U.S. FOOD & DRUG ADMINISTRATION

Accelerating the Development and Approval of Innovative Products

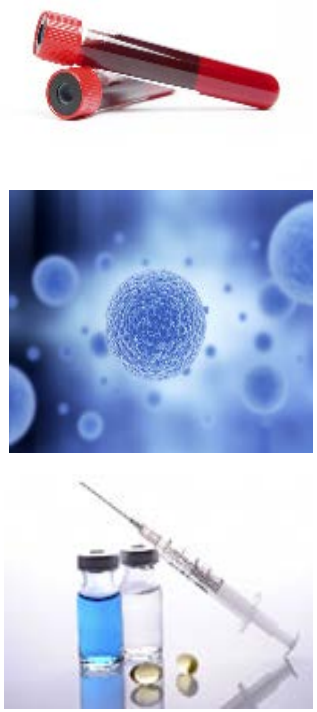
Peter Marks, M.D., Ph.D.
Director
Center for Biologics Evaluation and Research (CBER)

CBER Regulated Products: Something Old and Something New

Diphtheria antitoxin vial from about 1899

Artist's rendering of CRISPR/Cas9 Genome Editing

Products Regulated by CBER



Pictures of tubes of blood, a cell, and a syringe and vials

- Vaccines (preventative and therapeutic)
- Allergenics
- Live Biotherapeutic Products
- Blood Products
- Devices Related to Biologics
- Human Tissues and Cellular Products
- Xenotransplantation Products
- Gene Therapies

CBER Regulated Products: Vaccines for Disease Prevention

>150 million doses of influenza vaccine given in 2016-2017

Annual US disease in the 1900s:		US disease in 2013:
Smallpox:	29,005	0
Diptheria:	21,053	0
Pertussis:	200,752	28,639
Polio:	16,316	1
Measles:	530,217	187
Mumps:	162,344	584
Rubella:	47,745	9
H. Influenzae:	20,000	31

https://www.cdc.gov/vaccines/pubs/pinkbook/downloads/appendices/e/impact.pdf

CBER Regulated Products: Keeping the Blood Supply Safe

Need for continued vigilance against emerging threats

<u>Successes</u>*

HIV: 1 per 1,466,671 units

HBV: 1 per 292,561 units

HCV: 1 per 1,148,628 units

Pathogen reduction technology –approved for plasma and platelets

*Zou S, Stramer SL, Dodd RY. Transfus Med Rev. 2012;26:119-28

CBER Regulated Products: Advanced Therapies at the Leading Edge

Gene Therapy

- Ex vivo
  - Cells isolated from individual and transfected with gene therapy in a laboratory prior to growth in culture and reinfusion
- In vivo
  - Genetic material directly administered to individual by intravenous or other route leading to cellular modification

CBER Regulated Products: Advanced Therapies at the Leading Edge

Regenerative Medicine

- Cell therapies
- Therapeutic tissue engineering products
- Human cell and tissue products
- Some combination products

Field with great promise that goes directly to the FDA's role in helping meet unmet medical need

Chimeric Antigen Receptor-T Cells

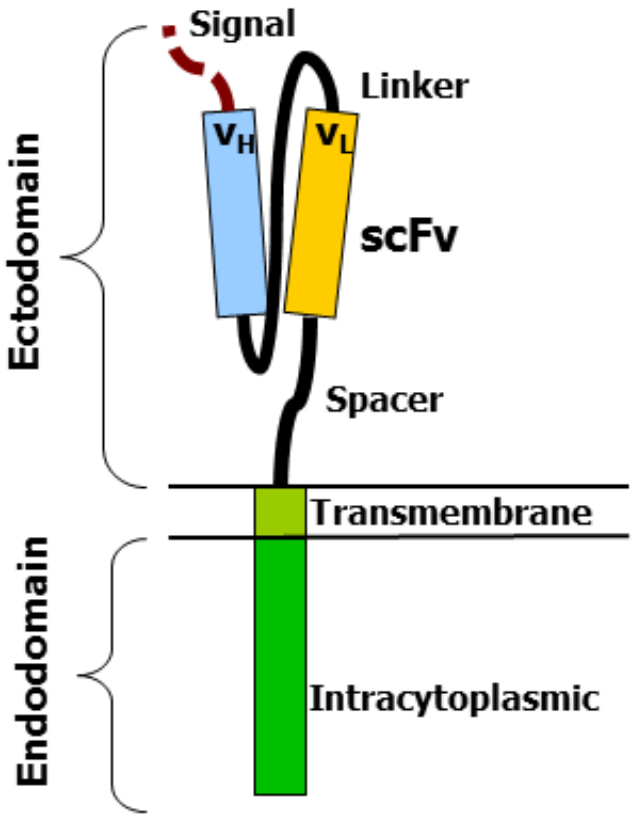
Cover of the Journal
Immunity
from February 2016

Chimeric Antigen Receptor-T Cells

- Chimeric antigen receptor-T cells (CAR-T cells) represent a cell-based gene therapy with potential applications to multiple diseases
  - Hematologic malignancies
  - Solid tumors
  - Infectious disease
  - Autoimmune disease
- Possibility to provide therapeutic benefit with an extended duration of effect

Genetic Modification: Introduction of Chimeric Antigen Receptor

- Using molecular genetics, novel protein receptors can be created that combine features of different proteins into one
- This allows one to both target and activate T cells to eliminate an cancerous or undesirable cell type



Drawing of chimeric antigen T cell receptor construct

Chimeric Antigen Receptor-T Cells Approved Products

- Kymriah
  - Indicated for treatment of patients up to 25 years of age with B-cell precursor acute lymphoblastic leukemia (ALL) that is refractory or in second or later relapse
- Yescarta
  - Indicated for treatment of adult patients with relapsed or refractory large B-cell lymphoma after two or more lines of systemic therapy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