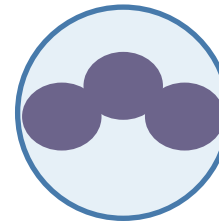
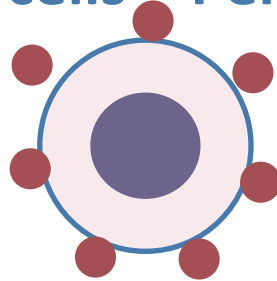
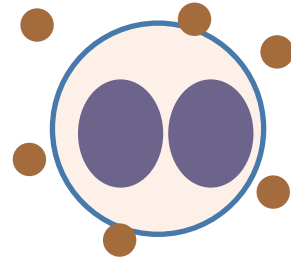


Other Cells in Chronic Inflammation

Eosinophils • Mast cells • Persistent neutrophils



Cell-specific recruitment, activation and tissue effects

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Learning objectives

By the end of the lecture, interpret the contribution of three additional inflammatory cell types.

- Explain how a chronic inflammatory infiltrate varies with the inciting stimulus.
- Trace Th2-associated recruitment and effector activity of eosinophils.
- Describe IgE receptor signaling and chronic functions of mast cells.
- Recognize why neutrophils may persist in chronic lesions.

Chronic inflammation is a continuing process

Inflammation, tissue injury and attempted repair coexist over weeks or months.

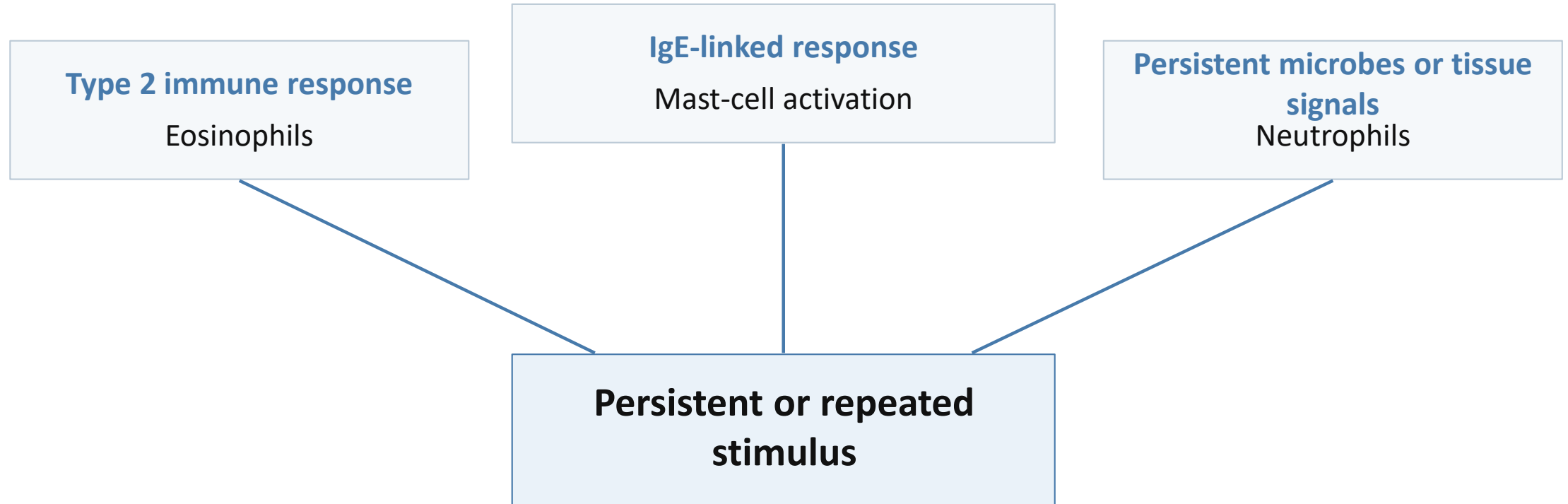
- A chronic process may follow acute inflammation or begin insidiously.
- The inflammatory population changes according to persistent stimuli and local mediators.
- Eosinophils, mast cells and neutrophils may join the mononuclear infiltrate.

Morphology: The baseline and the exceptions

Typical chronic pattern	Additional cells
• Macrophages, lymphocytes and plasma cells • Tissue destruction • Angiogenesis and fibrosis	• Eosinophils in selected immune responses • Mast cells in acute and chronic reactions • Neutrophils may remain prominent

Do not equate “chronic” with complete absence of neutrophils.

The offending stimulus influences the infiltrate



Cell composition is a clue to the underlying inflammatory mechanism.

Why “other cells” matters

Macrophages are dominant in most chronic lesions—but the infiltrate is not uniform.

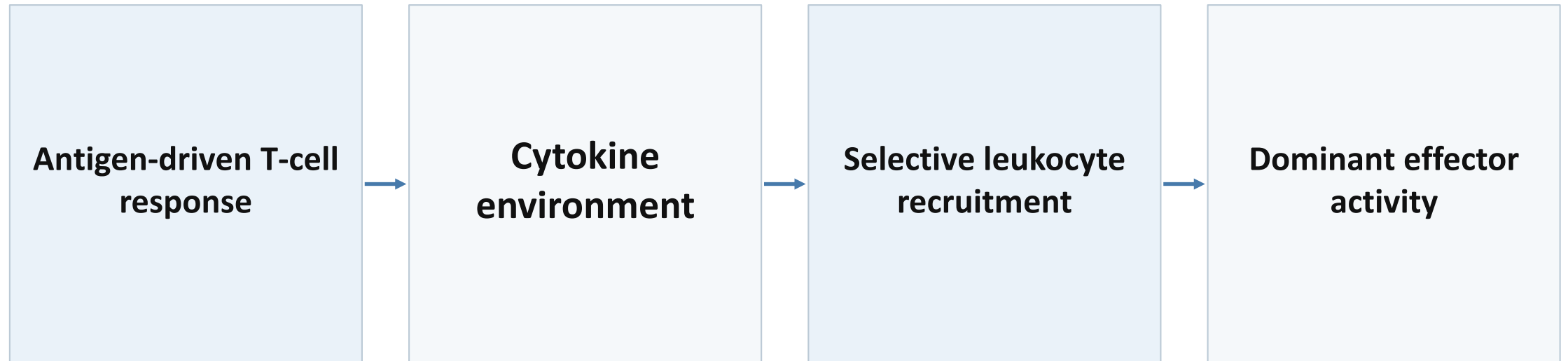
- Specific immunologic stimuli favor recruitment of additional leukocytes.
- Their mediators can protect against a threat and damage host tissues.
- A mixture of cell types can be present at the same time.

CD4⁺ helper subsets provide context

Th1	Th2	Th17
• IFN-γ secretion • Classical macrophage activation	• IL-5 $\rightarrow$ eosinophils • IL-4 / IL-13 $\rightarrow$ IgE production	• IL-17 and other cytokines • Chemokines recruit neutrophils and monocytes

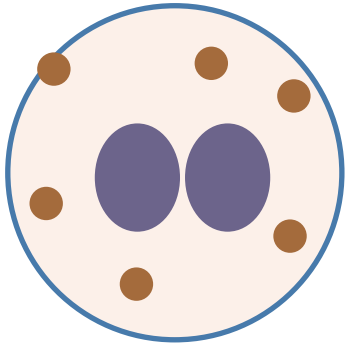
Th2 and Th17 links explain two major patterns covered in this lecture.

T helper signals are an upstream switch



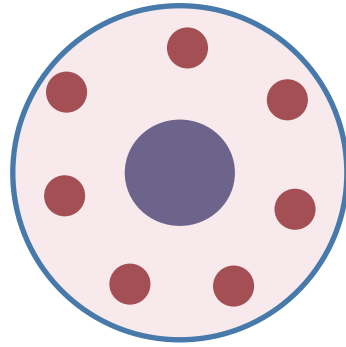
Local cytokines help determine which “other” cells accumulate.

Three additional cellular contributors



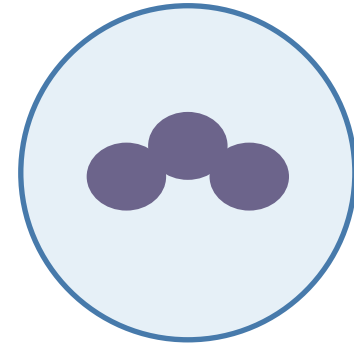
Eosinophil

Helminth defense and
epithelial injury



Mast cell

IgE-associated mediator
release and cytokines



Neutrophil

Persistent recruitment in
selected chronic lesions

Different cells imply different dominant mechanisms—not a unique diagnosis.

Eosinophils: Stimulus-specific abundance

Eosinophils are particularly abundant in Th2-mediated immune reactions.

- Parasitic infections are a core example.
- Some allergic disorders show the same type of cellular enrichment.
- Their presence reflects immune polarization rather than duration alone.

Two settings with eosinophils

Parasitic infection

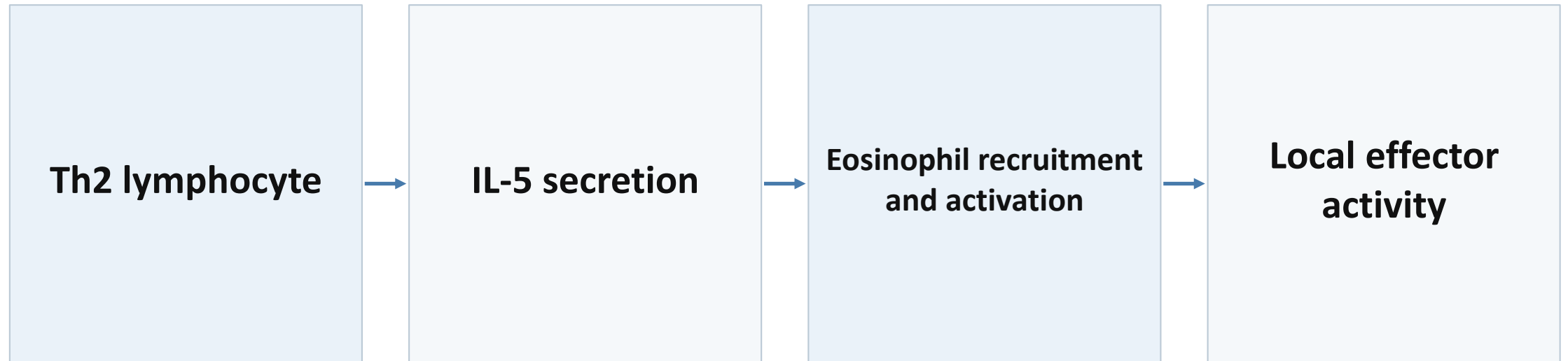
- Th2-associated response
- Eosinophil recruitment
- Granule protein can harm helminths

Allergic reaction

- Th2-associated response
- Eosinophil recruitment
- Granule protein can injure epithelium

The same cell population may be protective or injurious depending on the setting.

Th2-mediated eosinophil recruitment



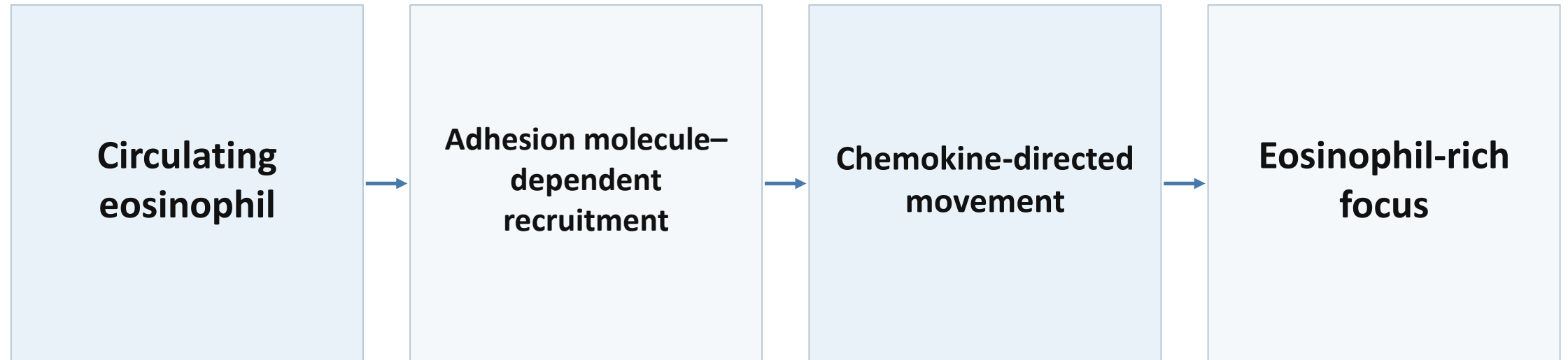
IL-5 as an important Th2 signal for eosinophils.

Recruitment requires adhesion and chemotaxis

Eosinophils reach inflamed tissue using both vascular and directional signals.

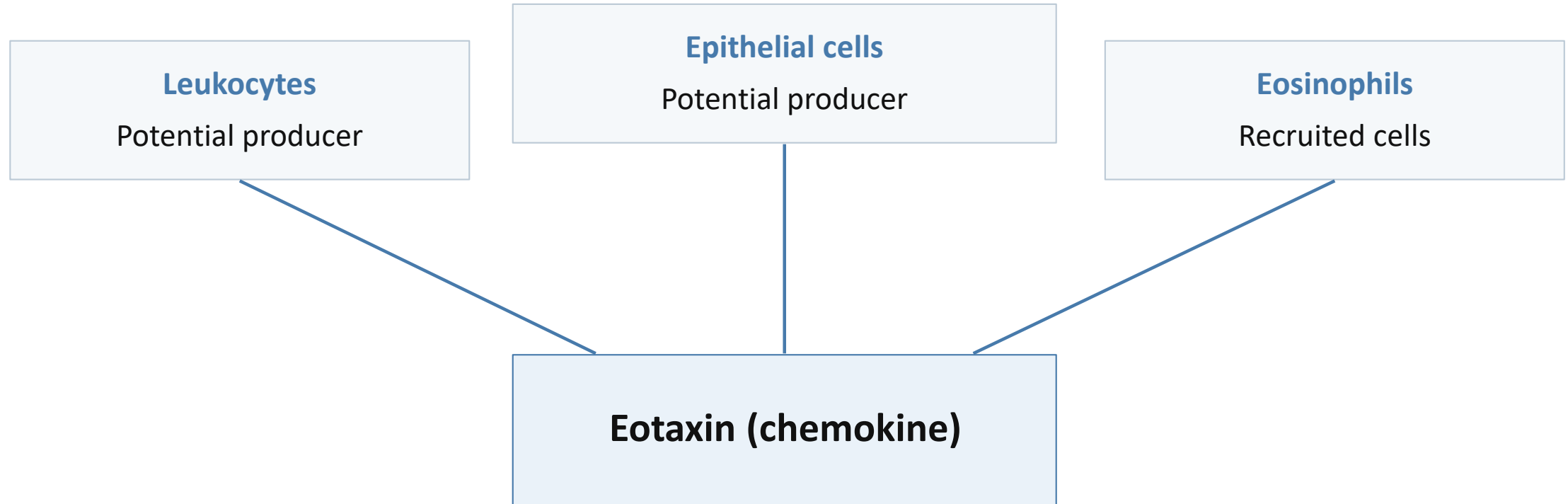
- Their recruitment uses adhesion molecules similar to those used by neutrophils.
- Specific chemokines, including eotaxin, provide recruitment signals.
- Chemokines can originate from leukocytes and epithelial cells.

From blood to an inflamed site



The same multistep recruitment principle applies to several leukocyte classes.

Eotaxin: A local directional cue



The local tissue participates in shaping its own inflammatory infiltrate.

Two recruitment signal classes

Adhesion molecules

- Permit interaction with the vascular wall
- Similar in principle to neutrophil recruitment
- Part of arrival at tissue

Chemokines

- Provide directional recruitment cues
- Eotaxin is a named example
- Produced locally by tissue and immune cells

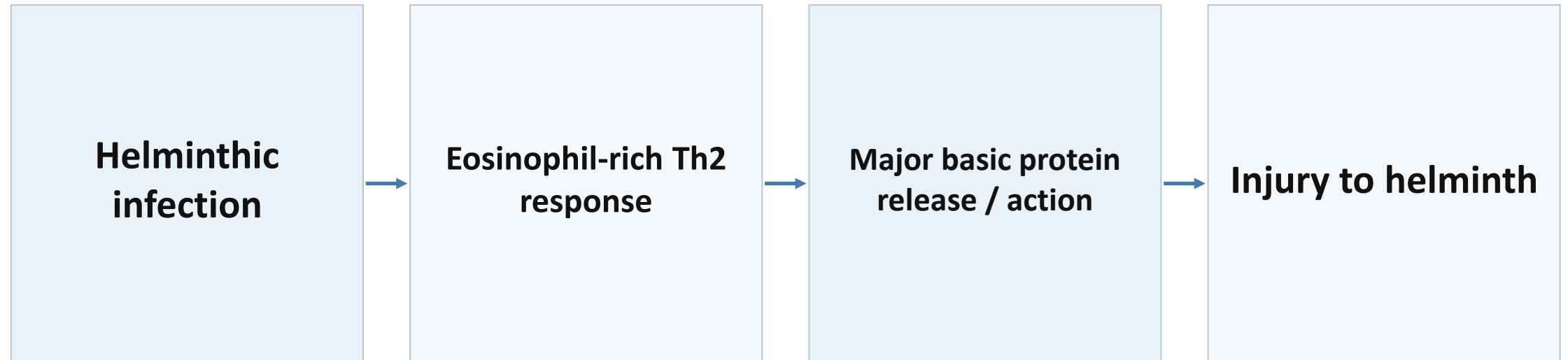
Adhesion and chemotactic signaling are complementary, not alternative, steps.

Eosinophil granules are effectors

Eosinophils contain cytoplasmic granules with major basic protein.

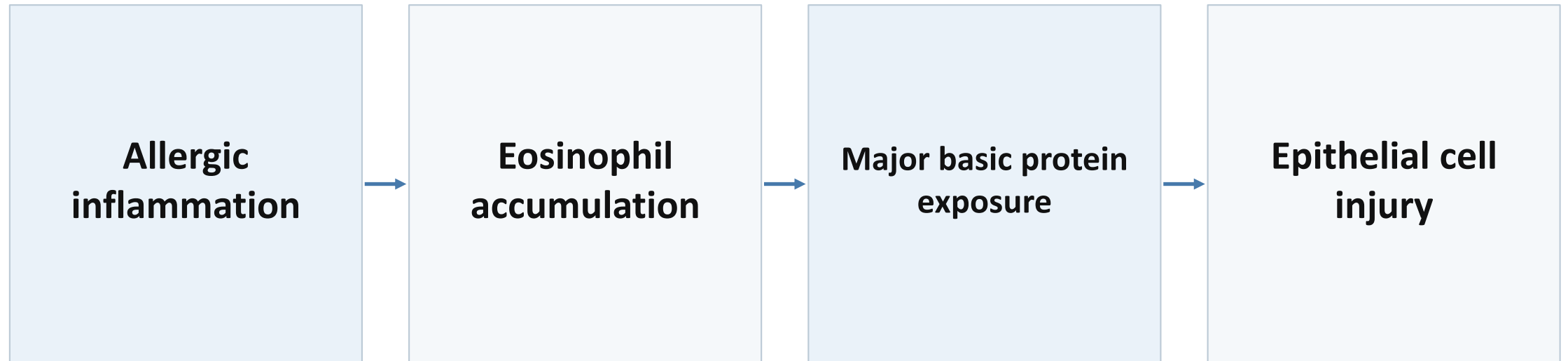
- Major basic protein is strongly cationic.
- It is toxic to helminths.
- It can also injure the host's epithelial cells.

Major basic protein: Protective pathway



Eosinophil antimicrobial benefit is linked to its granule protein.

Major basic protein: Collateral injury



Effector molecules do not inherently distinguish pathogen from host tissues.

One granule product; Two outcomes

Benefit

- The target is a helminth
- Toxic granule content assists defense
- Potential clearance of persistent parasite

Cost

- Host epithelium is exposed
- The same protein can damage host cells
- Inflammation may amplify tissue injury

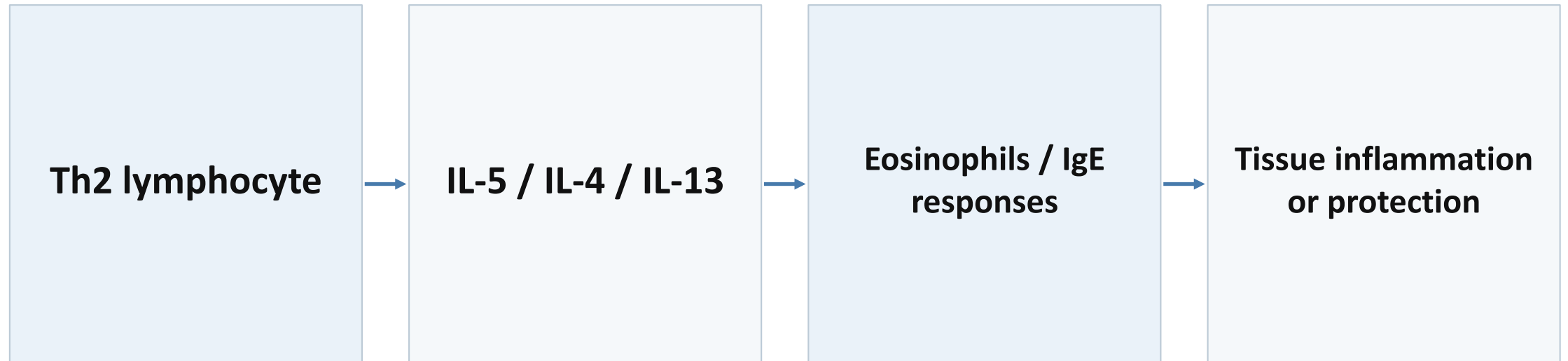
Explain both outcomes when interpreting eosinophil-rich inflammation.

Th2 cells connect eosinophils and IgE

Th2 cytokines coordinate more than one downstream effector.

- IL-5 recruits and activates eosinophils.
- IL-4 and IL-13 stimulate IgE antibody production.
- IL-4 and IL-13 also support alternative macrophage activation.

An integrated Th2-associated response



The precise outcome depends on the antigen and host tissue.

Application: Eosinophils in parasite defense

A chronic inflammatory focus occurs during a persistent helminthic infection. Eosinophils are conspicuous.

Which eosinophil product best explains the host-defense function?

Major basic protein in eosinophil granules.

Its toxicity to helminths provides benefit; The same protein may damage nearby epithelium.

Application: Eosinophils in allergy

A chronic allergic lesion contains abundant eosinophils near an epithelium.

Why can this infiltrate contribute to tissue damage, despite its role in host defense?

Major basic protein can injure epithelial cells.

Th2-associated recruitment can bring an effector optimized for helminth toxicity into host tissue.

Interpreting eosinophils: A necessary caution

An eosinophil-rich infiltrate indicates a possible mechanism—not a final diagnosis.

- Parasitic infection and some allergic diseases as key contexts.
- The source does not provide a numerical eosinophil threshold.
- Use the tissue context and clinical setting before attributing a cause.

Mast cells: Tissue distribution

Mast cells are widespread in connective tissues.

- They are situated where local responses can be initiated.
- Them in both acute and chronic inflammation.
- They should not be treated as exclusive to immediate allergy.

Mast cells participate in two time scales

Immediate response

- IgE-dependent activation
- Degranulation
- Histamine and prostaglandins

Chronic context

- Persist within inflammatory tissues
- Can produce multiple cytokines
- May promote continuing inflammation

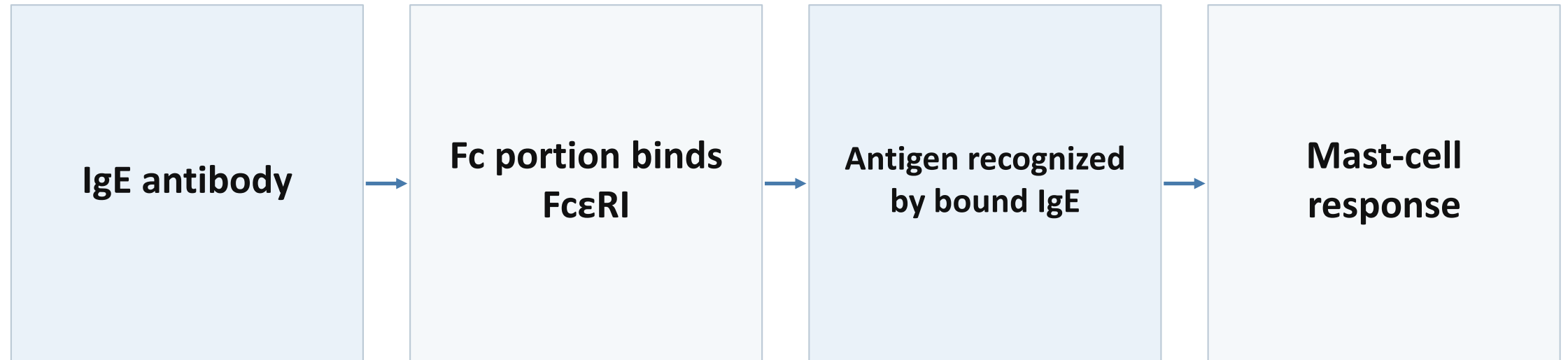
Acute mediator release and chronic immune modulation are distinct roles.

FcεRI is a high-affinity IgE receptor

Mast-cell surfaces express FcεRI.

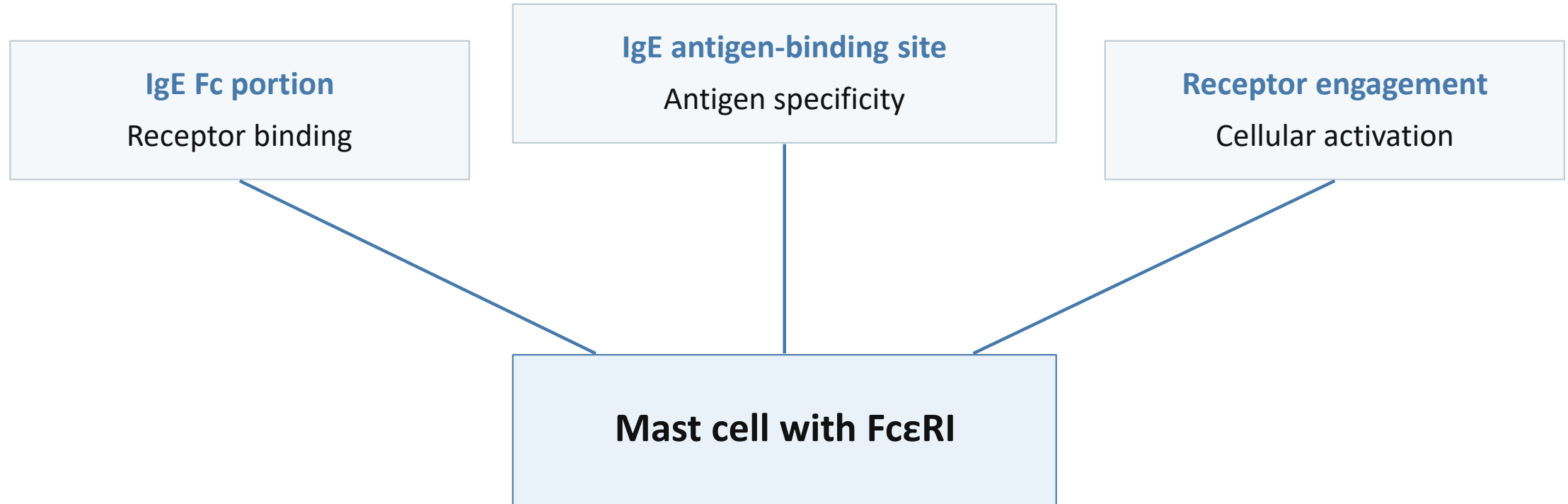
- FcεRI binds the Fc portion of IgE antibodies.
- Bound IgE confers antigen-specific recognition in immediate hypersensitivity.
- Antigen engagement initiates mast-cell activation.

IgE links antigen recognition to mast cells



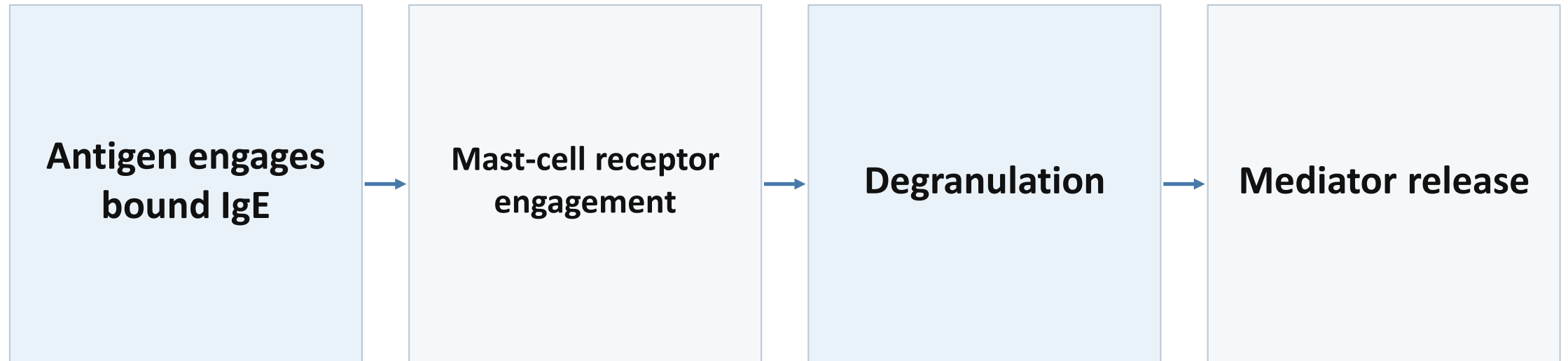
The mast cell senses antigen through its surface-bound IgE.

Two different roles in the same receptor system



Fc binding anchors antibody; Antigen recognition provides specificity.

Immediate mast-cell activation



This is the described pathway in immediate hypersensitivity reactions.

Mast-cell mediator release

Histamine and prostaglandins among the products released.

- They are associated with mast-cell activation in immediate reactions.
- Degranulation is an important mechanism in this response.
- The extracted section does not enumerate every mediator or downstream effect.

Receptor, stimulus and output

Recognition

- FcεRI expressed on mast-cell membrane
- IgE bound by its Fc region
- Antigen engages cell-bound IgE

Response

- Mast cell becomes activated
- Degranulation follows receptor engagement
- Histamine, prostaglandins and other mediators

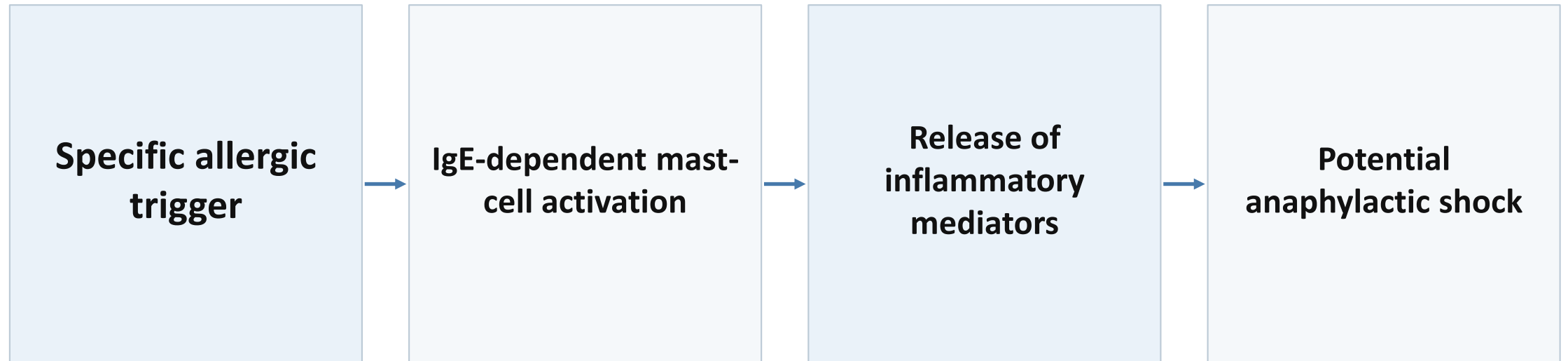
Recognition and effector phases should be taught as separate events.

Immediate hypersensitivity settings

IgE-mediated mast-cell activation has recognizable clinical contexts.

- Food-triggered allergic reactions.
- Reactions to insect venom.
- Drug-associated allergic reactions.

Severity can extend to anaphylaxis



The severe outcome is possible, not inevitable.

Why mast cells matter in chronic disease

Their contribution is not confined to degranulation during a single exposure.

- Mast cells can remain present in chronic inflammatory lesions.
- They can secrete a broad range of cytokines.
- These cytokines may promote inflammation in different settings.

Two mast-cell functions, one cell

Acute allergic episode

- Surface-bound IgE recognizes antigen
- Rapid mediator-release response
- Can be clinically severe

Chronic inflammation

- Mast cells remain among local immune cells
- Cytokines influence inflammatory milieu
- Contribution varies by context

Do not infer chronic activity solely from a history of an immediate reaction.

Application: Identifying mast-cell activation

After exposure to an insect venom, a patient develops an immediate allergic reaction.

Which antibody-receptor interaction is central to the mast-cell mechanism described here?

IgE binds the mast-cell FcεRI receptor through its Fc region.

Antigen engagement of cell-bound IgE triggers the mediator-release response.

Application: Chronic mast-cell contribution

A chronic inflammatory lesion contains mast cells without an acute systemic allergic episode.

Can mast cells still plausibly contribute to the ongoing reaction?

Yes—mast-cell cytokine secretion may promote local inflammation.

Mast cells participate in both acute and chronic reactions; Immediate IgE-mediated degranulation is not their only role.

Eosinophils and mast cells: Linked but not identical

Eosinophils

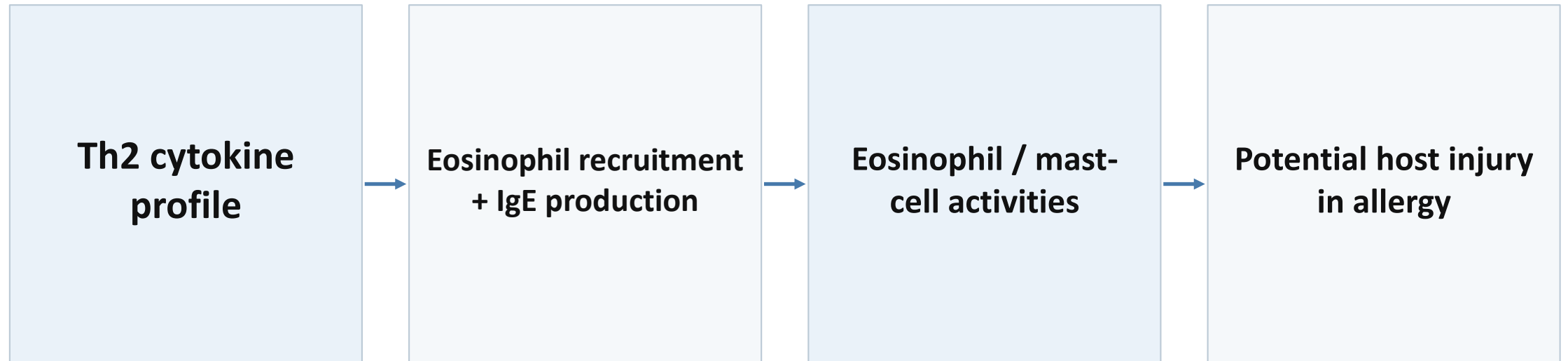
- Enriched by Th2 responses
- IL-5 / eotaxin recruit them
- Major basic protein may injure tissue

Mast cells

- Resident in connective tissue
- FcεRI-bound IgE senses antigen
- Degranulation and cytokine secretion

A common allergic context does not mean the two cells have identical functions.

Type 2 inflammatory network



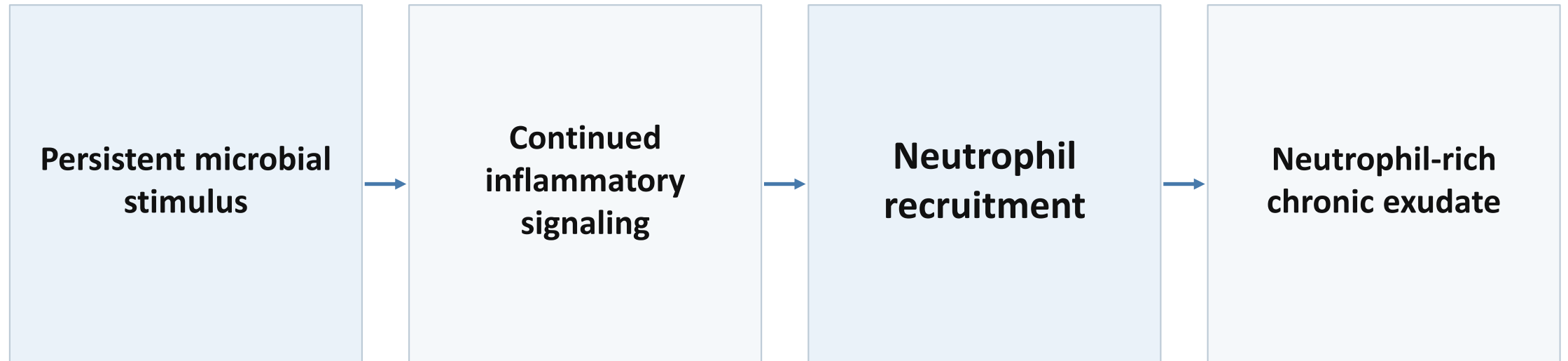
This diagram links source-described routes; It is not a complete molecular pathway.

Neutrophils: A chronic inflammation exception

Neutrophils commonly characterize acute inflammation, but they may persist in chronic processes.

- The term “chronic” reflects duration and tissue-response pattern.
- It does not exclude neutrophilic exudation.
- Robbins provides chronic bone infection and irritant-induced lung damage as examples.

Persistent microbes sustain neutrophils



Persistence may reflect ongoing recruitment rather than long survival of individual cells.

Macrophages can recruit neutrophils

Activated macrophages release mediators that favor continuing inflammation.

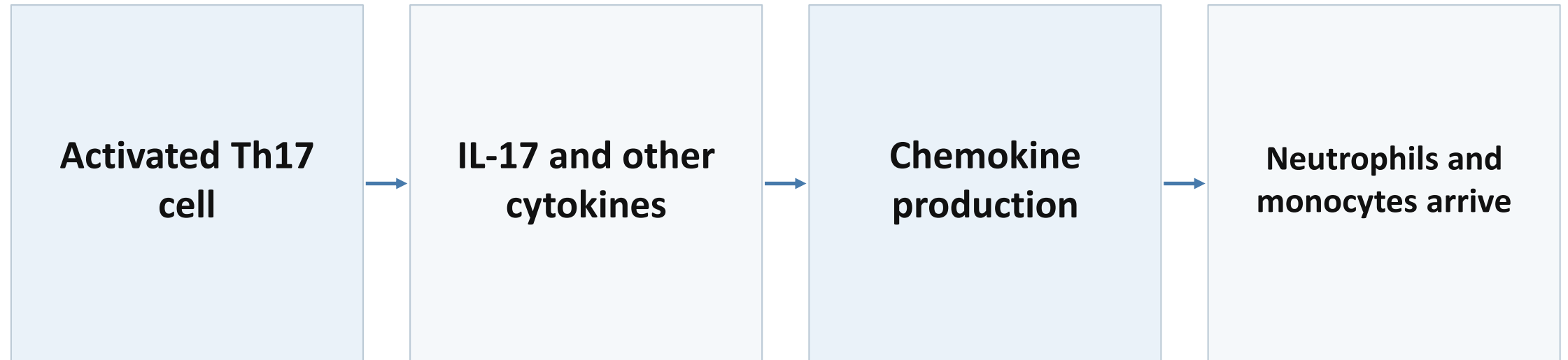
- Robbins explicitly identifies macrophage-derived mediators as a reason for neutrophils in chronic reactions.
- Macrophage products include TNF, IL-1 and chemokines in the parent section.
- A chronic mononuclear response can therefore recruit a neutrophilic component.

T lymphocytes can also sustain recruitment

Activated T-cell mediators contribute to persistent neutrophil influx.

- Th17 cells secrete IL-17 and related cytokines.
- These induce chemokine secretion that attracts neutrophils and monocytes.
- The Th17 connection explains one immune route to neutrophil-rich inflammation.

Th17 pathway toward neutrophil recruitment



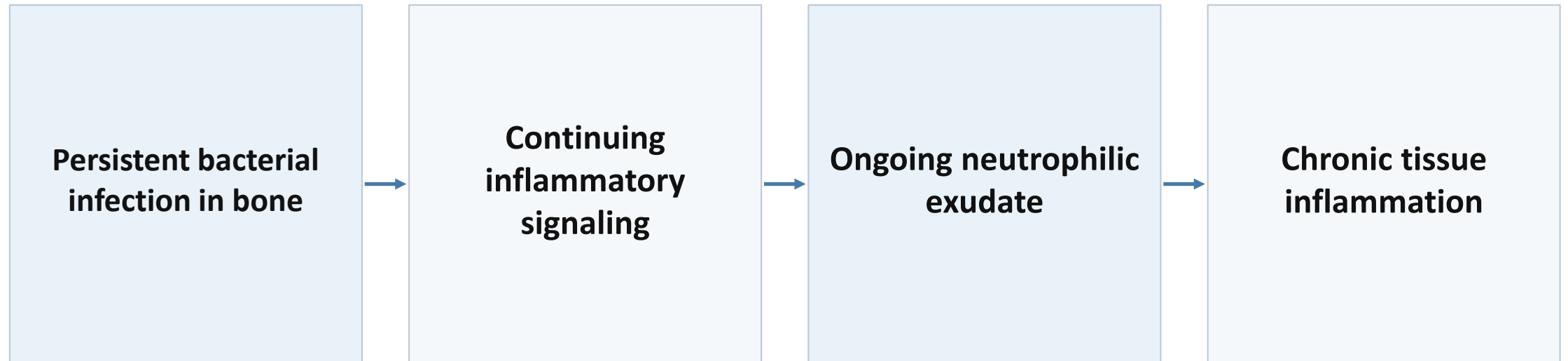
The pathway helps connect T-cell activity to mixed chronic infiltrates.

Chronic osteomyelitis: An instructive example

Chronic bacterial infection of bone may maintain neutrophilic exudate for months.

- This is an explicit Robbins example of neutrophils in a chronic lesion.
- Persistence of infection sustains the exudative component.
- Neutrophil-rich material alone does not prove that the process is short-lived.

Chronic osteomyelitis: The mechanistic chain



A prolonged lesion may retain an acute-type cellular component.

Smoking-related lung injury: A second example

Neutrophils contribute to chronic lung damage caused by smoking and other irritants.

- Persistent irritant exposure differs from persistent microbial infection.
- Both may nonetheless favor a neutrophilic inflammatory component.
- Interpret cell composition in light of the etiologic setting.

Two routes to chronic neutrophilic injury

Chronic bone infection

- Stimulus: Persistent bacteria
- Tissue: Bone
- Finding: Months of neutrophilic exudate

Smoking-associated injury

- Stimulus: Chronic irritant exposure
- Tissue: Lung
- Finding: Neutrophil-associated damage

Similar cellular players do not establish the same initiating cause.

Application: Interpreting neutrophils

A bone sample from long-standing osteomyelitis contains a substantial neutrophilic exudate.

Does neutrophil predominance exclude chronic inflammation?

No. Chronic osteomyelitis may show persistent neutrophilic exudation for months.

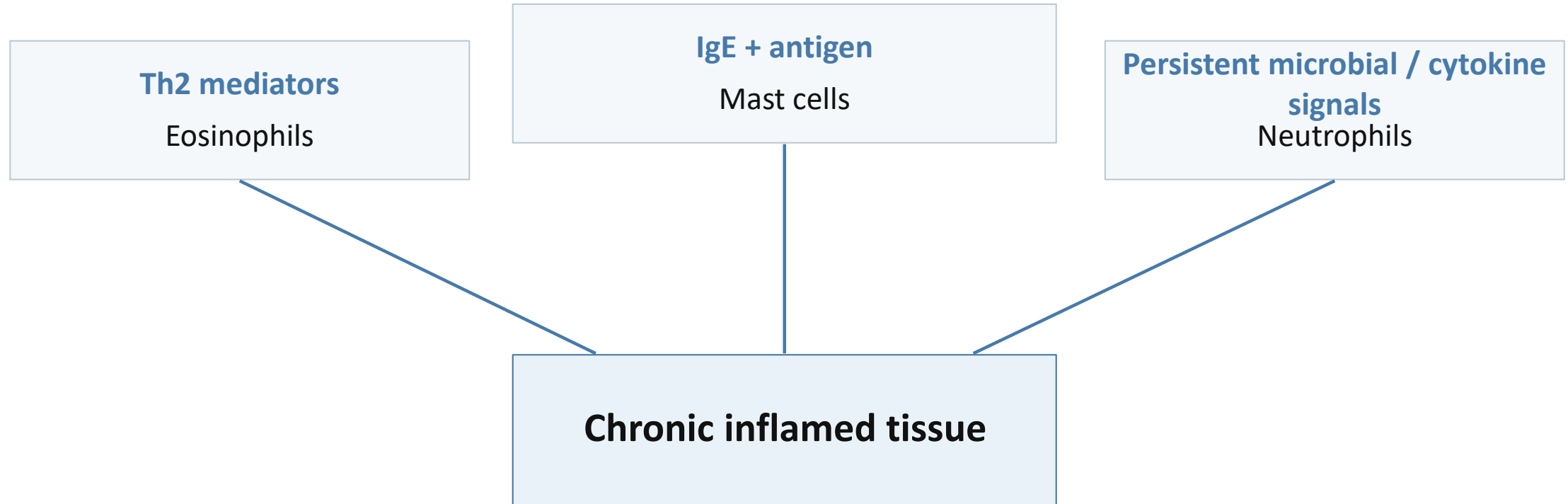
Inflammation is categorized by overall duration and tissue response, not by one leukocyte type alone.

A cellular comparison across mechanisms

Eosinophils	Mast cells	Neutrophils
• Th2 / parasitic or allergic settings • Eotaxin-mediated recruitment • Major basic protein	• IgE-linked and other chronic settings • FcεRI + bound IgE • Histamine / prostaglandins / cytokines	• Persistent microbes or chronic irritants • Macrophage / T-cell mediator support • Exudate and tissue damage

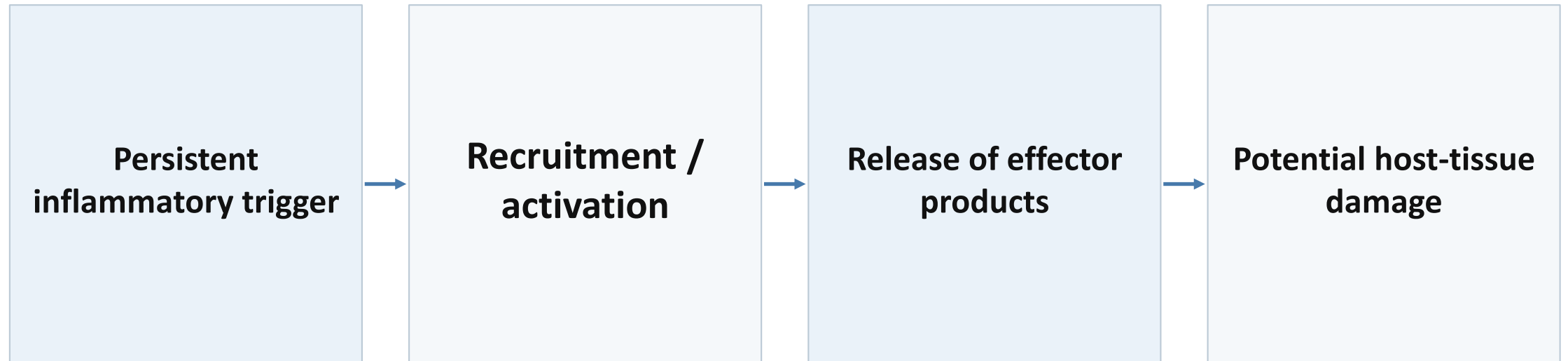
Stimulus → recruitment/activation → effector → tissue response is the shared explanatory framework.

One tissue can receive multiple immune signals



The diagram is a conceptual map, not a claim that all three are present in every lesion.

How recruited cells contribute to injury



Inflammation can protect, but uncontrolled or misdirected effector activity damages host cells.

Interpret inflammatory infiltrates as patterns

What composition suggests

- Potential initiating stimulus
- Dominant immune mediator pathway
- Likely effector mechanisms

What it cannot establish alone

- A single unique etiology
- A validated severity threshold
- A complete clinical diagnosis

Pattern recognition must be integrated with context; No diagnostic cutoffs are supplied.

Integrated application: Three specimens

Three chronic lesions are described: (A) helminth-associated tissue inflammation; (B) immediate venom allergy; (C) months-long bacterial bone infection.

Which additional cell or activation pathway best fits each example?

A: Eosinophils; B: IgE–FcεRI mast-cell activation; C: Persisting neutrophils.

Each association is directly; None is exclusive to that diagnosis.

Five defensible distinctions

The identity of the dominant effector matters more than the generic label “chronic.”

- Th2 cytokines recruit eosinophils; Eotaxin contributes chemotactic guidance.
- Major basic protein harms helminths and can injure host epithelium.
- FcεRI-bound IgE mediates antigen-linked mast-cell degranulation.
- Mast-cell cytokines may also contribute to chronic inflammation.
- Neutrophils can persist in bone infection and irritant-related lung damage.

Reference and scope

- Robbins, Cotran & Kumar: Pathologic Basis of Disease. 11th edition (2026).
- Chapter 3: Inflammation and Repair—Chronic Inflammation and Other Cells in Chronic Inflammation.
- Teaching schematics are original editable PowerPoint objects; they are not microscopy or clinical specimens.
- Interpret inflammatory cell patterns with the tissue context and the inciting stimulus.