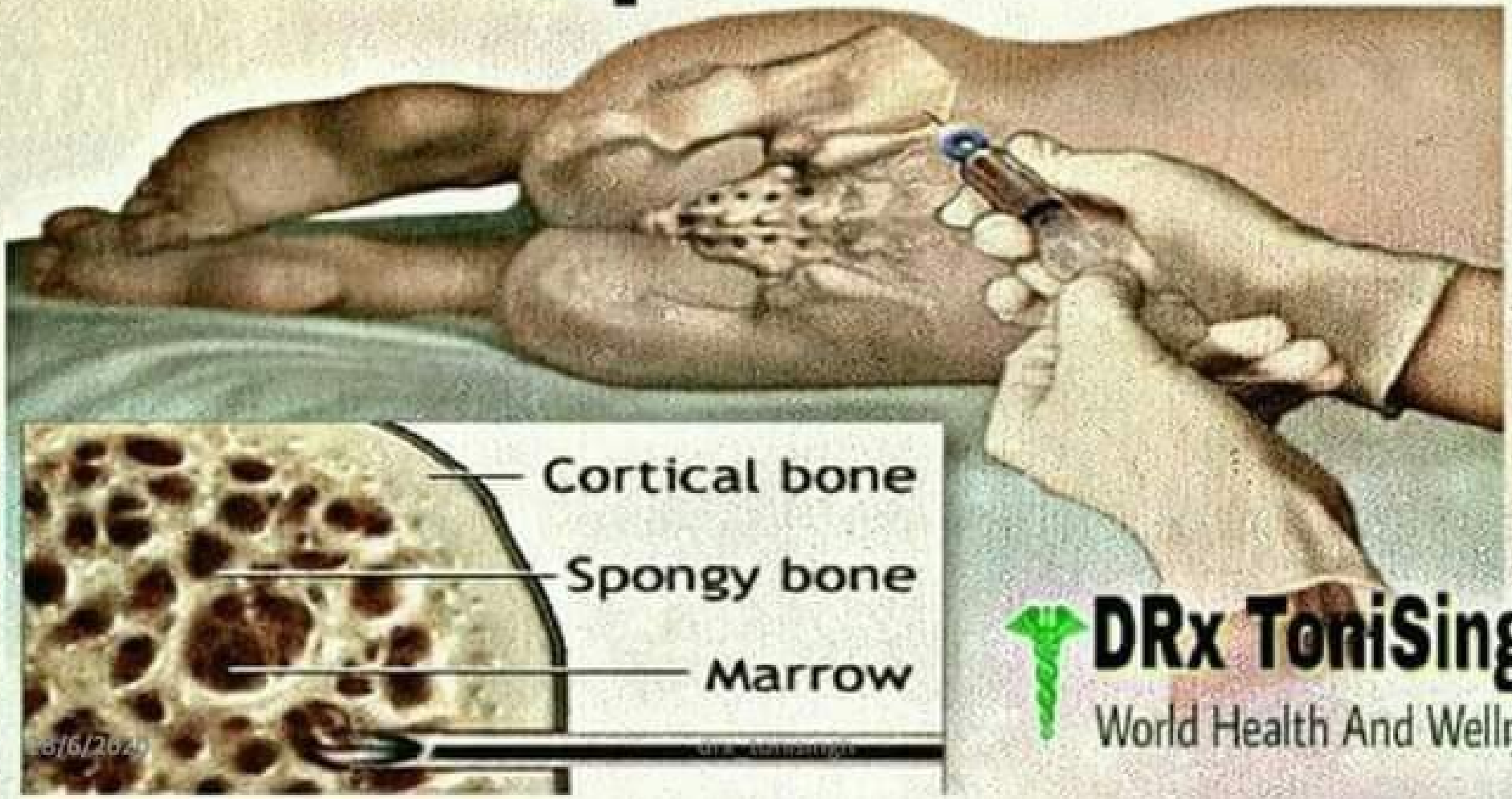
Bone-Marrow Transplantation



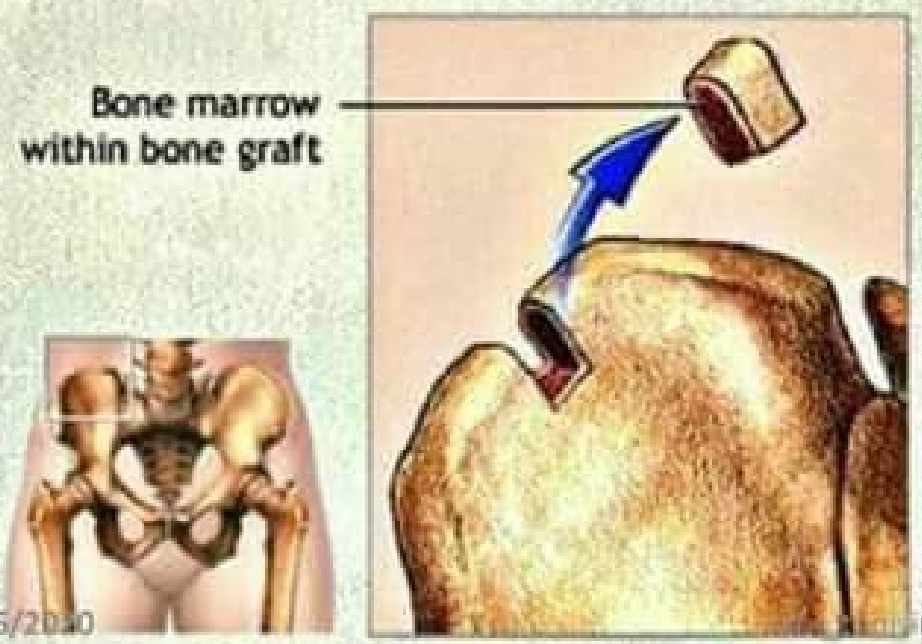
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What Is the Bone Marrow ??

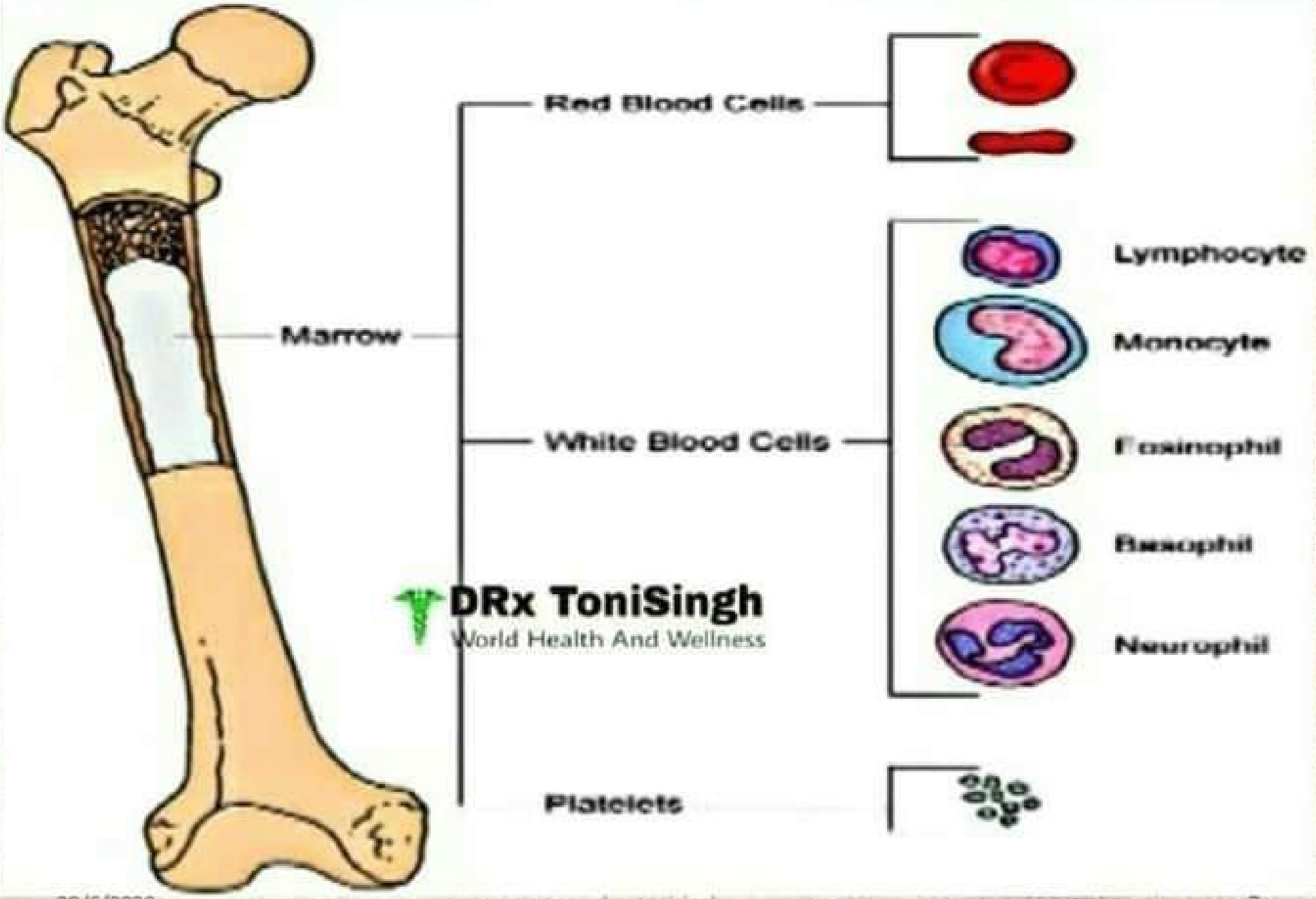
Bone Marrow is the soft spongy tissue that fills the cores of larger bones.

It serves an active function in the body by producing all three types of blood cells, as well as lymphocytes, wich support the immune system.

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Marrow
Red Blood Cells
White Blood Cells
Platelets
Lymphocyte
Monocyte
Eosinophil
Basophil
Neutrophil
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Types of bone marrow

There are two types of bone marrow

- red marrow that is responsible for producing red blood cells, white blood cells and platelets
- yellow marrow consisting mainly of fat cells



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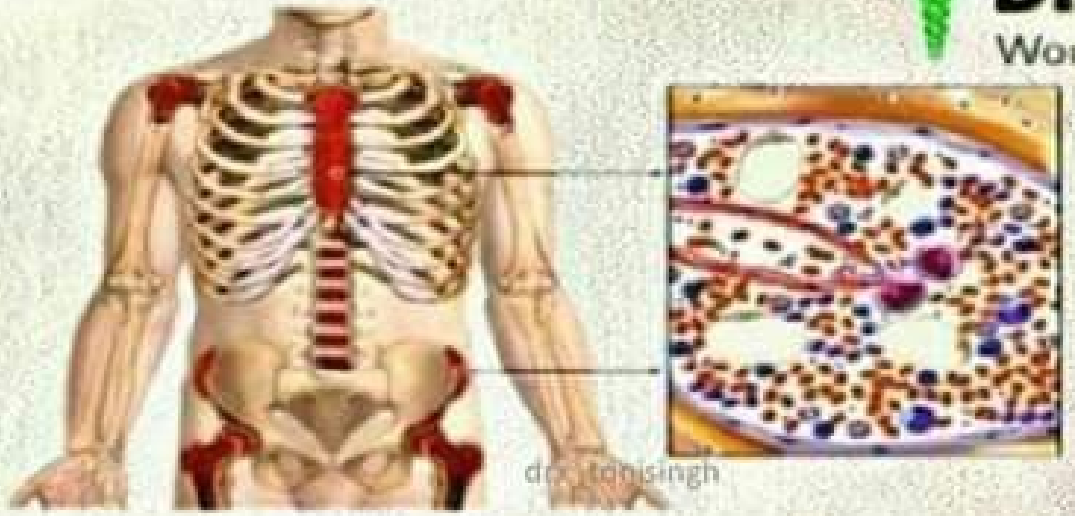
Functions of Bone-Marrow

- Red blood cells (erythrocytes) carry oxygen to the tissues
- Platelets or thrombocytes (derived from megakaryocytes) help prevent bleeding and aid in clotting of blood.
- Granulocytes (neutrophils, basophils and eosinophils) and macrophages (collectively known as myeloid cells) fight infections from bacteria, fungi, and other parasites. They also remove dead cells and remodel tissue and bones.
- B-lymphocytes produce antibodies, while T-lymphocytes can directly kill or isolate invading cells

What Is the Bone Marrow Transplant

Bone Marrow transplant is a procedure used to treat patients with life-threatening blood, immune or genetic disorders,This includes leukaemia and bone marrow cancers.
A bone Marrow transplant replaces the unhealthy blood-forming cells with healthy ones.
Healthy bone marrow stem cells are harvested from matching bone marrow donors.

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History

MID 19TH CENTURY

Marrow was the source of blood cells.
It is just a chemical factor - transferred by eating the marrow.

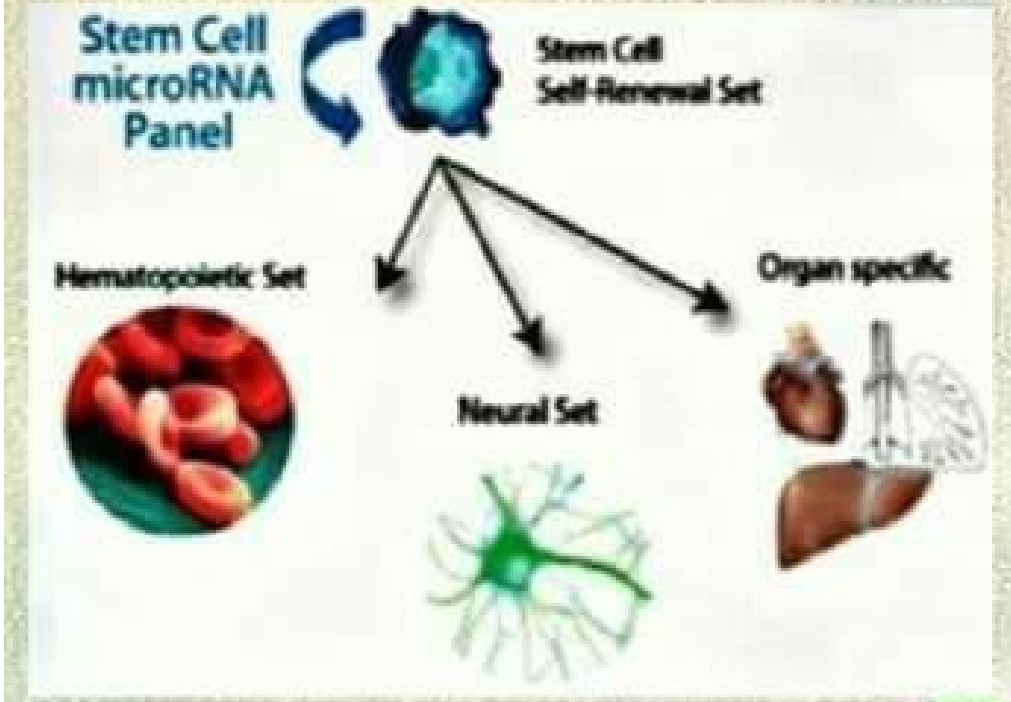
20TH CENTURY

Formulate the idea that :
a small number of cells in the marrow might be responsible for the development of all blood cells.
They began to refer to them as "stem cells"

1950 >>> first B.M.T
Over 200 transplant center whorldwide

What are stem cells ?

Stem cells are immature cells in the bone marrow that give rise to all your blood cells.





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Stem cell sources

Transplants can come from three sources:

- PERIPHERAL BLOOD
- MARROW
- UMBILICAL CORD

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Why do I need to have one ?

- You might have a bone marrow transplant if you have some types of cancer, like leukaemia, if chemotherapy cannot kill all the white blood cells that don't grow properly.

- You may also need a bone marrow transplant if you have a genetic condition that stops your blood cells from growing normally.

- If you have had an organ transplant and your body rejects your new organ you may have a bone marrow transplant if immunosuppressants can't stop the rejection.

- If the new bone is taken from the same donor that you got your new organ from, the transplant rejection is much less likely.

indications for bone marrow transplant surgery

- **Bone marrow transplant** is done to treat a number of cancerous and non cancerous conditions such as:
- Cancerous conditions:
  - Leukemia
  - Lymphoma
  - Multiple myeloma
  - Myelodysplasia.
- Non cancerous conditions:
  - Aplastic anemia
  - Hemoglobinopathies
  - Immunodeficiency disorders and conditions affecting blood present from birth

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Pre-Bone marrow transplantation procedures

- Bone marrow transplantation regimens vary from one patient to another, and depend upon the type of cancer
- the treatment program used by the medical center.
- the clinical trial protocol (if the patient is enrolled in a clinical trial), as well as other factors.

Transplant process (5 steps)

(1) Conditioning,
(2) Stem cell infusion,
(3) Neutropenic phase,
(4) Engraftment phase
(5) Post-engraftment period.

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1. CONDITIONING PHASE

- The conditioning period typically lasts 7-10 days.
- The purposes are (by delivery of chemotherapy and/or radiation)
  - to eliminate malignancy
  - to provide immune suppression to prevent rejection of new stem cells
  - create space for the new cells
- Radiation and chemotherapy agents differ in their abilities to achieve these goals.

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2. STEM CELL PROCESSING AND INFUSION

- Infusion - 20 minutes to an hour, varies depending on the volume infused.
- The stem cells may be processed before infusion, if indicated.

- Depletion of T cells can be performed to decrease GVHD.
- Premedication with acetaminophen and diphenhydramine to prevent reaction

- Infused through a CVL, much like a blood transfusion.

- Anaphylaxis, volume overload, and a (rare) transient **GVHD** are the major potential complications involved.

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- Stem cell products that have been cryopreserved contain dimethyl sulfoxide (DMSO) as a preservative and potentially can cause renal failure, in addition to the unpleasant smell and taste.

3. NEUTROPENIC PHASE

- During this period (2-4 wk), the patient essentially has no effective immune system.
- Healing is poor, and the patient is very susceptible to infection.
- Supportive care and empiric antibiotic therapy are the mainstays of successful passage through this phase.

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4. ENGRAFTMENT PHASE

- During this period (several weeks), the healing process begins with resolution of mucositis and other lesions acquired.
- In addition, fever begins to subside, and infections often begin to clear.
- The greatest challenges at this time are management of GVHD and prevention of viral infections (especially CMV).

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5. POST-ENGRAFTMENT PHASE

- This period lasts for months to years. Hallmarks of this phase include the gradual development of tolerance, weaning off of immunosuppression, management of chronic GVHD, and documentation of immune reconstitution.

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Types of Bone Marrow stem cell

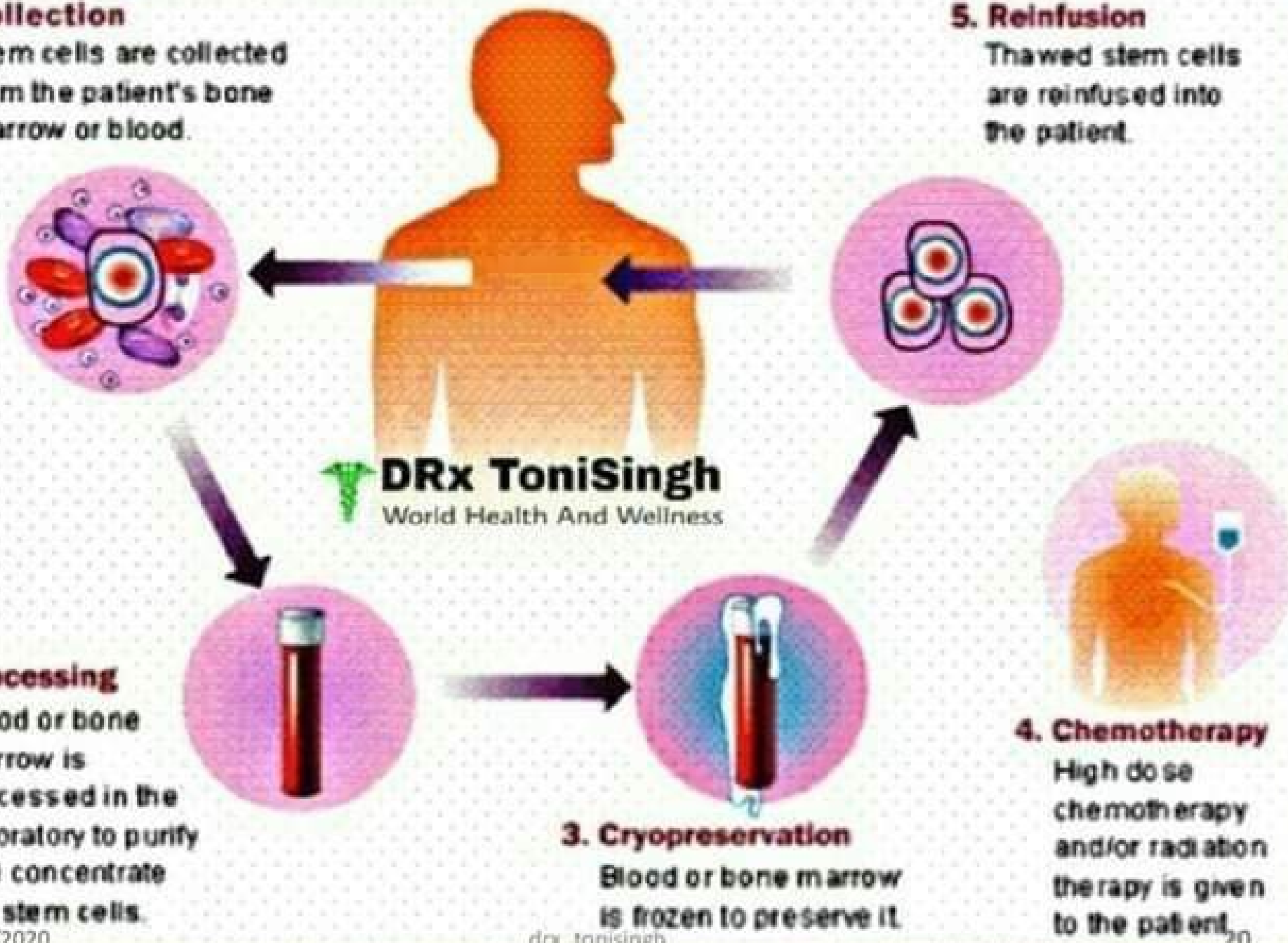
There are two main types of bone marrow transplantation:

- autologous
- Allogeneic

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The Autologous Transplant Process



The Allogeneic Transplant Process





1 Collection

Stem cells are collected from the patients bone marrow or blood.



2 Processing

Bone marrow or perifer al blood is taken to the processing laboratory where the stem cells are concentrated and prepared for the freezing process

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3 Cryopreservation

Bone marrow or blood is preserved by freezing (cryopreservation) to keep stem cells alive until they are infused into the patient's bloodstream.



4 Chemotherapy

High dose chemotherapy and/or radiation therapy is given to the patient.



5 Infusion

Thawed stem cells are infused into the patient.

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Adverse Effects

- **GASTROINTESTINAL TRACT :**

  Ulcers & dysfunction of GIT occur frequently.

- **SKIN:**

  Rashes may develop.

- **HAIR FOLLICLES:**

  Hair loss occurs temporary

- **LUNGS:**

  Pneumonia

- **BLOOD VESSELS:**

  Inflammation-damaged blood vessels

- **LIVER :**

  Jaundice

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GRAFT VERSES HOST DISEASE (GVHD)

- GVHD sometimes occurs with allogeneic transplantation.
- Lymphocytes from the donor graft attack the cells of the host
- GVHD can usually be treated with steroids or other immunosuppressive agents.
- Acute GVHD occurs before day 100 post-transplant
- Chronic GVHD occurs beyond day 100



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- Recent advances have reduced the incidence and severity of this post-transplant complication, but GVHD, directly or indirectly, still accounts for approximately 15% of deaths in stem cell transplant patients
- Chronic GVHD can develop months or even years post-transplant

GVHD SYMPTOMS

- Skin/Hair
  Rash, scleroderma, lichenoid skin changes, dyspigmentation,alopecia
- Eyes
  Dryness, abnormal Schirmer's Test, cornealerosions, conjunctivitis
  Mouth Atrophic changes, lichenoid changes, mucositis,ulcers, xerostomia, dental caries
- Lungs
  Bronchiolitis obliterans
- GI tract
  Esophageal involvement, chronic nausea/vomiting, chronic diarrhea, malabsorption, fibrosis, abdomina l pain/cramps
- Liver
  Abnormal LFTs, biopsy abnormalities
- Genitourinary
  Vaginitis, strictures, stenosis, cystitis
- Musculoskeletal
  Arthritis, contractures, myositis, myasthenia, fascities
- Hematologic
  Thrombocytopenia, eosinophilia, autoantibodies

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How a bone marrow transplant work ?

An autologous transplant is a way to treat cancer using very high doses of chemotherapy that destroy the bone marrow as a side effect. The autologous blood cells replace the damaged marrow. This is how autologous transplants are used to fight certain types of cancers such as lymphoma.

An allogeneic transplant also treats cancers of the blood, and offers the added benefit of using the donor's immune system to recognize and destroy cancer cells. Allogeneic transplant is also used to treat some non-cancerous diseases such as sickle cell anemia. In non-cancerous diseases, the transplant replaces defective marrow cells with the donor's healthy cells.

Post bone marrow transplantation care

- A two- to four-week waiting period follows the marrow transplant before its success can begin to be judged.
- The marrow recipient is kept in isolation during this time to minimize potential infections.
- The recipient also receives intravenous antibiotic, antiviral, and antifungal medications, as well as blood and platelet transfusions to help fight off infection and prevent excessive bleeding.
- Blood tests are performed
- daily to monitor the patient's kidney and liver function, as well as nutritional status.
- Other tests are performed as necessary.
- Further side effects, such as nausea and vomiting, can be treated with other medications.

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Conclusion

- Bone marrow transplantation (BMT) is rapidly expanding as a practical and therapeutic modalities.
- the transfusion medicine professional must take into account the series of immunohematological changes and complications that may arise in such patients.
- We must apply techniques, methods, and approaches not routinely used in the general blood-banking environment.

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Thanks For Reading...!



Dr. Jitendra Saraswat

Resident Medical Officer
Tantia General Hospital



DRx ToniSingh

(Pharmacist)
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