GENE THERAPY APPROVALS & QPS MILESTONES

KEY

- BIOANALYSIS
- ADME
- GENE THERAPY APPROVALS

QPS

2003
Oligo PK *via* LC-MS/MS

2006
CLIA Assay - Inclusion/ Exclusion Criteria
Biomarkers - Primary End-point

2007
Oligo PK *via* hybridization-ELISA

2009
Oligo PK *via* hybridization-LC-FLD
Oligo PK *via* LC-UV

2010
Oligo Biodistribution *via* Autoradiography
Oligo *in vitro* Metabolic Stability
Oligo Metabolite Identification
Oligo *in vitro* CYP Inhibition

2011
Oligo Biodistribution *via* QWBA
Oligo Mass Balance/Excretion

2012
Oligo Biodistribution *via* Microautoradiography

2013
Oligo ADA
Oligo *in vitro* CYP Induction

2014
Oligo PK *via* LC-HRMS
Oligo *in vitro* Protein Binding
mRNA PK/Biodistribution/ Shedding *via* QPCR
Vector PK/ Biodistribution/ Shedding *via* QPCR

2015
Oligo *in vitro* Reaction Phenotyping

2016
mRNA ADA
Vector ADA
Oligo in vitro Drug Transport

GENE THERAPY

1998
Gene Interference *via* ASO
Vitravene/fomivirsen

2004
Gene Interference *via* Aptamer
Macugen/pegaptanib

2012
***In vivo* Gene Insertion *via* AAV1**
Glybera/alipogene tiparvovec

2013
Gene Interference *via* ASO
Kynamro/mipomersen

2015
***In vivo* Gene Insertion *via* HSV-1**
Imlygic/talimogene laherparepvec

2016
Gene Interference *via* polydisperse natural oligonucleotides
Defitelio/defibrotide

Gene Interference *via* ASO
Spinraza/nusinersen

Gene Interference *via* ASO
Exondys 51/eteplirsen

***Ex vivo* Gene Insertion *via* Gammaretrovirus**
Strimvelis

2017
***Ex vivo* Gene Insertion *via* CAR-T**
Yescarta/axicabtagene ciloleucel

***Ex vivo* Gene Insertion *via* CAR-T**
Kymriah/ tisagenlecleucel

***In vivo* Gene Insertion *via* AAV2**
Luxturna/voretigene neparvovec

2018
Gene Interference *via* siRNA
Onpattro/patisiran

Gene Interference *via* ASO
Tegsedi/inotersen

2019
Gene Interference *via* siRNA
Givlaari/givosiran

2019
***Ex vivo* Gene Insertion *via* LVV**
Zynteglo/betibeglogene autotemcel

Gene Interference *via* ASO
Waylivra/ volanesorsen

Gene Interference *via* ASO
Viltepso/viltolarsen

***In vivo* Gene Insertion *via* AAV9**
Zolgensma/onasemnogene abeparvovec-xioi