Gene therapy: Overview and Update

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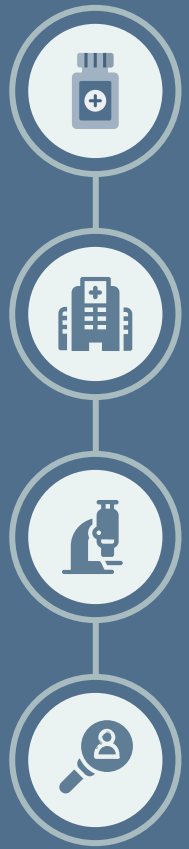
Outline



Overview of gene therapy

Current clinical applications of gene therapy

Outlook for gene therapy and current research

Impact of gene therapy on patients

01

Overview of gene therapy

Gene therapy

Treatment that uses specific genetic material to treat a condition by:

- Providing a functional copy of a gene
- Increasing disease-modifying genes
- Suppressing activity of a damaged gene

(Belete, 2021)

Vectors

Viral

Surface proteins on viruses interact with host receptor to enter the cell and release their genome

Common viral vectors used:

- ➔ Herpes simplex virus (HSV)
- ➔ Adenovirus (Ad)
- ➔ Adeno-associated virus (AAV)
- ➔ Lentivirus (LV)

Non-Viral

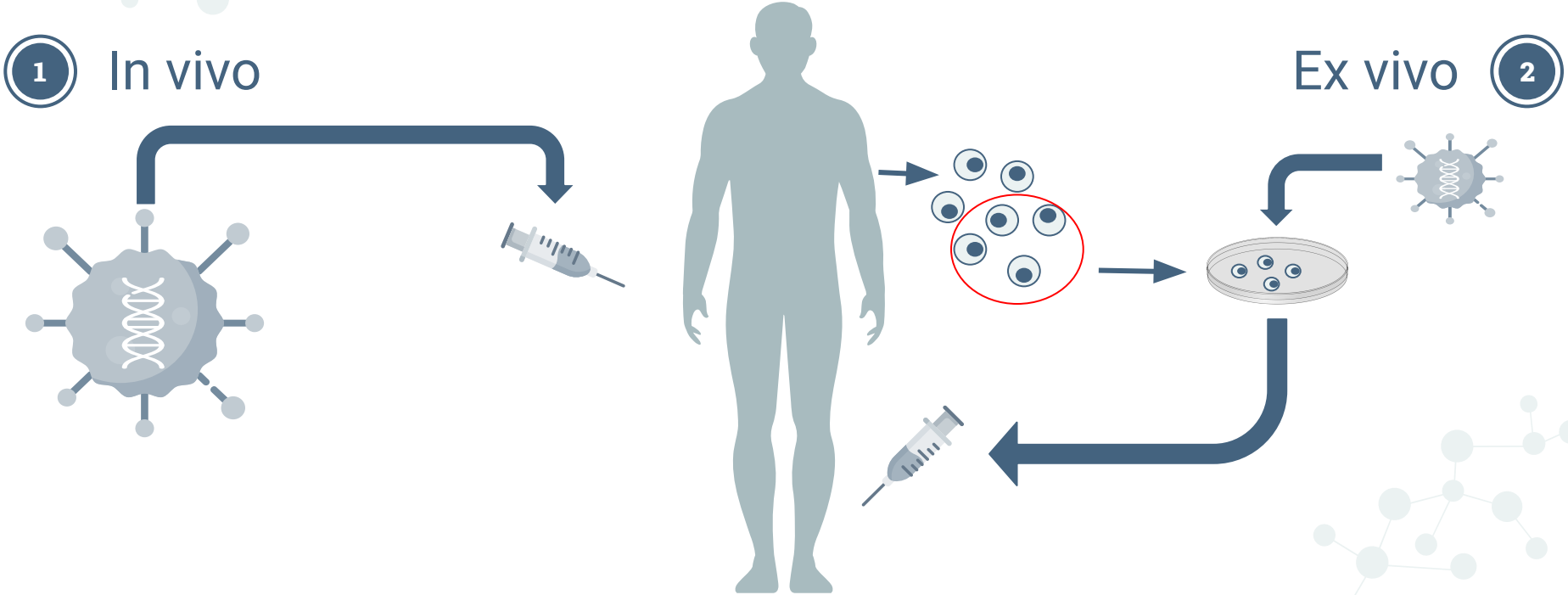
Organic and nonorganic vectors that deliver small/large DNA or RNA

Methods of delivery:

- ➔ Chemical
- ➔ Physical

(Belete, 2021)

Administration



(FDA, 2021)

02

Current clinical applications of gene therapy

Diseases treated with gene therapy

6

Spinal muscular atrophy
Retinal dystrophy
Lymphoma & Leukemia

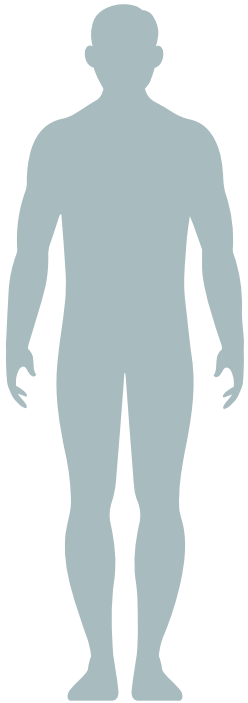
Melanoma
Prostate cancer
Hematopoietic conditions

(FDA, 2021)

Administration

1 In vivo

Spinal muscular atrophy
Retinal dystrophy
Melanoma



Ex vivo 2

Lymphoma & Leukemia
Hematopoietic conditions
Prostate cancer

(FDA, 2021; Ma et al., 2019)

American Society of Gene + Cell Therapy

Gene Therapy Centers

This list of gene therapy centers in the U.S. is intended for use by patients, advocates, and caregivers who are seeking gene therapy research for a rare disease. This list excludes oncology (cancer) due to the wide scope of cancers and number of centers working on them. The Blood & Marrow Transplant Information Network has a list of medical centers offering CAR T-cell therapy. If you are unsure whether a clinical trial is open for your disease, search by diagnosis using the ASGCT Clinical Trials Finder. To suggest a center or make an update to a center listed please contact us.

Center	Disease focus area*	Location	Contact
Cell and Gene Therapy Collaborative at CHOP	• Beta thalassemia • Choroideremia • Hemophilia • Leber congenital amaurosis (LCA) • Methylmalonic acidemia • Mucopolysaccharidosis (MPS I, MPS II) • Phenylketonurias (PKU) • Sickle cell disease • Spinal muscular atrophy (SMA)	The Children's Hospital of Philadelphia 3501 Civic Center Blvd Philadelphia, PA 19104	Contact Learn more

https://patienteducation.asgct.org/gene-therapy-101/gene-therapy-centers

The Blood & Marrow Transplant Information Network

ARKANSAS

University of Arkansas for Medical Sciences
Little Rock, AR
Phone: 501-296-1200
Click here for website

ARIZONA

Banner Health
Gilbert, AZ
Phone: 480-256-6444
Click here for website

Phoenix Children's Hospital
Phoenix, AZ
Phone: 480-826-4251
Click here for website

Medical Centers Offering CAR T-cell Therapy

Click on the state below to view information about those centers.

Alabama	Maryland	South Carolina
Arkansas	Massachusetts	South Dakota
Arizona	Michigan	Tennessee
California	Minnesota	Texas
Colorado	Mississippi	Utah
Connecticut	Missouri	Virginia
Delaware	Nebraska	Washington
District of Columbia (DC)	New Hampshire	West Virginia
Florida	New Jersey	Wisconsin
Georgia	New York	
Illinois	North Carolina	

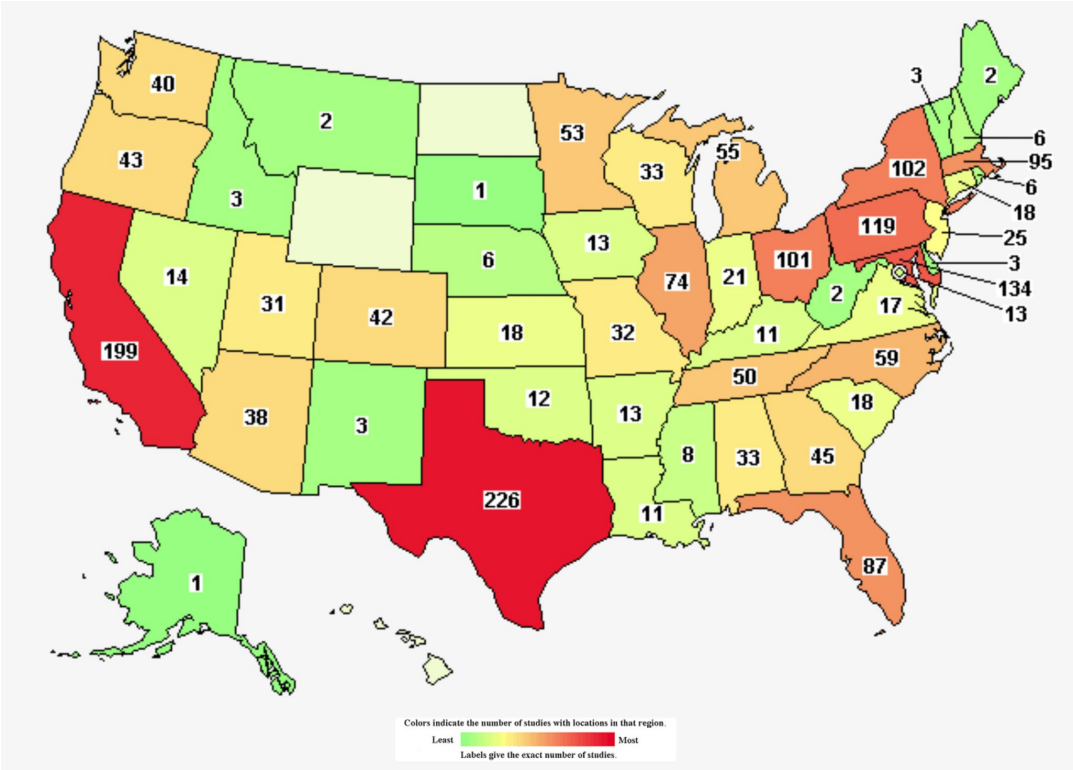
https://www.bmtinfonet.org/transplant-article/medical-centers-offering-car-t-cell-therapy

03

Outlook for gene therapy and current research

Current Clinical Trials

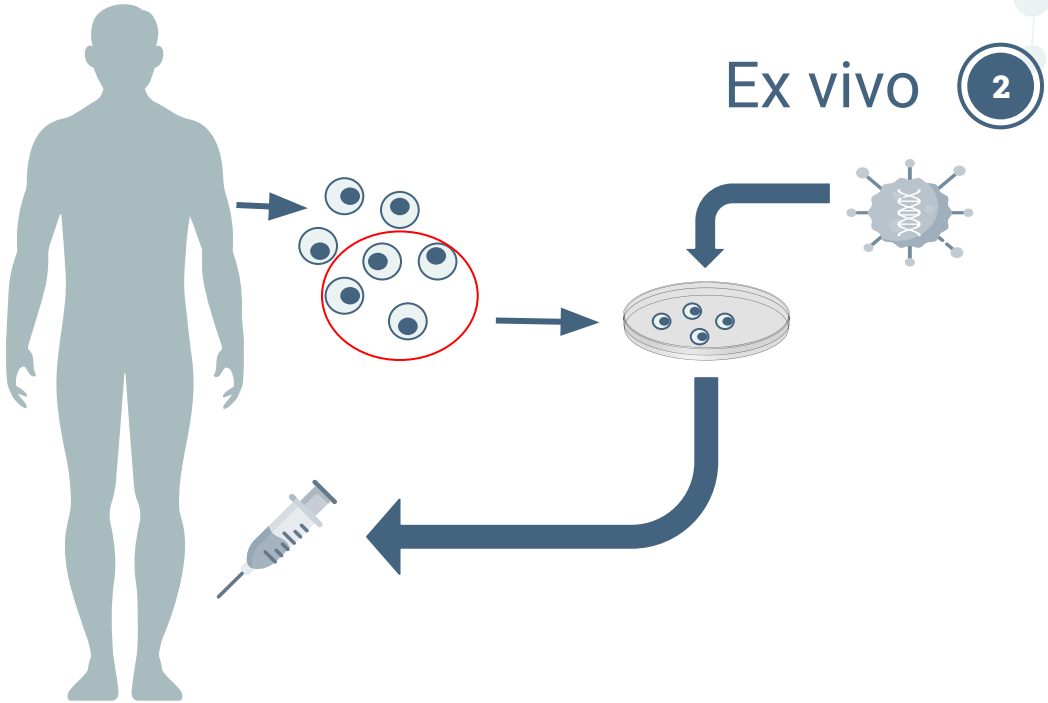
~900+
In US



(Clinicaltrials.gov, 2021)

Sickle Cell Gene Therapy Trial

- Ex vivo administration
- HIV modified virus vector (lentivirus)
- DNA encoding hemoglobin
- Compensate for defective gene



(Biopharmadive, 2021; Clinicaltrials.gov, 2021)

Sickle Cell Gene Therapy Trial

14 people free of pain crises

1 has developed acute myeloid leukemia (AML)

2 have developed myelodysplastic syndrome (MDS)

(Biopharmadive, 2021)

SICKLE CELL DISEASE (SCD)

LentiGlobin

PHASE 1/2 STUDIES

HGB-206

Evaluating safety and efficacy of LentiGlobin gene therapy in patients with SCD

STATUS: ACTIVE, NOT RECRUITING

HGB-205

Evaluating safety and efficacy of LentiGlobin gene therapy in patients with TDT or SCD

STATUS: COMPLETE

PHASE 3 STUDY

HGB-210

Evaluating safety and efficacy of LentiGlobin gene therapy in patients with SCD

STATUS: RECRUITING

LONG-TERM FOLLOW-UP

LTF-307

Long-term Follow-up of Subjects With Sickle Cell Disease Treated With Ex Vivo Gene Therapy Using Autologous Hematopoietic Stem Cells Transduced With a Lentiviral Vector

STATUS: ENROLLING BY INVITATION

https://www.bluebirdbio.com/our-science/clinical-trials

04

Impact of gene therapy on patients

Cost

Retinal dystrophy

$425,000

Spinal muscular atrophy

$2.1 million

(Wong et al., 2020)

Considerations

- Access to services
- Patient understanding
- Elimination of disability
- Informed consent
- Social effects and barriers

Common misconceptions

- Genetic so it will be passed to children
- If it is changing the genes then it will change who I am
- It can be used for any condition with a known genetic component

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Thank You!

DO YOU HAVE ANY QUESTIONS?