



Xavier's Daily

STAY INFORMED. STAY INSPIRED.

→ Challenge Yourself!

I am tiny, powerful and travel only a very short distance, but I can destroy cancer cells when delivered to the right target. What am I?

Answer:
Alpha particle

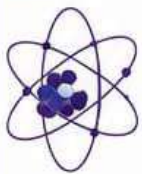
✗ Fact or Myth?

TAT is simply conventional external-beam radiotherapy.

Answer: Myth

TAT delivers a radioactive payload through a targeting molecule directly to cancer cells inside the body. It uses alpha-emitting radionuclides, which act over a very short range, unlike external-beam radiotherapy that delivers radiation from outside the body.

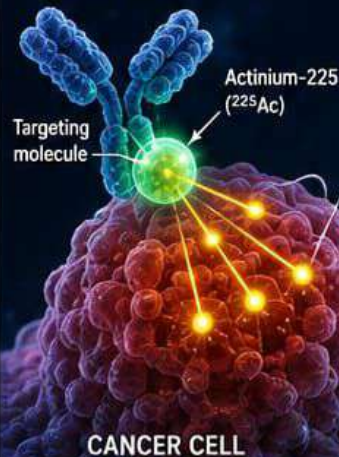
💡 Did You Know?



Actinium-225 has a half-life of about 10 days and its decay chain releases four alpha particles.

This makes it a promising radioisotope for Targeted Alpha Therapy as it can deliver a high radiation dose to cancer cells while minimizing damage to surrounding healthy tissue.

TARGETED ALPHA THERAPY HOW IT WORKS



ALPHA PARTICLES

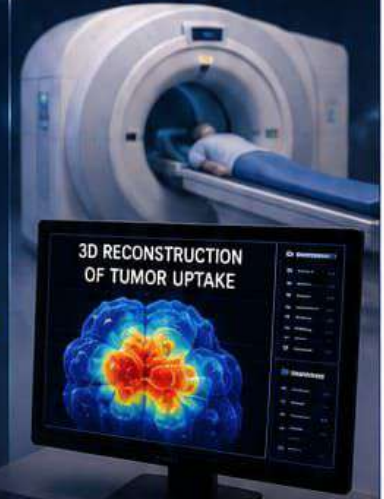
- High linear energy transfer
- Very short range (50–100 micrometers)
- Powerful cell-killing effect on cancer cells

VERY SHORT RANGE

50–100 μm

A new imaging approach—Time-of-Flight Cascade Gamma Imaging (TOF-CGI)—may enable existing PET scanners to image Actinium-225 more effectively.

VISUAL ADVANCEMENT TOF-CGI IMAGING



TARGETED ALPHA THERAPY: SEEING THE TREATMENT MORE CLEARLY

Targeted Alpha Therapy (TAT) is an emerging approach in cancer treatment. It uses tumor-targeting molecules, such as antibodies or peptides, to deliver alpha-emitting radionuclides directly to cancer cells. Alpha particles carry a high amount of energy over a very short distance (about 50–100 micrometers). This allows them to destroy cancer cells while sparing most of the surrounding healthy tissue.

Imaging plays a crucial role in TAT. It helps doctors confirm where the radiopharmaceutical goes, estimate how much radiation the tumor receives and monitor treatment response. However, imaging alpha emitters—especially Actinium-225 (^{225}Ac)—is challenging. Actinium-225 has a half-life of about 10 days and, during its decay, emits four alpha particles. Conventional SPECT and PET scanners have limitations in accurately imaging ^{225}Ac because treatments use very small doses and alpha particles do not travel far; instead, they produce gamma rays that are few in number and difficult to detect.

On October 1, 2026, scientists at Lawrence Berkeley National Laboratory (Berkeley Lab), USA, reported a promising solution: Time-of-Flight Cascade Gamma Imaging (TOF-CGI). This new approach can be implemented on existing PET scanners.

TOF-CGI detects and tracks multiple gamma rays in quick sequence—known as gamma cascades—from the decay of Actinium-225. By measuring the time it takes for these gamma rays to reach the scanner, the technology can determine where they came from with much greater accuracy. This could significantly improve the visualization of ^{225}Ac inside the body, enabling clearer images of tumors and better monitoring of treatment.

Recent 2026 reviews highlight that TAT is under active clinical development worldwide using alpha emitters such as Actinium-225, Lead-212, Radium-223 and Astatine-211 for different types of cancers. Early results are encouraging, but many challenges remain.

These include limited supply of some isotopes, the need for highly sensitive imaging, accurate dosimetry (radiation dose estimation), and large-scale clinical trials to prove safety and effectiveness. TOF-CGI is a research advance and not yet a proven routine clinical standard, but it brings us closer to more precise, safer and more effective alpha therapies for patients.



THOUGHT FOR TODAY

The future of medicine is not only about treating disease, but seeing it more precisely.

