How to select the right viral vector for your unique therapy

Key considerations, trends, and manufacturing factors to help guide your decision

Key factors in vector selection

Choosing the best viral vector for your unique cell or gene therapy is critical, as it can directly impact the safety and efficacy of the final product. There are many different factors to consider as each vector type comes with its own unique set of characteristics, applications, and limitations.

Some considerations when evaluating vector options include:

- **Target cell:** Vector must be capable of targeting the specific cell/tissue type required for therapy
- **Packaging capacity:** Vector must have sufficient capacity to transport the genetic material required for treatment
- **Transduction efficiency:** Vector must be able to deliver the therapeutic genetic material to target cells efficiently
- **Duration of gene expression:** Some applications require vectors to maintain long-term expression while transient expression may suffice in other cases
- **Safety:** Vector should pose minimal risk of triggering an unwanted immune response and an acceptable toxicity profile

Trends in viral vectors

Adeno-associated viruses (AAV) are generally the most widely used vector in cell and gene therapy applications as they are considered to be both safe and efficient. Other commonly used options include adenoviruses (AV) and lentiviruses (LV). However, novel vector types such as herpes simplex virus (HSV), retrovirus (RV), modified vaccinia Ankara (MVA), vesicular stomatitis virus (VSV), and others are gaining traction for a variety of clinical applications.

Overview of viral vector types for gene therapy clinical trials

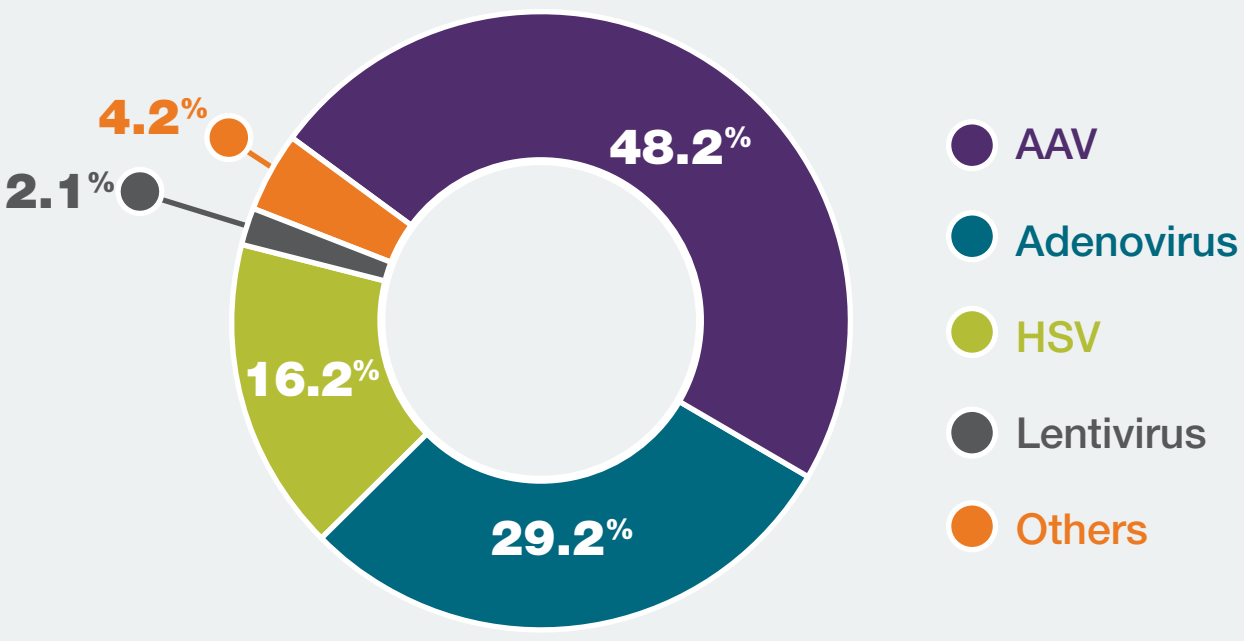

Figure 1. Viral vector snapshot.*

* Zhao Z, Anselmo AC, Mitragotri S. Viral vector-based gene therapies in the clinic. Bioeng Transl Med. 2021;7(1):e10258. Published 2021 Oct 20. doi:10.1002/btm2.10258

Manufacturing considerations

Working with complex vectors requires special considerations for the manufacturing environment to ensure aseptic conditions and avoid cross-contamination. The following factors should be assessed when establishing your viral vector manufacturing strategy with non-traditional vector types.

1. **Safety:** Requirements for personnel, product, facility
2. **Process:** Equipment, cleaning protocol, suite layout, scalability
3. **Facility fit:** Cleanroom design, segregation, air flow/utilities
4. **Staff expertise:** Virus manipulation, aseptic processing, analytics

Comparison of viral vector characteristics

	AdV	AAV	RV	LV	MVA	HSV
Size (nm)	90–100	~25	80–100	80–100	300–450	150–200
Genome	dsDNA	ssDNA	ssRNA	ssRNA	dsDNA	dsDNA
Packaging capacity (kbp)	8–36	~4.7	10	8	25-30	Up to 150
Cells transduction	Dividing & non-dividing	Dividing & non-dividing	Dividing cells	Dividing & non-dividing	Wide range of target cells. Dividing and non-dividing.	Wide range of target cells. Dividing and non-dividing.
Integration	Non-integrating	Non-integrating	Integrating	Integrating	Non-integrating	Non-integrating
Expression	Transient	Transient or stable	Stable	Stable	Transient	Transient
Immunogenicity	High	Low	Moderate-High	Moderate-High	High	Low
Delivery strategy	In vivo	In vivo	Ex vivo	Ex vivo	In vivo (vaccine)	In vivo & ex vivo
Manufacturing mode	Suspension	Suspension	Adherence (Mainly)	Suspension (Mainly)	Suspension	Adherence/ Suspension
Manufacturing grade	B/C	B/C	B/C	B/C	B/A (manufacturing in aseptic conditions)	B/C
Cell lines	A549 and other proprietary cell lines	HEK293	Producer cell lines	HEK293 HEK293T	Avian cell line	VERO cells
Clinical applications	Oncology, vaccines against infectious diseases	Genetic disorders affecting tissues like the liver, nervous system, eyes, and skeletal muslces	Genetic disorders, oncology, HIV	Oncology (CAR-T cell therapy)	Oncology, vaccines against infectious diseases	Oncology, conditions affecting the nervous system

Leveraging a CDMO partner with breadth of experience across different vector types

Thermo Fisher has more than 20 years of viral vector manufacturing experience with multiple virus types including AAV, LV, AdV, HSA, RV, MVA, VSV, and more. We understand the unique requirements of working with complex vectors and have invested in the necessary protocols and facilities to support a variety of vector types.

Contact our team of experts to discuss the best development and manufacturing strategy for your unique program needs.

Viral vector products by type

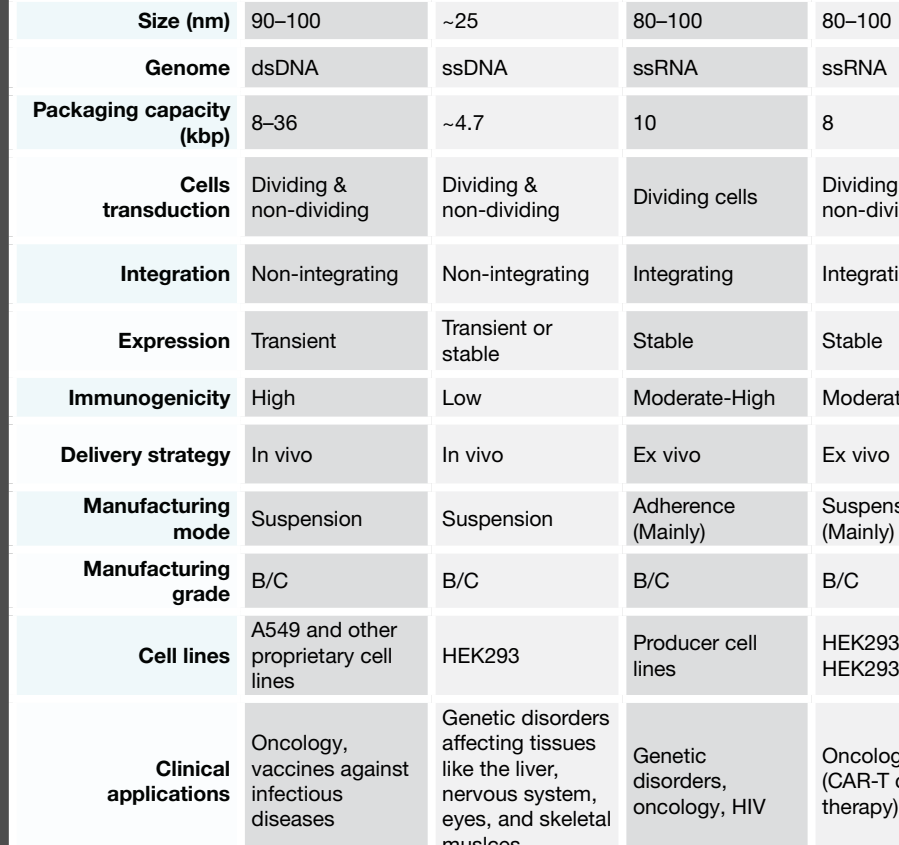

Figure 2. Programs supported by Thermo Fisher as of Q1 2025 by viral vector type.

900+
viral vector lots manufactured, including GMP clinical and commercial lots over time

3
commercially approved products and several others pending

13+
facilities worldwide supporting advanced therapy projects

>10%
programs leverage novel vector types

Learn more at **thermofisher.com/patheon**
or email us at **pharmaservices@thermofisher.com**