# Protein Kinase Inhibitor

Protein kinase inhibitors (PKIs) are molecules that inhibit the activity of protein kinases — enzymes that regulate essential cellular processes through phosphorylation.

## Overview

Protein kinases catalyze the transfer of phosphate groups from ATP to target proteins, typically on serine, threonine, or tyrosine residues. This phosphorylation affects protein function, localization, and interactions.

PKIs are especially relevant in:

- Cell growth and proliferation
- Apoptosis
- Signal transduction
- DNA repair mechanisms

## Mechanism of Action

PKIs block kinase activity by:

- Competing with ATP at the catalytic site
- Binding allosterically to regulatory domains
- Inhibiting downstream signaling cascades

They can be:

- **Selective inhibitors**: Target one specific kinase
- **Multikinase inhibitors**: Inhibit several kinases simultaneously

## Examples of Protein Kinase Inhibitors

| Inhibitor | Targets | Indications |
|---|---|---|
| Imatinib | BCR-ABL, c-KIT, PDGFR | Chronic Myeloid Leukemia (CML) |
| Erlotinib | EGFR | NSCLC, pancreatic cancer |
| Sorafenib | VEGFR, PDGFR, RAF | Renal, liver, thyroid cancers |
| Trametinib | MEK1/2 | BRAF-mutated melanoma |
| Everolimus | mTOR | SEGA (Tuberous sclerosis), RCC |

## Relevance in Neuro-Oncology

Protein Kinase Inhibitor for Glioblastoma

Several PKIs are under investigation or approved for brain tumors:

- **EGFR inhibitors** – some glioblastomas exhibit EGFR mutations or amplifications
- **mTOR inhibitors** – used in subependymal giant cell astrocytoma (SEGA)
- **VEGFR inhibitors** – targeting angiogenesis in high-grade gliomas

## Classification

- **Tyrosine kinase inhibitors (TKIs)** – e.g., gefitinib, erlotinib
- **Serine/threonine kinase inhibitors** – e.g., vemurafenib
- **Dual or multikinase inhibitors** – e.g., regorafenib, sunitinib

## See Also

- molecular_markers_gliomas
- targeted_therapies
- mTOR_pathway
- EGFR_mutations