

# "Blood Cells and Blood Vessels Formation"

Both blood cells and blood vessels are derived from mesoderm, specifically from mesodermal progenitors called hemangioblasts.

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## 1. Origin

- Mesoderm → source of blood vessels and blood cells.
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## 2. Blood Vessel Formation

### A. Vasculogenesis

- Formation of new vessels from blood islands (mesodermal aggregates).

- Primary mechanism during early embryonic development.

## B. Angiogenesis

- Formation of new vessels by sprouting from pre-existing vessels.
- Maintains and expands the vascular network.

### Flowchart: Blood Vessel Formation

Mesoderm → Hemangioblasts → Blood islands →

Vasculogenesis → Formation of primary vessels

And: Existing vessels → Angiogenesis → Sprouting & expansion

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## 3. Blood Islands

- Appear at week 3 in mesoderm surrounding the yolk sac.
- Later appear in lateral plate mesoderm and other regions.
- Mesodermal cells differentiate into hemangioblasts, the common precursor for blood cells and vessels.

Flowchart: Blood Islands → Blood & Vessels

Mesoderm cells → Hemangioblasts → Blood cells

(primitive) + Endothelial cells → Blood vessels

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#### 4. First Blood Cells (Primitive Hematopoiesis)

- Generated in blood islands of yolk sac wall.
- These primitive blood cells are transitory, supporting early embryonic oxygen needs.

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## 5. Definitive Hematopoietic Stem Cells (HSCs)

- Originate from mesoderm around the aorta near the mesonephric kidney in the Aorta-Gonad-Mesonephros (AGM) region.
- Migrate to the liver, which becomes the primary hematopoietic organ from ~2nd to 7th month of gestation.

### Flowchart: Definitive Hematopoiesis

AGM mesoderm → HSCs → Colonize liver → Major fetal hematopoietic organ (2-7 months) → Later colonize bone marrow → Definitive hematopoiesis

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## 6. Liver to Bone Marrow Transition

- Around 7th month of gestation, HSCs migrate from liver → bone marrow.
- Bone marrow becomes the definitive blood-forming tissue.
- Liver loses its hematopoietic function after this transition.

### Timeline Summary: Hematopoiesis

Stage	Location	Notes
Week 3	Yolk sac	Primitive blood cells (transitory)
Week 3+	AGM region	Definitive HSCs arise
Month 2-7	Liver	Main hematopoietic organ
Month 7 onwards	Bone marrow	Definitive blood formation

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## High-Yield Takeaways

1. Hemangioblasts → common precursor for blood vessels + blood cells.
2. Primitive hematopoiesis → yolk sac (transient).
3. Definitive HSCs → AGM → liver → bone marrow.
4. Bone marrow → lifelong hematopoietic organ.
5. Vasculogenesis vs Angiogenesis:
  - Vasculogenesis = de novo vessels from mesoderm
  - Angiogenesis = sprouting from existing vessels

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-> The End <-