أهلا وسهلا

الأستاذ الدكتور يوسف حسين

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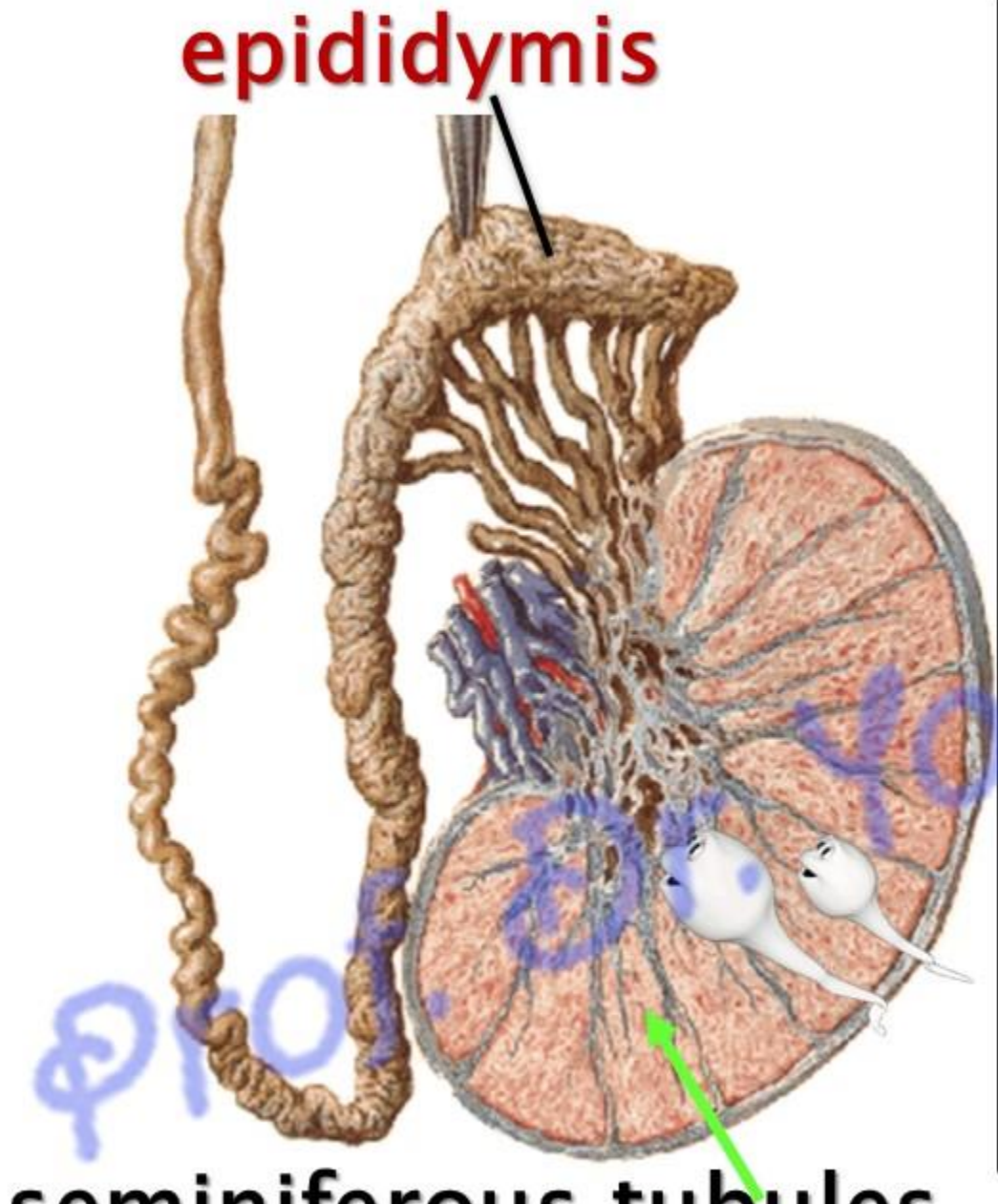
SPERMATOGENESIS

** **Definition**: It is the process of formation of the sperms (mature male gametes) from the primordial germ cells (spermatogonia)

- **Time: starting at puberty (15-17 years) and continues till old age.**



- Site of spermatogenesis

- in seminiferous tubules in testis and sperms stored in epididymis.
- **Testis** primary Male sex gland, Located in the Scrotum.

- Produce Sperms.
- Testis have interstitial cells (Leydig cells) that produce male sex hormone (testosterone or androgen hormone).
- Seminiferous tubules is structural unit of testes, site of developmental phases of sperms, containing Sertoli cells.

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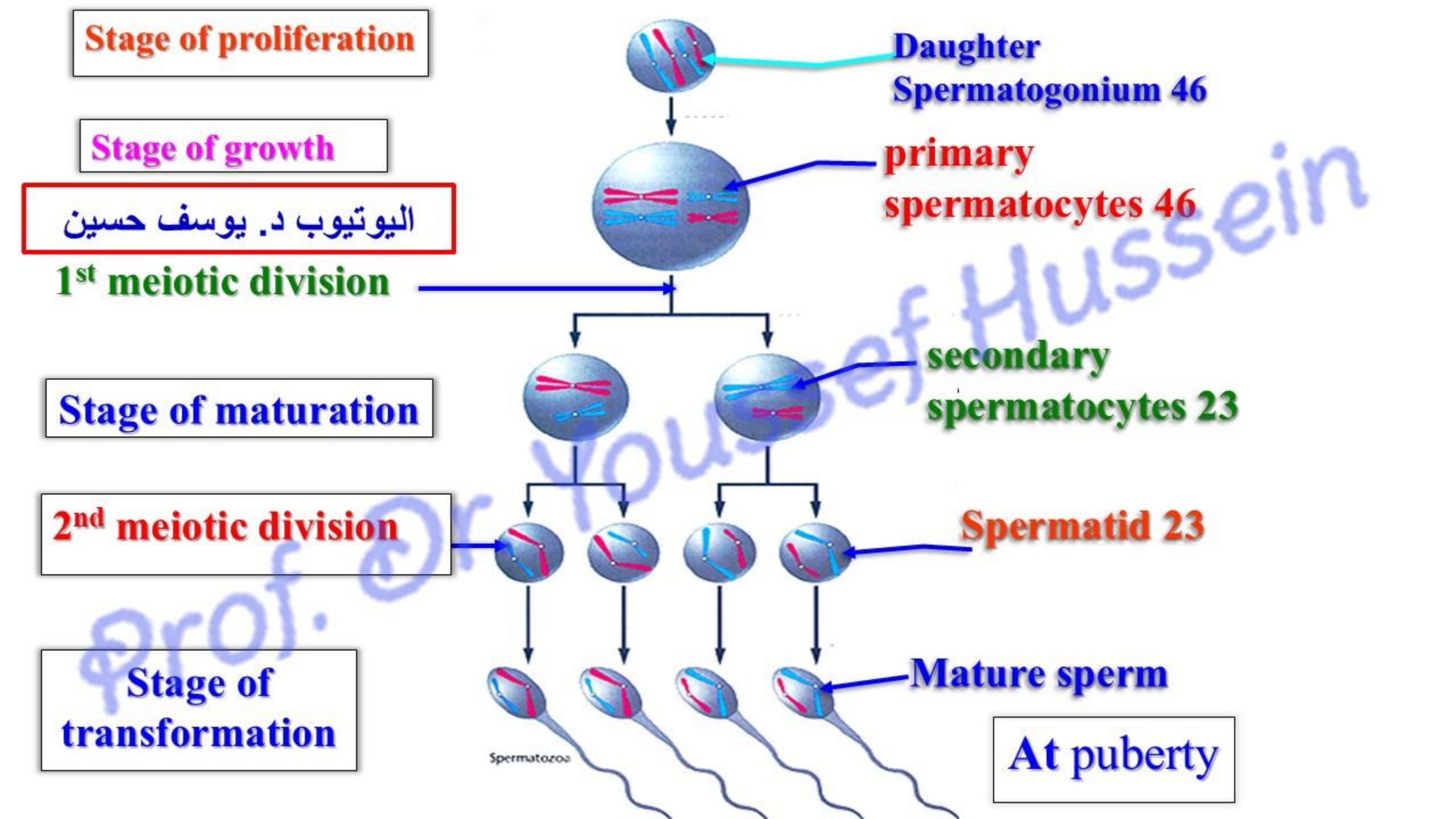
❖ Functions of Sertoli cells

1. Secret protein for **nutrition** of developing sperms So called **mother cells or Nurse cells**
2. **Phagocytosis** for residual cytoplasm from spermatogenesis.
3. Maintain the **environment** necessary for development and maturation of sperms via forming a **blood-testis barrier**.
4. **Secret anti-Mullarian hormones** during early stage of fetal life which represses formation of derivatives of müllerian duct
5. **Secret inhibin and activin** which controls pituitary gland to regulate FSH
6. **Secret androgen binding protein** leading to increase testosterone hormone to stimulate spermatogenesis


Stage of proliferation
Daughter Spermatogonium 46
Stage of growth
primary spermatocytes 46
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1st meiotic division
Stage of maturation
secondary spermatocytes 23
2nd meiotic division
Spermatid 23
Stage of transformation
Mature sperm
Spermatozoa
At puberty
Prof. Dr Youssef Hussein

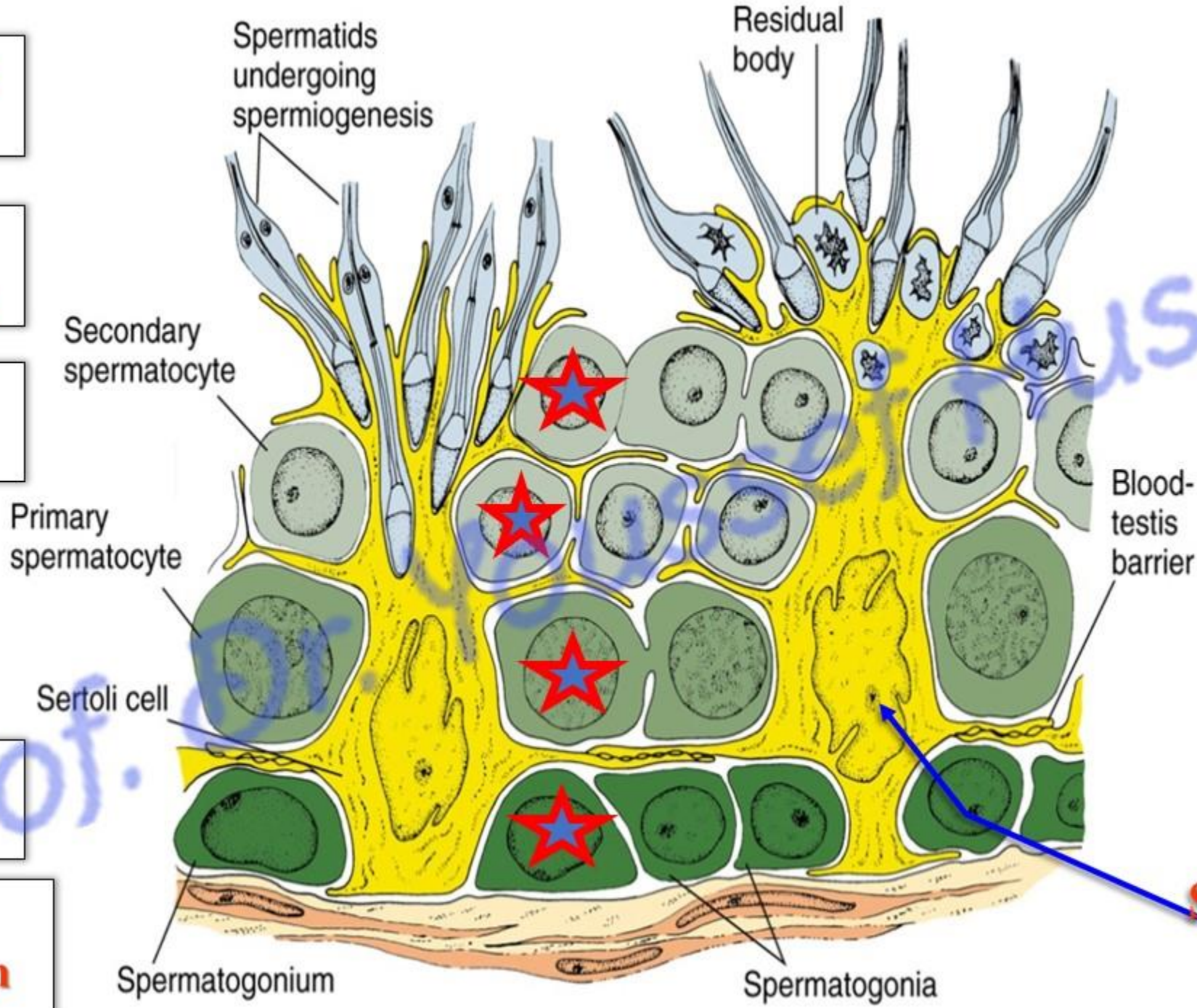
2nd meiotic division

Stage of Maturation

1st meiotic division

Stage of Growth

Stage of proliferation



** Stages of spermatogenesis

** It includes 4 stages:

(1) Stage of proliferation

- Each primordial germ cell (**spermatogonium**, 46 chromosome) undergo many rounds of **mitotic division** successively to form a large stock of **daughter spermatogonia** (each one contains 46 chromosomes).

(2) Stage of growth

- A number of daughter spermatogonia acquired more cytoplasm and increased in size forming **primary spermatocyte** (46 chromosomes).
- **Other numbers of daughter spermatogonia** remain a source of new **Spermatogonium cells.**

(3) Stage of maturation

- After many mitotic divisions, The primary spermatocytes, divide by meiotic division as follows:

I) **1st meiotic division (reduction division):** each primary spermatocyte divide by meiotic division into two **secondary spermatocytes** {23 chromosome (one contains 22+X and one 22+Y)}.

II) **2nd meiotic division (equational division):** each of the developed secondary spermatocytes divide into two cells called **spermatids** (each contains 23 chromosomes 22+X or 22+Y).

N.B; Each **daughter spermatogonium** gives 4 spermatids (2= 22+X and 2= 22+Y).

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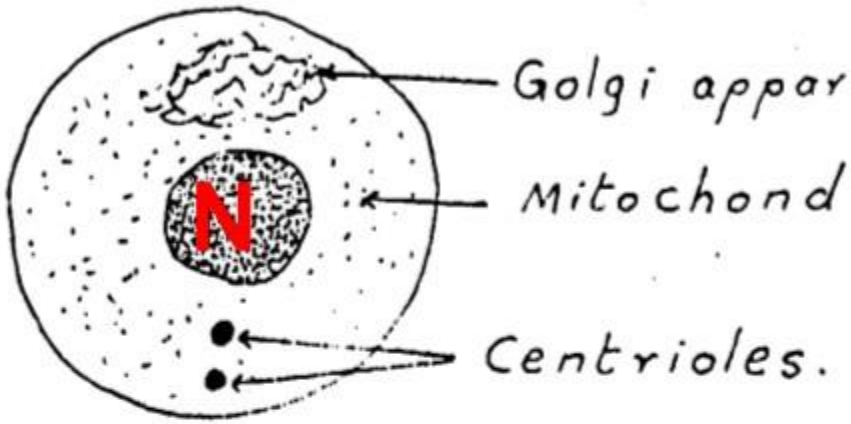

Spermatid

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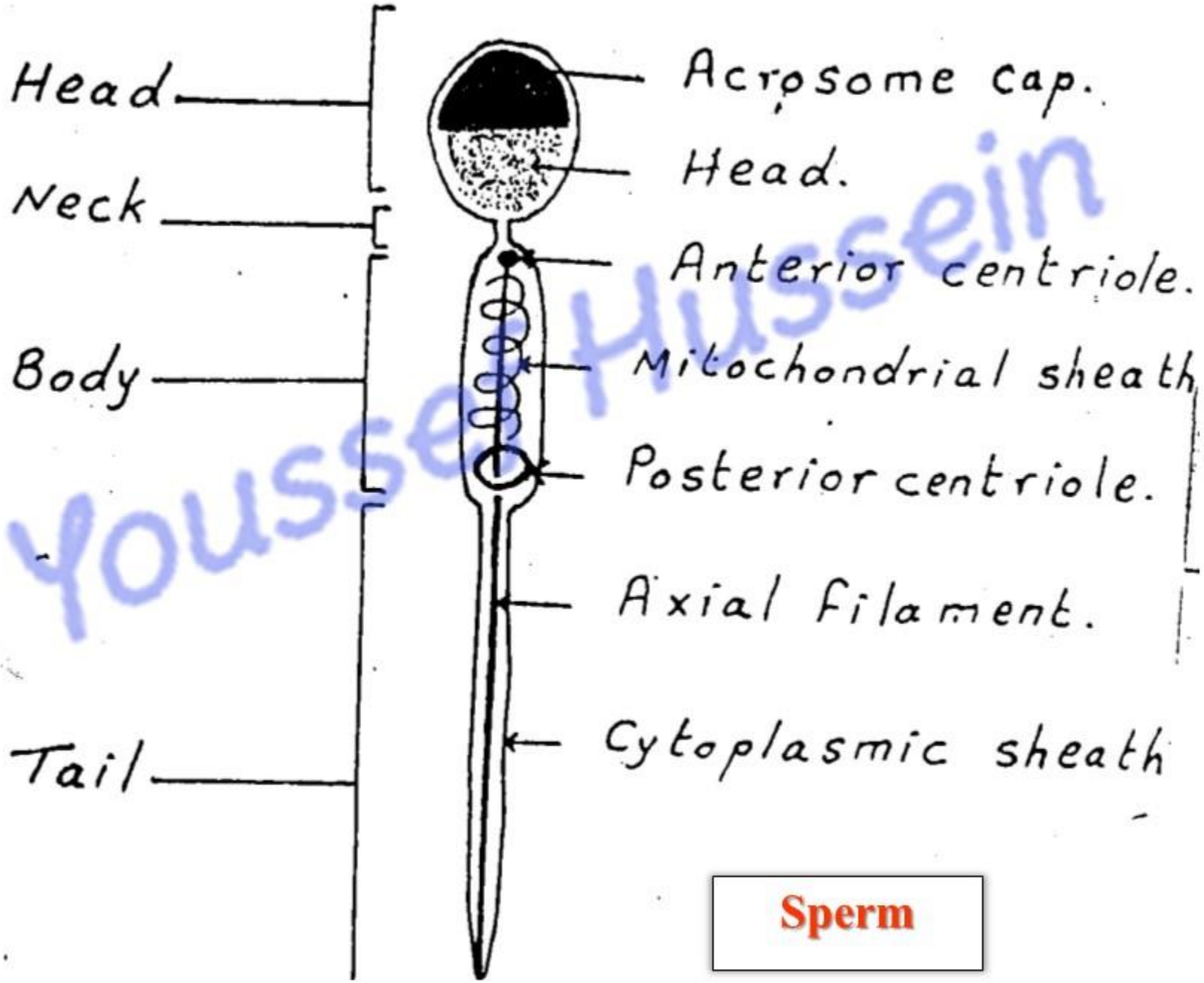
Stage of transformation



Sperm

(4) Stage of transformation (Spermiogenesis):

- It occurs in male only.
- Transformation of the spermatid into a mature sperm.

- The **length** of the sperm is about **50- 60 micrometer**

1. The **nucleus** forms the **head** of sperm.
2. The **Golgi** apparatus forms **acrosomal cap** contains hydrolytic enzymes which covers the anterior 1/2 of the head.

3. **Centrioles,**

a- **Anterior** centriole: in the neck, immediately behind the head.

b- **Posterior** centriole: forms a **ring** shaped structure at end of the body.

- **Axial filament** arises from anterior centriole and passes through the ring shaped posterior centriole to the tail.

4. **Mitochondria** forms a mitochondrial sheath around axial filaments between centrioles.

5. **Cytoplasmic membrane** forms a cytoplasmic sheath around the neck, body and tail.

• Characters of normal sperm

1. **Number of sperm** about 20-200 million per ml and survive on fructose.
2. **Parts of mature sperm:** head, neck, body and tail.
3. **Motile of sperm at ejaculation:** more than 80%.
4. **Rate of movement of sperms** in the female genital tract about 1- 3 mm per minute.
5. **Survival of sperm** in the female genital tract about 3-4 days.
6. **The average volume of semen** at ejaculation is 3-5 ml
7. **Appearance** is whitish to gray
8. **PH** is 7.2 – 8.0 (If low is acidic while high is alkaline)
9. **The seminal fluid is secreted by** testis, seminal vesicle, prostate, and bulbourethral glands (Cooper's gland)

- Anterior part of pituitary gland produces **luteinizing hormone** stimulates the **Leydig cells** located between the seminiferous tubules in the testis to secrete testosterone, which transforms the spermatid into sperm.
- **Sertoli cells** Secret protein for **nutrition** of developing sperms and contribute to pushing the sperm towards the epididymis (place of storage).
- The secretions of the two **seminal vesicles**, which contain fructose, contribute to providing the sperm with the energy needed for movement.
- The secretions of the **prostate gland (seminal fluid)** contribute to facilitating the movement of sperm and nutrition
- **Cooper's gland (bulbourethral gland)** In the deep perineal pouch at the base of penis open into spongy urethra, its secretions work to neutralize the acidity caused by urine residue in the urethra and thus contribute to keeping the sperm alive
- The stages of sperm formation take a period of **about 64-73 days**

- **Abnormal spermatogenesis**

i) **Azoospermia:** absence of sperms in the seminal fluid

ii) **Oligospermia:** decreased number of sperms in the seminal fluid

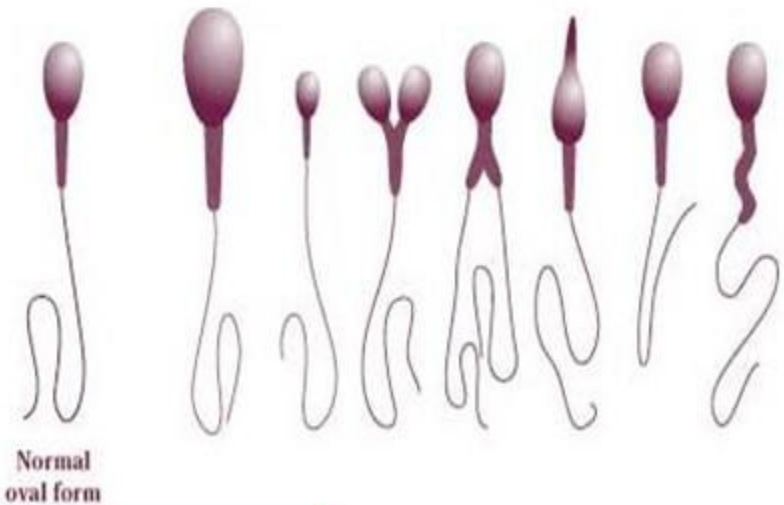
iii) **Asthenospermia reduced sperm motility**

iv) **Necrospermia: sperms found dead.**

v) **Genetic abnormalities**: Sperm having abnormal chromosomal content

vi) **Morphological Abnormalities:** If more than 20% affect fertility

- Giant. - Dwarf. - Joined in head or in tail.



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Oogenesis

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** **Definition**: It is a process by which mature ovum is formed from primitive germ cell (oogonium)

• OOGENESIS

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** **Site**: in the cortex of ovary in female.

** **Time**:

- It **started** during foetal (intrauterine) life
- **Continues** after puberty
- **Completed** after fertilization
- **Arrested** at the age of menopause.

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- Many of the primary oocytes degenerate before birth
- At birth, the ovary contains about **two million primary oocyte,** most of them degenerate and, by puberty, when ovulation begins only about 300,000- **400,000 primary oocytes** are left in the ovary.

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Before birth

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At puberty (ovulation)

At fertilization

Stage of Proliferation

daughter

Stage of growth

Primary oocyte

Stage of maturation

Secondary oocyte

First polar body

Ootid

Second polar bodies

Daughter oogonium

primary oocyte

1st meiotic division

2ry oocyte and 1st polar body

2nd meiotic division

Ovum and 2nd polar body

** Stages of Oogenisis

A- During foetal life

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(1) Stage of proliferation:

- Each primordial germ cell; {oogonium} (46 chromosome) is divided by mitosis into 2 daughter oogonia (each contains 46 chromosomes).

(2) Stage of growth:

- Each of the daughter oogonia increases in size forming the primary oocyte containing 46 chromosomes (at birth).

B- After puberty

(3) Stage of maturation:

I) 1st meiotic division (reduction division): each primary oocyte divide by meiotic division into one secondary oocytes (contains 22 +X chromosomes and 1st polar body (contains 22 +X chromosomes and minimal amount of the cytoplasm).

C- After fertilization

II) 2nd meiotic division (equational division):

- **The secondary oocyte divides into mature ovum (contains 23 chromosome, 22 + X and most of the cytoplasm) and 2nd polar body (contains 22 +X chromosomes and minimal amount of the cytoplasm) in the Fallopian tube.**
- **The 1st polar body divided by secondary meiotic division into two 2nd polar bodies.**

N.B;

- **The role of the polar body is to reduce the number of chromosomes. Later on decay and disintegrated**

• Differences between spermatogenesis and oogenesis

	Spermatogenesis	Oogenesis
Definition	Formation of the sperms from the primordial germ cells.	Formation of the ova from the primordial germ cell.
Site	In the seminiferous tubules of testis	In the cortex of the ovary
Time	- It started at puberty and continues till very old age (all over life).	- It started during intrauterine life, and continues after puberty to be completed after fertilization. - It arrested at the age of menopause.
Hormones	- Follicle stimulating hormone, Luteinizing hormone, and testosterone	- FSH and LH
Stages	Proliferation, growth, maturation and transformation.	Proliferation, growth, maturation (No transformation stage)
Results	Each daughter spermatogonium gives 4 sperms.	Each daughter oogonium gives 1 ova and 3 polar bodies.

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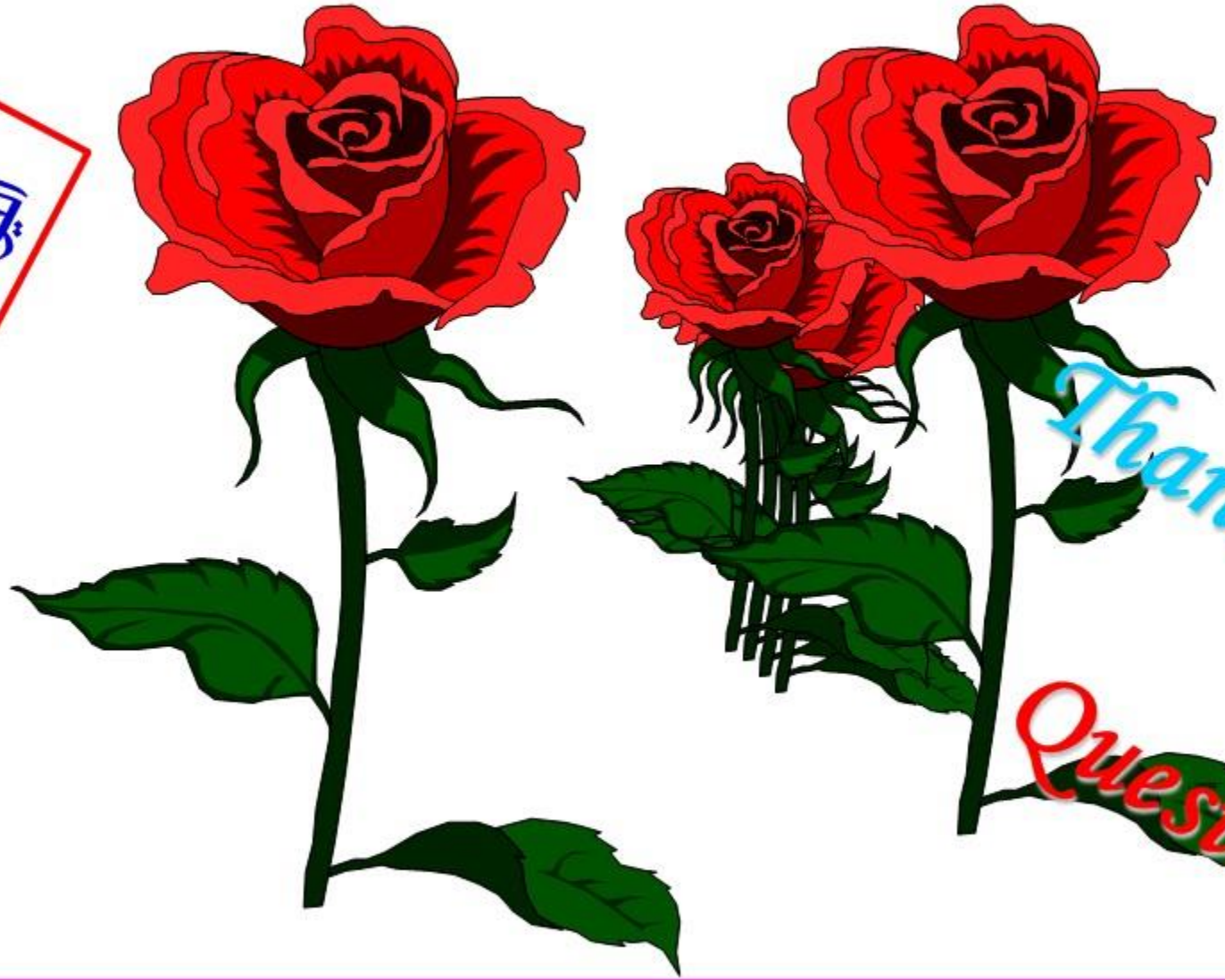

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