Tumor-Targeting Vector

A **tumor-targeting vector** is a molecule or carrier used to **deliver therapeutic agents** (such as radionuclides, drugs, or nanoparticles) **specifically to cancer cells** by binding to tumor-associated antigens or receptors.

Key Features

- **High specificity** for tumor markers
- **Low affinity for healthy tissues**
- Can be chemically linked to:
  - Alpha-emitting radionuclides (e.g., ^^225^^Ac, ^^213^^Bi)
  - Chemotherapeutic agents
  - Nanoparticles or liposomes

Common Types of Vectors

- **Monoclonal antibodies (mAbs):**
  - Recognize specific tumor antigens (e.g., HER2, EGFR)
  - High binding specificity
  - Example: Trastuzumab
- **Peptides:**
  - Small and fast-clearing
  - Bind to receptors like somatostatin or substance P
  - Example: DOTA-substance P used in glioblastoma TAT
- **Aptamers:**
  - DNA or RNA molecules folded into 3D shapes
  - Bind with high specificity to tumor markers
- **Small molecules:**
  - Chemically synthesized
  - Can target enzymes, transporters, or overexpressed receptors
  - Example: PSMA ligands in prostate cancer

⚙ Conjugation to Radionuclides

- Vectors are **chelated** or **covalently linked** to radionuclides
- Chelators like **DOTA** or **NOTA** are commonly used for stable binding
- Must retain binding ability after labeling

Ideal Properties

- Tumor specificity and minimal off-target binding
- Stable in circulation
- Compatible with chosen therapeutic agent
- Able to internalize (optional, but preferred for some radionuclides)

Summary

Tumor-targeting vectors are the **precision delivery tools** of modern oncology. When combined with alpha emitters, they form the basis of **Targeted Alpha Therapy (TAT)**, enabling **potent and selective destruction** of tumor cells.