

**Big Idea 3: Living
systems store, retrieve,
transmit and respond
to information essential
to life processes.**

Enduring understanding 3.D:
Cells communicate by
generating, transmitting and
receiving chemical signals.

Essential knowledge 3.D.4: Changes in signal transduction pathways can alter cellular response.

a. Conditions where signal transduction is blocked or defective can be deleterious, preventative or prophylactic.

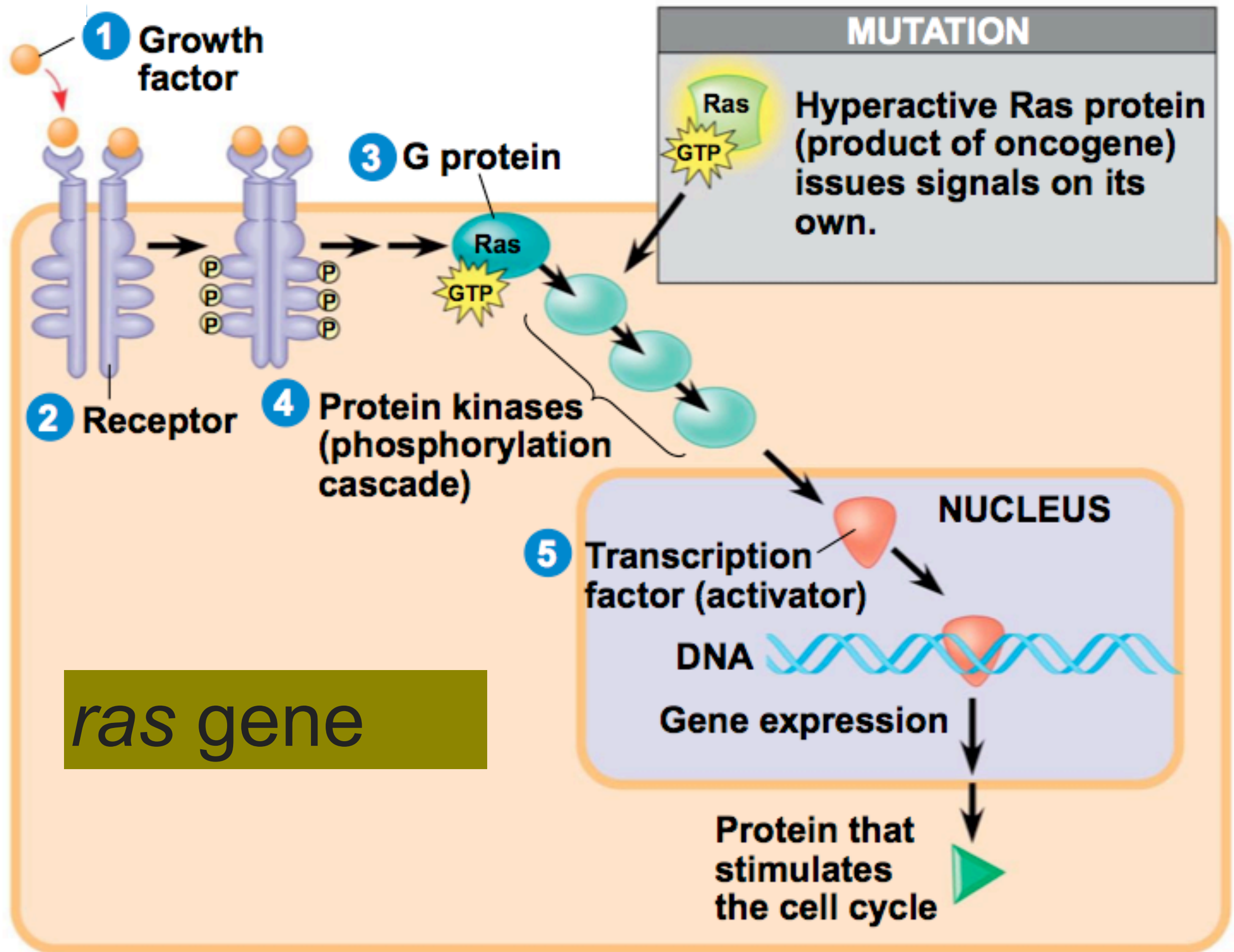
To foster student understanding of this concept, instructors can choose an illustrative example such as:

- Diabetes, heart disease, neurological disease, autoimmune disease, **cancer**, **cholera**
- Effects of neurotoxins, poisons, pesticides
- Drugs (Hypertensives, Anesthetics, **Antihistamines** and Birth Control Drugs)

XX Specific mechanisms of these diseases and action of drugs are beyond the scope of the course and the AP Exam.

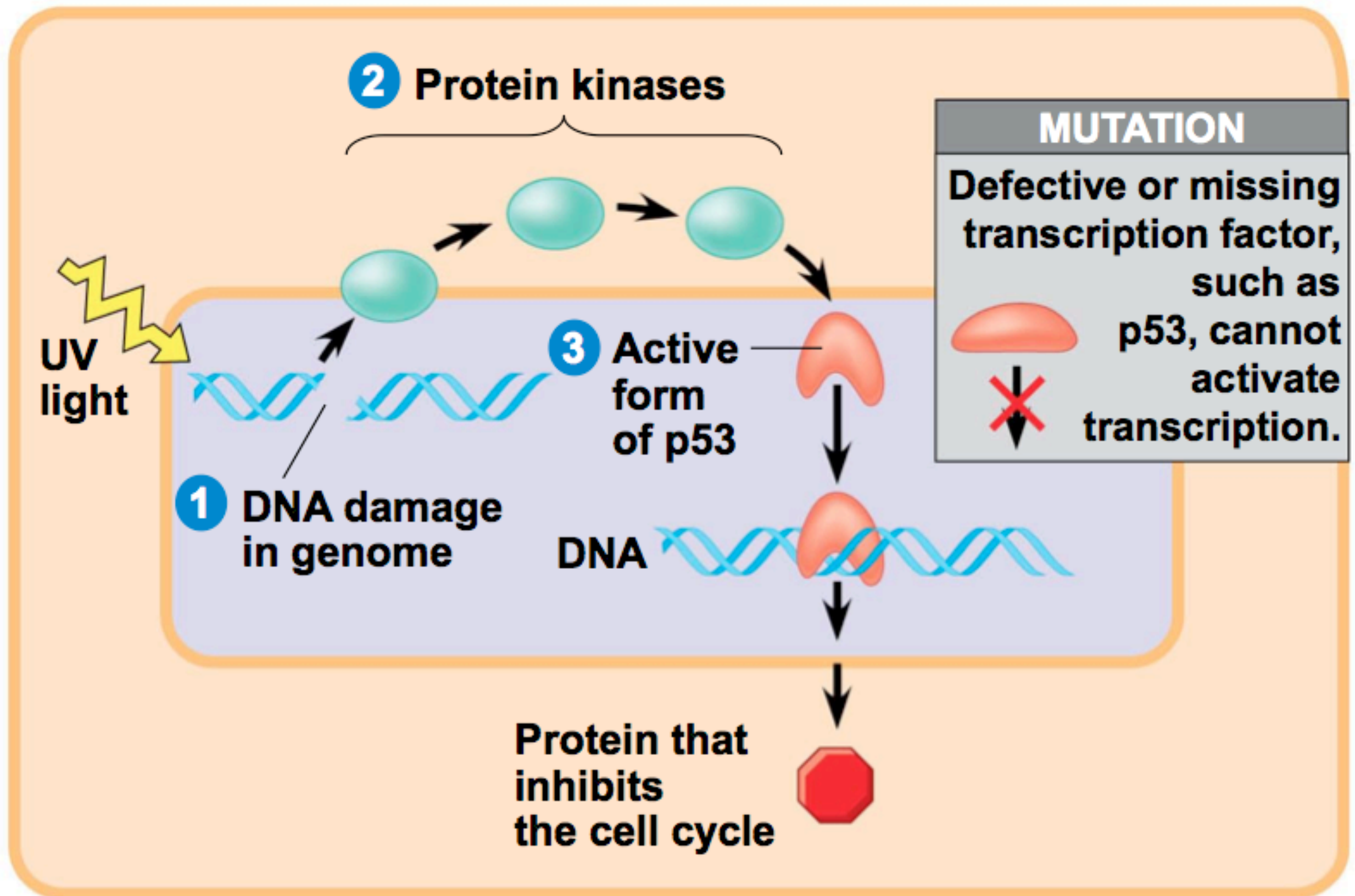
Interference of Cell Signaling

- The proteins encoded by most oncogenes and tumor-suppressor genes are components of cell signaling pathways.
- To understand how these genes function in cancer we will look at two common causing genes:
 - The ras proto-oncogene, mutations in this gene occur in ~30% of all cancers.
 - The p53 tumor-suppressor gene, mutations in this gene occur in more than 50% of all cancers.



(a) Cell cycle-stimulating pathway

p53 gene



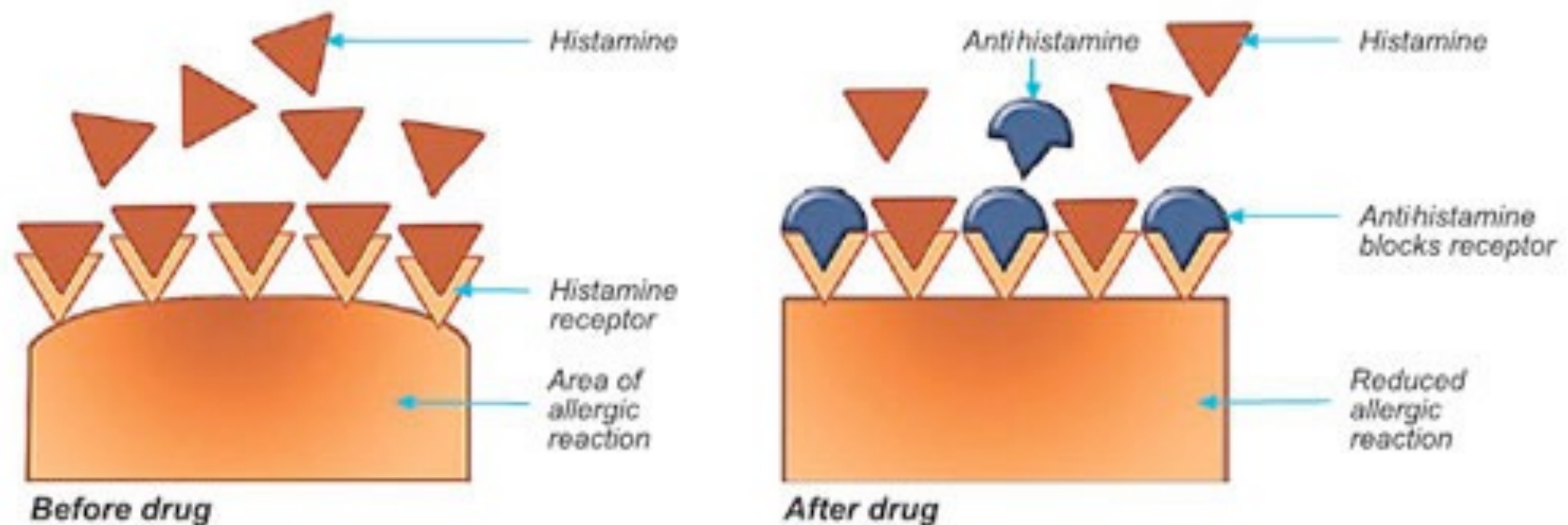
(b) Cell cycle–inhibiting pathway

Interference of Cell Signaling

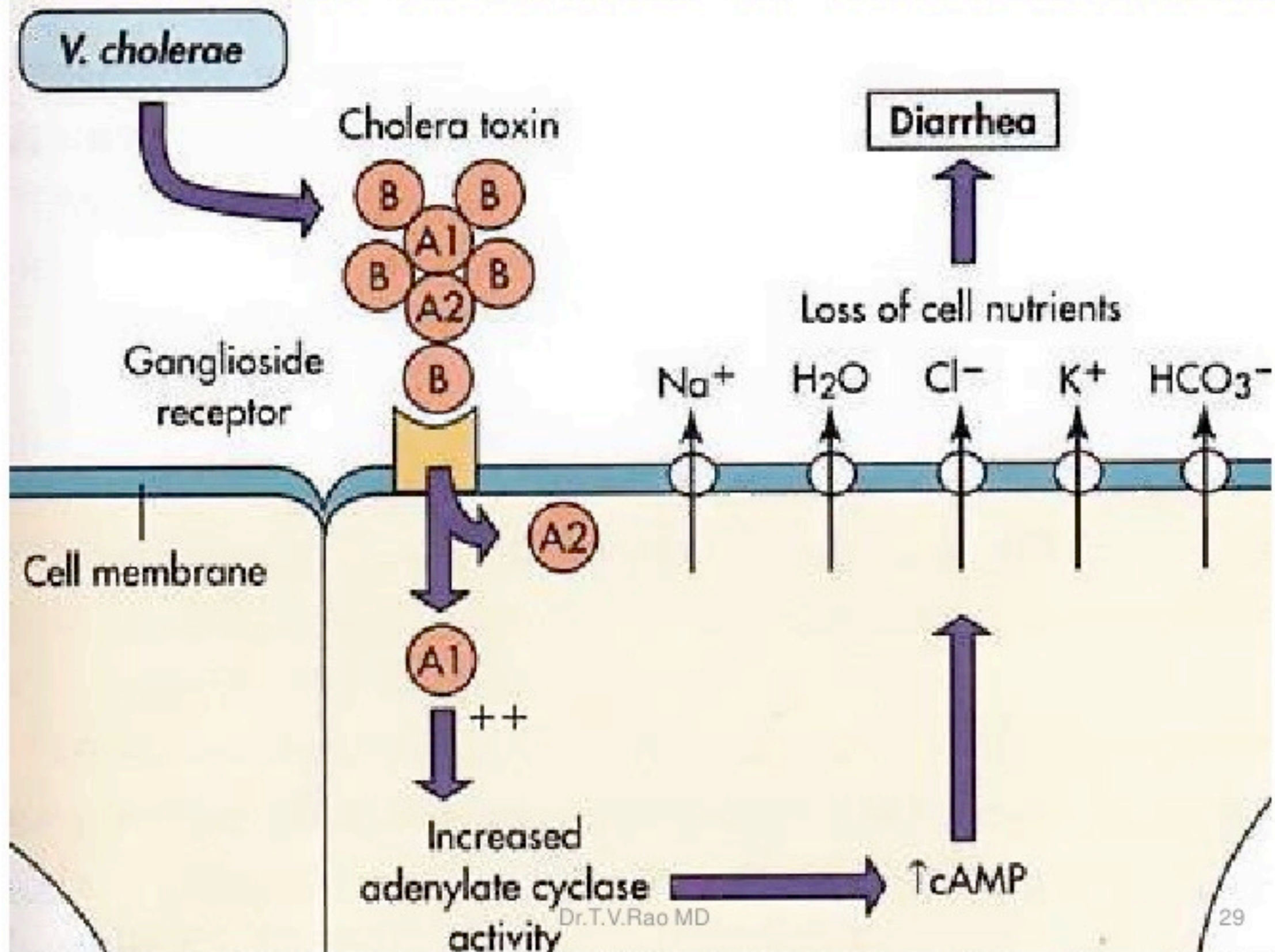
- The p53 tumor-suppressor gene, has been called the “guardian angel” of the genome, it functions as an activator for many genes.
- p53, activates a gene that stops the cell cycle
- p53, activates miRNAs that stop the cell cycle
- p53, activates genes directly involved in DNA repairing damaged DNA
- p53, activates “suicide genes” that cause cell apoptosis when damage is irreparable.

Antihistamines

Diagram showing how histamine and antihistamines work



Mechanism of Action of Cholera Toxin



Learning Objectives:

LO 3.37 The student is able to justify claims based on scientific evidence that changes in signal transduction pathways can alter cellular response. [See SP 6.1]

LO 3.38 The student is able to describe a model that expresses key elements to show how change in signal transduction can alter cellular response. [See SP 1.5]

LO 3.39 The student is able to construct an explanation of how certain drugs affect signal reception and, consequently, signal transduction pathways. [See SP 6.2]