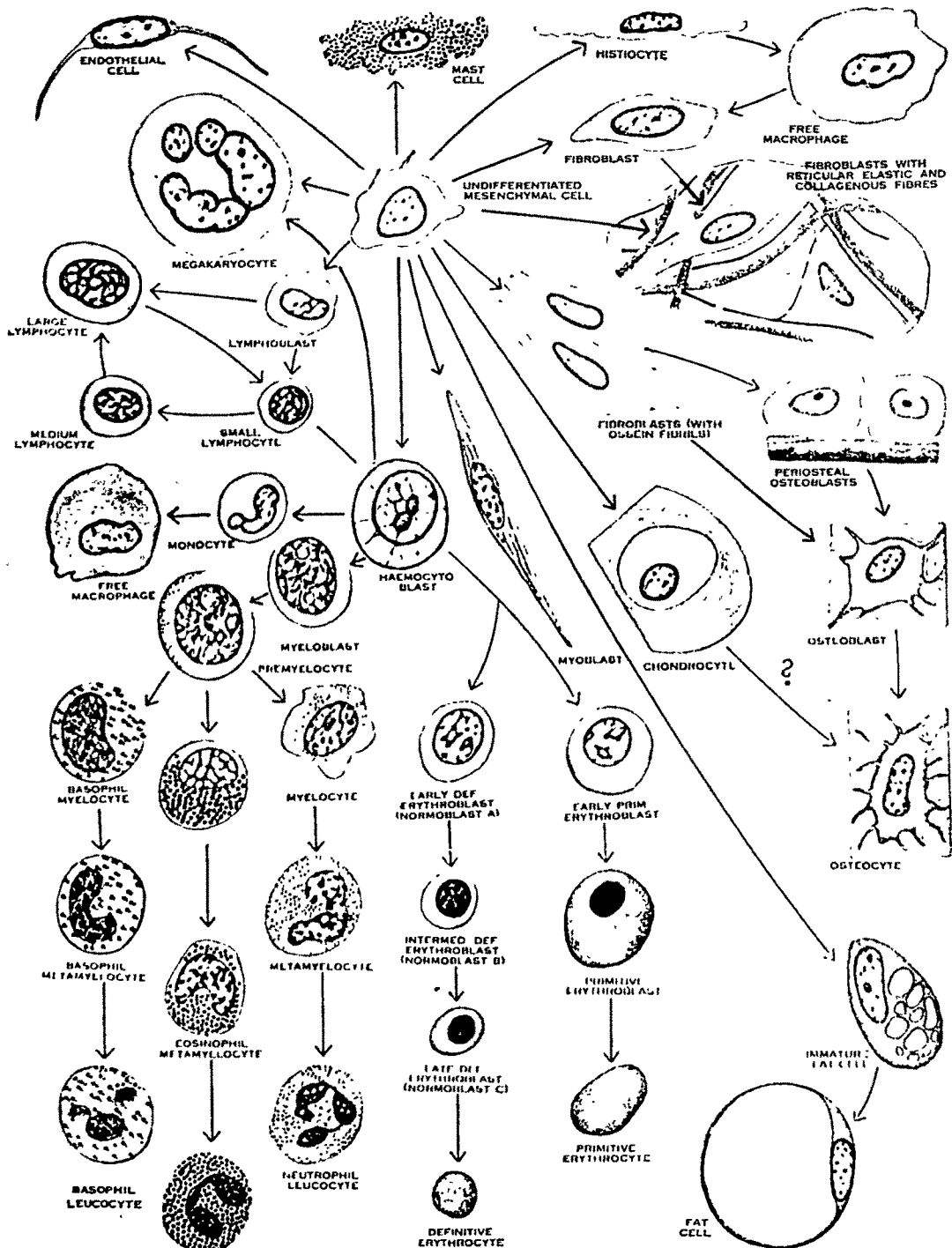


Fig. —A scheme to show the differentiation of various cell types from the undifferentiated mesenchymal cell.

Embryology ... contd...

Post Natal Period:

After the completion of full term pregnancy in female human, a baby; male or female is delivered out of the mother's uterus. Now, growth continues out side the uterus, covering all the different stages* of life; e.g. babyhood, infancy, childhood and youth age or the stage of maturation. Growth saturates at the stage of maturation.

After maturation, growth begins to retard till the last but one stage of life i.e. old age. Human has to die after this stage.

The next chapter, contains the details of death & decomposition. The first part of this chapter V, contains the Qoranic Verses regarding the death & decomposition of human body.

* يَا أَيُّهَا النَّاسُ إِن كُنْتُمْ فِي رَيْبٍ مِّنَ الْبَيْتِ فَأَنَا خَالِقُكُمْ مِّن تُرَابٍ ثُمَّ مِّن نُّطْفَةٍ ثُمَّ مِّن عَلَقَةٍ ثُمَّ مِّن مُّضْغَةٍ مُّغَلَّقَةٍ وَغَيْرِ مُخْلَقَةٍ يَتَّبِعُنَّ نَكْمَهُ وَنَقَرُ فِي الْأَرْهَامِ مَا نَشَاءُ إِلَىٰ أَجَلٍ مُّسَمًّى ثُمَّ نُخْرِجُكُمْ طِفْلًا ثُمَّ لِتَبْلُغُوا أَشُدَّكُمْ وَمِنْكُمْ مَّن يَتَّقُوا وَمِنْكُمْ مَّن يُرَدِّ إِلَىٰ أَهْذَلِ الْغَمَرِ - ٥ (١٧- الحج- ٥)