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Study of Sickle Cell Disease

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A STUDY OF SICKLE CELL DISEASE

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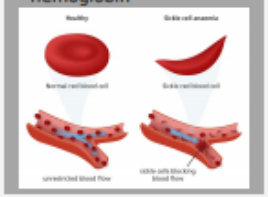
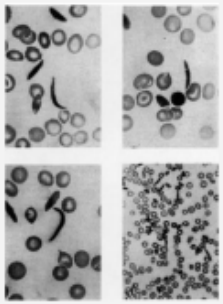
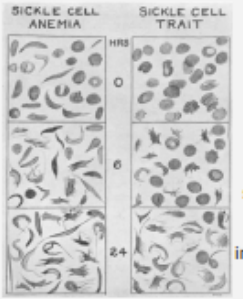
Sickle Cell

- Patients have sickle-shaped cells that may accumulate in the bloodstream and cause anemia, possibly leading to other health problems
- Patients commonly suffer from periodic episodes of pain (10)(11).
- More likely to affect those from areas afflicted by malaria and those of African descent (3)(12).
- Single nucleotide mutation leads to an amino acid change, resulting in abnormal hemoglobin



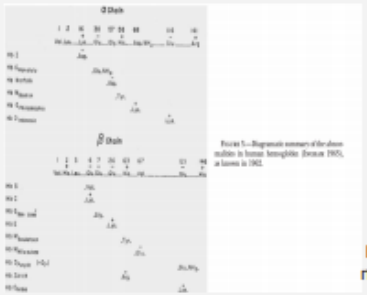


First description of SCD as slender-shaped red blood cells and anemia in medical literature by James B. Herrick (6).

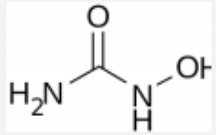


Diggs, Ahmann, & Bibb demonstrate differences between sickle cell anemia and sickle cell trait. Genetic difference is still unknown, however (1).

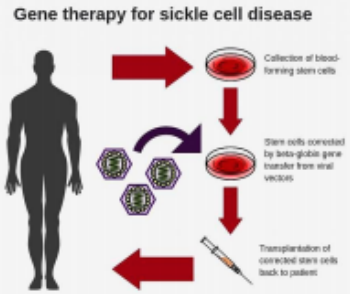
Allison concludes that sickle cell trait provides increased resistance to malarial infections, thus providing a **heterozygote advantage** (2).



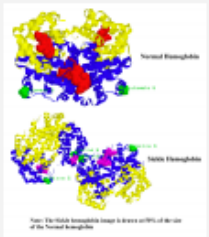
Goldstein & colleagues specify that the **missense mutation** occurs at codon number 6 (rs334) and that the single base change is from adenine to thymine (5).



FDA approves of the 1st medication to treat SCD, Hydroxyurea



First reported use of gene therapy technology to treat SCD

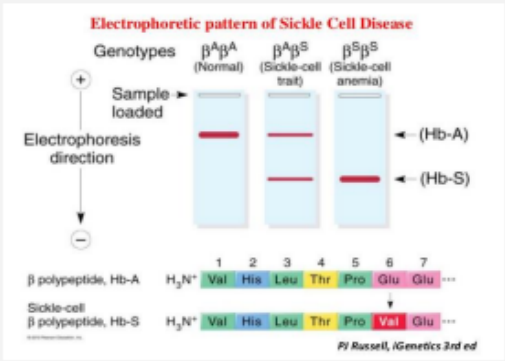


On a biochemically molecular level, sickle hemoglobin takes a different shape from normal hemoglobin

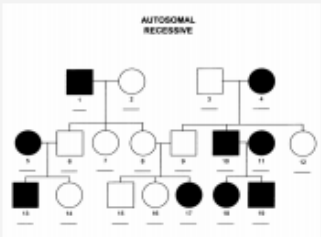
1910 | 1915 | 1933 | 1949 | 1954 | 1957 | 1963 | 1984 | 1998 | 2016 | 2017

Cook & Meyer introduce the idea that SCD may be inherited, commenting that the patient's siblings also suffered from anemia and similar complications (4).

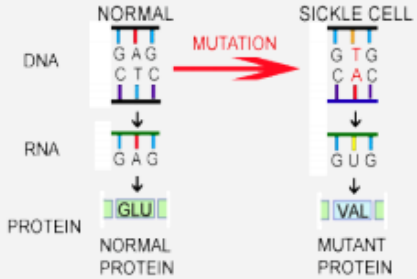
Pauling and colleagues reveal molecular differences between normal hemoglobin and sickle-cell hemoglobin using gel electrophoresis. Researchers describe SCD as a **molecular disease**, the first of its kind.



Neel demonstrates that SCD is inherited in an **autosomal recessive** Pattern utilizing data from individuals of African descent (9).



Ingram & Stretton discover that sickle-cell Hemoglobin (HbS) is caused by a single **amino acid substitution** at the 6th position of the B-globin chain, resulting in a Glu to Val change (7)(8).



First documented case of bone marrow transplant on patient with SCD

First instance of hematopoietic stem cell transplantation from an unrelated donor to children with SCD

Treatments, Cures, and the Future

Current treatments and cures for SCD:

- Blood transfusion to manage acute cases
- Hydroxyurea may lead to increased expression of fetal hemoglobin
- Bone marrow transplant is currently the only cure for SCD, however, finding donors is difficult due to the highly polymorphic nature of HLAs (10)(11).

Future of SCD can take several paths, including:

- Stem cell Transplantation, using other one's own modified or a donor's healthy stem cells to replace mutant cells
- Gene therapy to either drive expression of fetal hemoglobin or to fix disease-causing mutation entirely