

Hypersensitivity Reactions of the Ocular Surface



Firstly: What is a Hypersensitivity Reaction? of the Ocular Surface



Firstly: What is a Hypersensitivity Reaction? of the Ocular Surface

An exaggerated version of a normal immune response—ie, too much of good thing



How many Hypersensitivity Reactions of the Ocular Surface are there?



How many Hypersensitivity Reactions of the Ocular Surface are there?



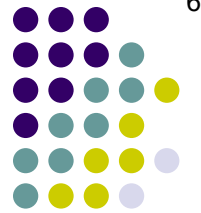
Type I

Type II

Type III

Type IV

How many Hypersensitivity Reactions of the Ocular Surface are there?



Type I

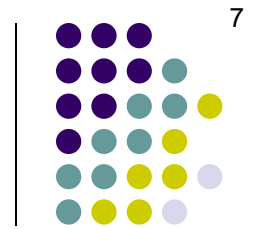
Type II

Type III

Type V?
Type IV ^

Four? But I seem to recall from med school that there are **five** hypersensitivity reactions. What gives?

How many Hypersensitivity Reactions of the Ocular Surface are there?



Type I

Type II

Type III

Type V?
Type IV ^

Four? But I seem to recall from med school that there are **five** hypersensitivity reactions. What gives?
There is a fifth, but it plays no role regarding the ocular surface

Hypersensitivity Reactions of the Ocular Surface



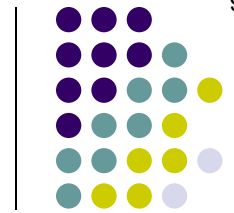
Type I

Type II

Type III

Type IV

Before proceeding further, it should be noted that the conceptualization of 4 (or 5) distinct hypersensitivity reactions is considered **outdated** by modern immunologists. In truth, most clinical conditions represent a blend of the proposed hypersensitivity mechanisms. That said, this framework for categorizing hypersensitivity reactions persists in the literature, and thus familiarity with it remains an obligation of ophthos-in-training.



Hypersensitivity Reactions of the Ocular Surface

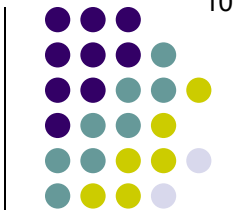
Type I

Type II

Type III

Type IV

Type I reactions involve... [One word that captures the nature of this rxn]
Type II reactions involve...
Type III reactions involve...
Type IV reactions involve...



Hypersensitivity Reactions of the Ocular Surface

Anaphylaxis
Type I

Type II

Type III

Type IV

Type I reactions involve...Anaphylaxis
Type II reactions involve...
Type III reactions involve...
Type IV reactions involve...



Hypersensitivity Reactions of the Ocular Surface

Anaphylaxis
Type I

Type II

Type III

Type IV

Type I reactions involve...Anaphylaxis

Type II reactions involve...

Type III reactions involve...

Type IV reactions involve...

Briefly, how does an anaphylactic reaction proceed?



Hypersensitivity Reactions of the Ocular Surface

Anaphylaxis
Type I

Type II

Type III

Type IV

Type I reactions involve...Anaphylaxis
Type II reactions involve...
Type III reactions involve...
Type IV reactions involve...

Briefly, how does an anaphylactic reaction proceed?

The binding of to receptors on causes the cells to



Hypersensitivity Reactions of the Ocular Surface

Anaphylaxis

Type I

Type II

Type III

Type IV

Type I reactions involve...Anaphylaxis

Type II reactions involve...

Type III reactions involve...

Type IV reactions involve...

Briefly, how does an anaphylactic reaction proceed?

The binding of **antigen (Ag)** to **IgE** receptors on **mast cells** causes the cells to **degranulate**



Hypersensitivity Reactions of the Ocular Surface

Anaphylaxis

Type I

Type II

Type III

Type IV

Type I reactions involve...Anaphylaxis

Type II reactions involve...

Type III reactions involve...

Type IV reactions involve...

Briefly, how does an anaphylactic reaction proceed?

The binding of **antigen (Ag)** to **IgE** receptors on **mast cells** causes the cells to **degranulate**, with the subsequent release of

one word

and other pre-formed inflammatory mediators



Hypersensitivity Reactions of the Ocular Surface

Anaphylaxis

Type I

Type II

Type III

Type IV

Type I reactions involve...Anaphylaxis

Type II reactions involve...

Type III reactions involve...

Type IV reactions involve...

Briefly, how does an anaphylactic reaction proceed?

The binding of **antigen (Ag)** to **IgE** receptors on **mast cells** causes the cells to **degranulate**, with the subsequent release of **histamine** and other pre-formed inflammatory mediators



Hypersensitivity Reactions of the Ocular Surface

Anaphylaxis

Type I

Type II

Type III

Type IV

Type I reactions involve...Anaphylaxis

Type II reactions involve...

Type III reactions involve...

Type IV reactions involve...

Briefly, how does an anaphylactic reaction proceed?

The binding of **antigen (Ag)** to **IgE** receptors on **mast cells** causes the cells to **degranulate**, with the subsequent release of **histamine** and other pre-formed inflammatory mediators

Sounds fast. How long does it take to become clinically apparent?



Hypersensitivity Reactions of the Ocular Surface

Anaphylaxis

Type I

Type II

Type III

Type IV

Type I reactions involve...Anaphylaxis

Type II reactions involve...

Type III reactions involve...

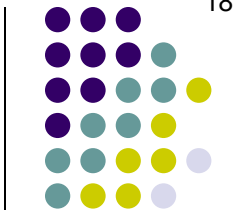
Type IV reactions involve...

Briefly, how does an anaphylactic reaction proceed?

The binding of **antigen (Ag)** to **IgE** receptors on **mast cells** causes the cells to **degranulate**, with the subsequent release of **histamine** and other pre-formed inflammatory mediators

Sounds fast. How long does it take to become clinically apparent?

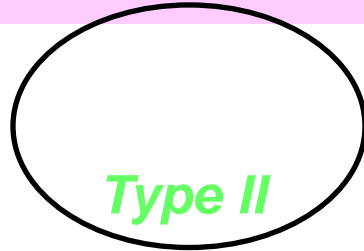
Only minutes (which is why which is why this reaction is often referred to as *immediate hypersensitivity*)



Hypersensitivity Reactions of the Ocular Surface

Anaphylaxis

Type I



Type II

Type III

Type IV

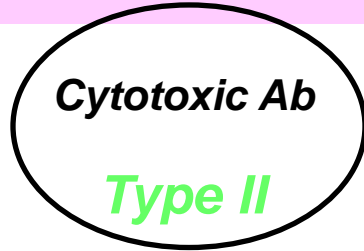
Type I reactions involve...Anaphylaxis
Type II reactions involve... [Two words capturing this rxn]
Type III reactions involve...
Type IV reactions involve...



Hypersensitivity Reactions of the Ocular Surface

Anaphylaxis

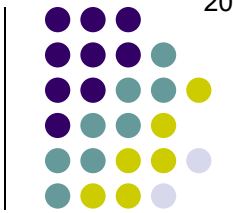
Type I



Type III

Type IV

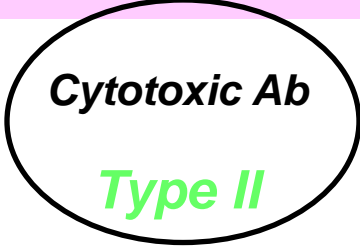
Type I reactions involve...Anaphylaxis
Type II reactions involve...Cytotoxic antibodies
Type III reactions involve...
Type IV reactions involve...



Hypersensitivity Reactions of the Ocular Surface

Anaphylaxis

Type I

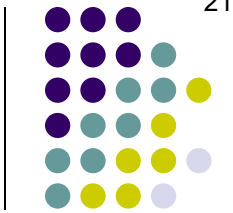


Type III

Type IV

Type I reactions involve...Anaphylaxis
Type II reactions involve...Cytotoxic antibodies
Type III reactions involve...
Type IV reactions involve...

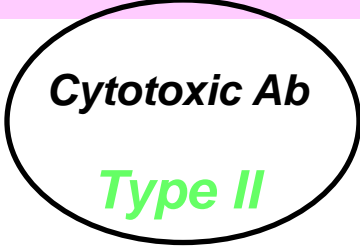
Is the antibody (Ab) involved in Type II reactions IgE, as it is in Type I?



Hypersensitivity Reactions of the Ocular Surface

Anaphylaxis

Type I

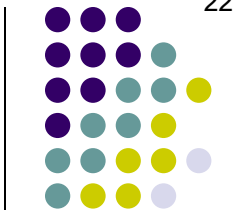


Type III

Type IV

Type I reactions involve...Anaphylaxis
Type II reactions involve...Cytotoxic antibodies
Type III reactions involve...
Type IV reactions involve...

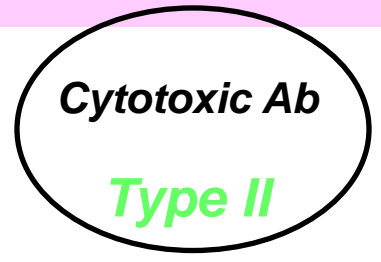
Is the antibody (Ab) involved in Type II reactions IgE, as it is in Type I?
 No, it is IgG and/or IgM



Hypersensitivity Reactions of the Ocular Surface

Anaphylaxis

Type I



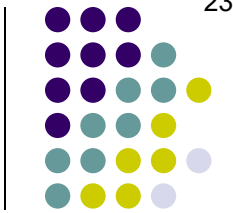
Type III

Type IV

Type I reactions involve...Anaphylaxis
Type II reactions involve...Cytotoxic antibodies
Type III reactions involve...
Type IV reactions involve...

Is the antibody (Ab) involved in Type II reactions IgE, as it is in Type I?
 No, it is IgG and/or IgM

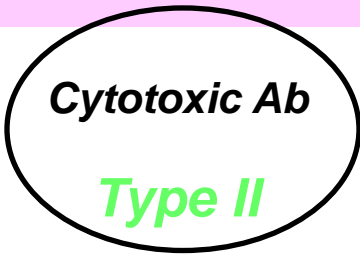
How does a Type II reaction proceed?



Hypersensitivity Reactions of the Ocular Surface

Anaphylaxis

Type I



Type III

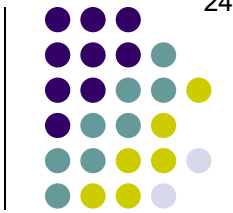
Type IV

Type I reactions involve...Anaphylaxis
Type II reactions involve...Cytotoxic antibodies
 Type III reactions involve...
 Type IV reactions involve...

Is the antibody (Ab) involved in Type II reactions IgE, as it is in Type I?
 No, it is IgG and/or IgM

How does a Type II reaction proceed?

Antibodies bind to antigens located on cell membranes. These cell-membrane bound Ag-Ab complexes prompt complement-system attacks on the cell.



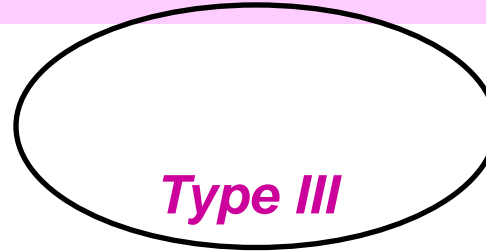
Hypersensitivity Reactions of the Ocular Surface

Anaphylaxis

Type I

Cytotoxic Ab

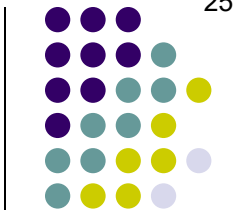
Type II



Type III

Type IV

Type I reactions involve...Anaphylaxis
Type II reactions involve...Cytotoxic antibodies
Type III reactions involve... [Three words for this one]
Type IV reactions involve...



Hypersensitivity Reactions of the Ocular Surface

Anaphylaxis

Type I

Cytotoxic Ab

Type II

Immune-complex reactions

Type III

Type IV

Type I reactions involve...Anaphylaxis
Type II reactions involve...Cytotoxic antibodies
Type III reactions involve...Immune-complex reactions
Type IV reactions involve...



Hypersensitivity Reactions of the Ocular Surface

Anaphylaxis

Type I

Cytotoxic Ab

Type II

**Immune-complex
reactions**

Type III

Type IV

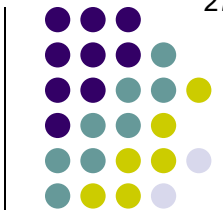
Type I reactions involve...Anaphylaxis

Type II reactions involve...Cytotoxic antibodies

Type III reactions involve...Immune-complex reactions

Type IV reactions involve...

Is the antibody involved in Type III IgE as in Type I, or IgG and IgM as in Type II?



Hypersensitivity Reactions of the Ocular Surface

Anaphylaxis
Type I

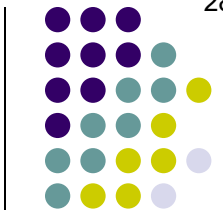
Cytotoxic Ab
Type II

Immune-complex reactions
Type III

Type IV

Type I reactions involve...Anaphylaxis
Type II reactions involve...Cytotoxic antibodies
Type III reactions involve...Immune-complex reactions
Type IV reactions involve...

*Is the antibody involved in Type III IgE a la Type I, or IgG and IgM as in Type II?
IgG and/or IgM*



Hypersensitivity Reactions of the Ocular Surface

Anaphylaxis
Type I

Cytotoxic Ab
Type II

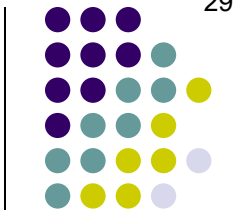
Immune-complex reactions
Type III

Type IV

Type I reactions involve...Anaphylaxis
Type II reactions involve...Cytotoxic antibodies
Type III reactions involve...Immune-complex reactions
Type IV reactions involve...

*Is the antibody involved in Type III IgE as in Type I, or IgG and IgM as in Type II?
IgG and/or IgM*

How does a Type III reaction proceed?



Hypersensitivity Reactions of the Ocular Surface

Anaphylaxis
Type I

Cytotoxic Ab
Type II

Immune-complex reactions
Type III

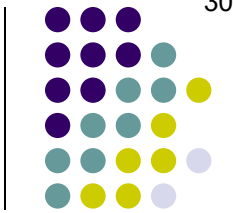
Type IV

Type I reactions involve...Anaphylaxis
Type II reactions involve...Cytotoxic antibodies
Type III reactions involve...Immune-complex reactions
Type IV reactions involve...

*Is the antibody involved in Type III IgE as in Type I, or IgG and IgM as in Type II?
IgG and/or IgM*

How does a Type III reaction proceed?

Antibodies bind to antigens circulating in the bloodstream. The resulting Ab-Ag complexes get deposited somewhere (often on the lining of a blood vessel).



Hypersensitivity Reactions of the Ocular Surface

Anaphylaxis
Type I

Cytotoxic Ab
Type II

Immune-complex reactions
Type III

Type IV

Type I reactions involve...Anaphylaxis
Type II reactions involve...Cytotoxic antibodies
Type III reactions involve...Immune-complex reactions
Type IV reactions involve...

*Is the antibody involved in Type III IgE as in Type I, or IgG and IgM as in Type II?
IgG and/or IgM*

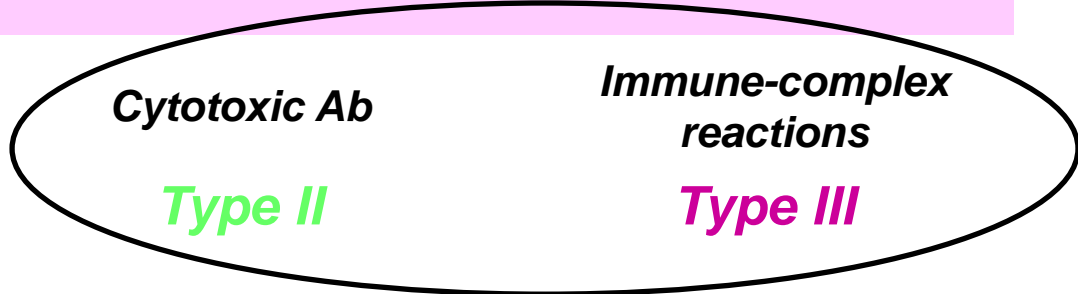
How does a Type III reaction proceed?

Antibodies bind to antigens circulating in the bloodstream. The resulting Ab-Ag complexes get deposited somewhere (often on the lining of a blood vessel). Once ensconced in tissue, the Ab-Ag complexes precipitate attacks on the tissue by PMNs.



Hypersensitivity Reactions of the Ocular Surface

Anaphylaxis
Type I



Type IV

Type I reactions involve...Anaphylaxis
 Type II reactions involve...Cytotoxic antibodies
 Type III reactions involve...Immune-complex reactions
 Type IV reactions involve...

Types II and III are easily confused with one another. Note the key differences:
 --In Type II, Ab attach to **cell-bound** Ag, whereas in Type III they attach to **circulating** Ag, and
 --



Hypersensitivity Reactions of the Ocular Surface

Anaphylaxis

Type I

Cytotoxic Ab

Type II

Immune-complex
reactions

Type III

Type IV

Type I reactions involve...Anaphylaxis

Type II reactions involve...Cytotoxic antibodies

Type III reactions involve...Immune-complex reactions

Type IV reactions involve...

Types II and III are easily confused with one another. Note the key differences:

--In Type II, Ab attach to **cell-bound** Ag, whereas in Type III they attach to **circulating** Ag, and

--In Type II, the damage is caused by **complement**, whereas in Type III it is caused by **PMNs**

Hypersensitivity Reactions of the Ocular Surface

Anaphylaxis

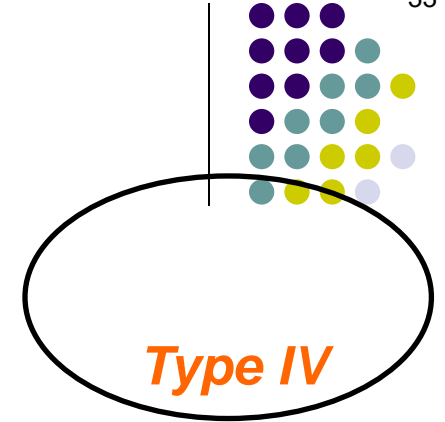
Type I

Cytotoxic Ab

Type II

**Immune-complex
reactions**

Type III



Type I reactions involve...Anaphylaxis

Type II reactions involve...Cytotoxic antibodies

Type III reactions involve...Immune-complex reactions

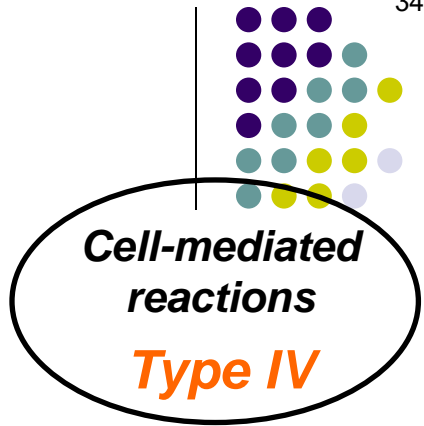
Type IV reactions involve... [Three words again]

Hypersensitivity Reactions of the Ocular Surface

Anaphylaxis
Type I

Cytotoxic Ab
Type II

Immune-complex reactions
Type III



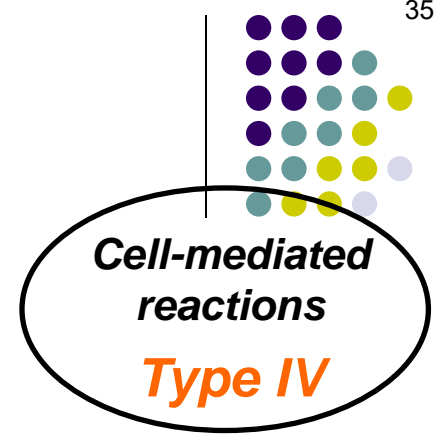
Type I reactions involve...Anaphylaxis
Type II reactions involve...Cytotoxic antibodies
Type III reactions involve...Immune-complex reactions
Type IV reactions involve...Cell-mediated reactions

Hypersensitivity Reactions of the Ocular Surface

Anaphylaxis
Type I

Cytotoxic Ab
Type II

Immune-complex reactions
Type III



Type I reactions involve...Anaphylaxis
Type II reactions involve...Cytotoxic antibodies
Type III reactions involve...Immune-complex reactions
Type IV reactions involve...Cell-mediated reactions

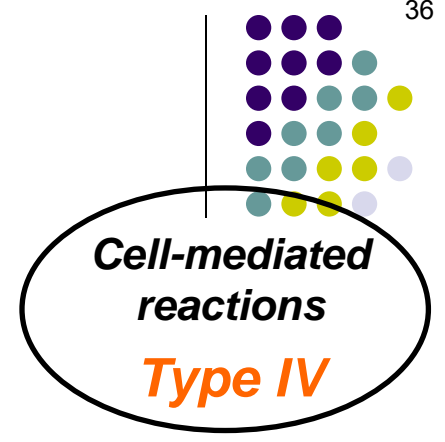
'Cell-mediated reaction'...Which sort of immune cell is doing the mediating?

Hypersensitivity Reactions of the Ocular Surface

Anaphylaxis
Type I

Cytotoxic Ab
Type II

Immune-complex reactions
Type III



Type I reactions involve...Anaphylaxis
Type II reactions involve...Cytotoxic antibodies
Type III reactions involve...Immune-complex reactions
Type IV reactions involve...Cell-mediated reactions

'Cell-mediated reaction'...Which sort of immune cell is doing the mediating?
 T-helper cells

Hypersensitivity Reactions of the Ocular Surface

Anaphylaxis

Type I

Cytotoxic Ab

Type II

**Immune-complex
reactions**

Type III

**Cell-mediated
reactions**

Type IV

Type I reactions involve...Anaphylaxis

Type II reactions involve...Cytotoxic antibodies

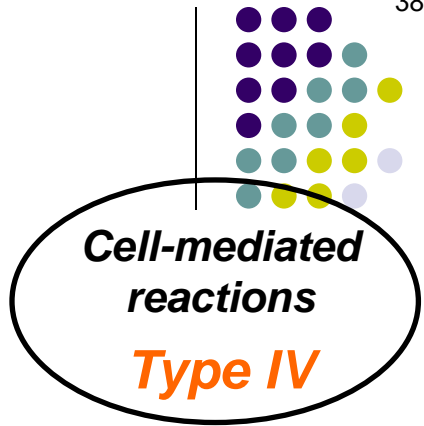
Type III reactions involve...Immune-complex reactions

Type IV reactions involve...Cell-mediated reactions

*'Cell-mediated reaction'...Which sort of immune cell is doing the mediating?
T-helper cells*

In what way are T-helper cells mediating the reaction?

Hypersensitivity Reactions of the Ocular Surface



Anaphylaxis
Type I

Cytotoxic Ab
Type II

Immune-complex reactions
Type III

Type I reactions involve...Anaphylaxis
Type II reactions involve...Cytotoxic antibodies
Type III reactions involve...Immune-complex reactions
Type IV reactions involve...Cell-mediated reactions

'Cell-mediated reaction'...Which sort of immune cell is doing the mediating?
T-helper cells

In what way are T-helper cells mediating the reaction?
In Type IV reactions, T-helpers interact with antigens, thereby becoming activated.

Hypersensitivity Reactions of the Ocular Surface

Anaphylaxis

Type I

Cytotoxic Ab

Type II

**Immune-complex
reactions**

Type III

**Cell-mediated
reactions**

Type IV

Type I reactions involve...Anaphylaxis

Type II reactions involve...Cytotoxic antibodies

Type III reactions involve...Immune-complex reactions

Type IV reactions involve...Cell-mediated reactions

'Cell-mediated reaction'...Which sort of immune cell is doing the mediating?
T-helper cells

In what way are T-helper cells mediating the reaction?

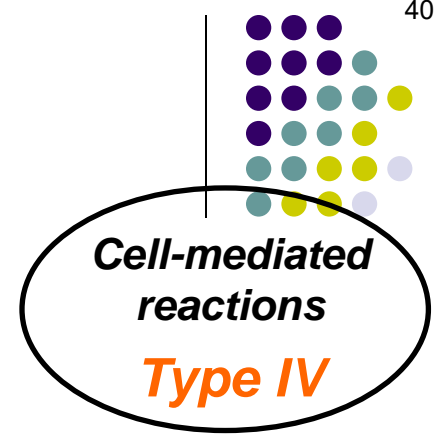
In Type IV reactions, T-helpers interact with antigens, thereby becoming activated. Once activated, the T-helpers release chemotactic factors that recruit and activate macrophages.

Hypersensitivity Reactions of the Ocular Surface

Anaphylaxis
Type I

Cytotoxic Ab
Type II

Immune-complex reactions
Type III



Type I reactions involve...Anaphylaxis
Type II reactions involve...Cytotoxic antibodies
Type III reactions involve...Immune-complex reactions
Type IV reactions involve...Cell-mediated reactions

'Cell-mediated reaction'...Which sort of immune cell is doing the mediating?
 T-helper cells

In what way are T-helper cells mediating the reaction?
 In Type IV reactions, T-helpers interact with antigens, thereby becoming activated. Once activated, the T-helpers release chemotactic factors that recruit and activate macrophages.

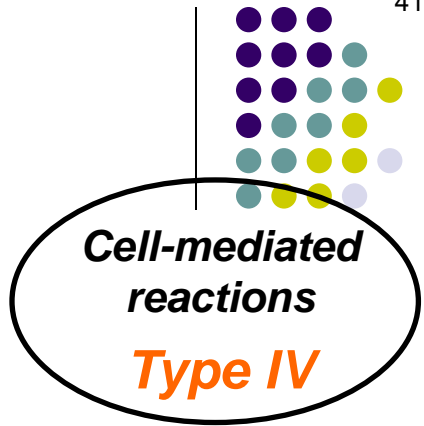
That's a convoluted process. How long does it take to become clinically apparent?

Hypersensitivity Reactions of the Ocular Surface

Anaphylaxis
Type I

Cytotoxic Ab
Type II

Immune-complex reactions
Type III



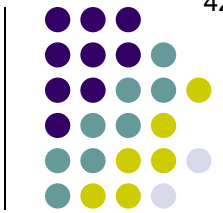
Type I reactions involve...Anaphylaxis
Type II reactions involve...Cytotoxic antibodies
Type III reactions involve...Immune-complex reactions
Type IV reactions involve...Cell-mediated reactions

'Cell-mediated reaction'...Which sort of immune cell is doing the mediating?
T-helper cells

In what way are T-helper cells mediating the reaction?

In Type IV reactions, T-helpers interact with antigens, thereby becoming activated. Once activated, the T-helpers release chemotactic factors that recruit and activate macrophages.

That's a convoluted process. How long does it take to become clinically apparent?
24-72 hours, which is why this reaction is often referred to as *delayed hypersensitivity*



Hypersensitivity Reactions of the Ocular Surface

Anaphylaxis
Type I

Cytotoxic Ab
Type II

Immune-complex reactions
Type III

Cell-mediated reactions
Type IV

Type I reactions involve...Anaphylaxis
Type II reactions involve...Cytotoxic antibodies
Type III reactions involve...Immune-complex reactions
Type IV reactions involve...Delayed hypersensitivity

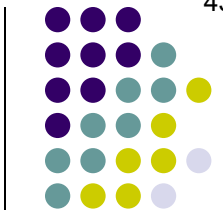
'Cell-mediated reaction'...Which sort of immune cell is doing the mediating?
T-helper cells

In what way a
In Type IV re
activated, the T-helpers release chemotactic factors that recruit and activate
macrophages.

Note that if you remember Type IV as 'delayed hypersensitivity'...

That's a convoluted process. How long does it take to become clinically apparent?
24-72 hours, which is why this reaction is often referred to as

delayed hypersensitivity



Hypersensitivity Reactions of the Ocular Surface

Anaphylaxis
Type I

Cytotoxic Ab
Type II

Immune-complex reactions
Type III

Cell-mediated reactions
Type IV

Type I reactions involve...Anaphylaxis
Type II reactions involve...Cytotoxic antibodies
Type III reactions involve...Immune-complex reactions
Type IV reactions involve...Delayed hypersensitivity

'Cell-mediated reaction'...Which sort of immune cell is doing the mediating?
T-helper cells

In what way a
In Type IV re
activated, the T-helpers release chemotactic factors that recruit and activate
macrophages.

**Note that if you remember Type IV as 'delayed hypersensitivity'...
the four forms can be remembered with the mnemonic ACID**

That's a convoluted process. How long does it take to become clinically apparent?
24-72 hours, which is why this reaction is often referred to as **delayed hypersensitivity**



Hypersensitivity Reactions of the Ocular Surface
Divvy 'em up

Anaphylaxis
Type I

Cytotoxic Ab
Type II

Immune-complex reactions
Type III

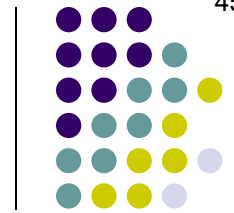
Cell-mediated reactions
Type IV

Topical anesthetics ← **Start here**

- Neomycin
- Anaphylaxis
- IgE
- Histamine release

Work down the list assigning each term to the form of hypersensitivity with which it is most closely associated

- vasculitis
- Atropine
- Contact dermatitis
- Chemosis
- PK rejection
- SLE
- Red excematous periorbital skin
- Peripheral ulcerative keratitis
- Involves complement
- Phlyctenulosis



Hypersensitivity Reactions of the Ocular Surface
Divvy 'em up

Anaphylaxis

Type I

Topical anesthetics

Cytotoxic Ab

Type II

Immune-complex reactions

Type III

Cell-mediated reactions

Type IV

Neomycin



Anaphylaxis

IgE

Histamine release

Cicatricial pemphigoid

Mast-cell degranulation

Vasculitis

Atropine

Contact dermatitis

Chemosis

PK rejection

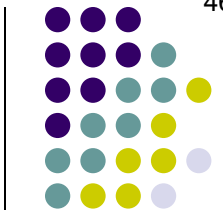
SLE

Red excematous periorbital skin

Peripheral ulcerative keratitis

Involves complement

Phlyctenulosis



Hypersensitivity Reactions of the Ocular Surface
Divvy 'em up

Anaphylaxis

Type I

Topical anesthetics

Cytotoxic Ab

Type II

Immune-complex reactions

Type III

Cell-mediated reactions

Type IV

Neomycin

Anaphylaxis



IgE

Histamine release

Cicatricial pemphigoid

Mast-cell degranulation

Vasculitis

Atropine

Contact dermatitis

Chemosis

PK rejection

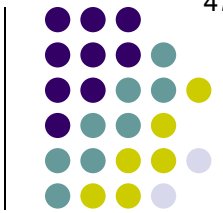
SLE

Red excematous periorbital skin

Peripheral ulcerative keratitis

Involves complement

Phlyctenulosis



Hypersensitivity Reactions of the Ocular Surface
Divvy 'em up

Anaphylaxis

Type I

Topical anesthetics

Anaphylaxis

Cytotoxic Ab

Type II

Immune-complex reactions

Type III

Cell-mediated reactions

Type IV

Neomycin

IgE

Histamine release

Cicatricial pemphigoid

Mast-cell degranulation

Vasculitis

Atropine

Contact dermatitis

Chemosis

PK rejection

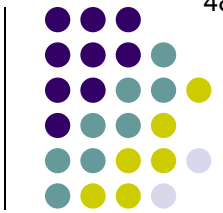
SLE

Red exxematous periorbital skin

Peripheral ulcerative keratitis

Involves complement

Phlyctenulosis



Hypersensitivity Reactions of the Ocular Surface
Divvy 'em up

Anaphylaxis

Type I

Topical anesthetics

Anaphylaxis
IgE

Cytotoxic Ab

Type II

Immune-complex reactions

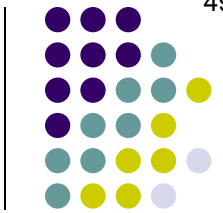
Type III

Cell-mediated reactions

Type IV

Neomycin

- Histamine release**
- Cicatricial pemphigoid
- Mast-cell degranulation
- Vasculitis
- Atropine
- Contact dermatitis
- Chemosis
- PK rejection
- SLE
- Red excematous periorbital skin
- Peripheral ulcerative keratitis
- Involves complement
- Phlyctenulosis



Hypersensitivity Reactions of the Ocular Surface
Divvy 'em up

Anaphylaxis

Type I

Topical anesthetics

Anaphylaxis

IgE

Histamine release

Cytotoxic Ab

Type II

Immune-complex reactions

Type III

Cell-mediated reactions

Type IV

Neomycin

Cicatricial pemphigoid

Mast-cell degranulation

Vasculitis

Atropine

Contact dermatitis

Chemosis

PK rejection

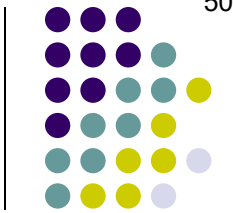
SLE

Red excematous periorbital skin

Peripheral ulcerative keratitis

Involves complement

Phlyctenulosis



Hypersensitivity Reactions of the Ocular Surface
Divvy 'em up

Anaphylaxis

Type I

Topical anesthetics

Anaphylaxis

IgE

Histamine release

Cytotoxic Ab

Type II

(No question on this slide—advance to the next one)

Cicatricial pemphigoid

Mast-cell degranulation

Vasculitis

Atropine

Contact dermatitis

Chemosis

PK rejection

SLE

Red excematous periorbital skin

Peripheral ulcerative keratitis

Involves complement

Phlyctenulosis

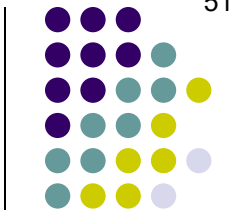
Immune-complex reactions

Type III

Cell-mediated reactions

Type IV

Neomycin



Hypersensitivity Reactions of the Ocular Surface
Divvy 'em up

Anaphylaxis

Cytotoxic Ab

Immune-complex reactions

Cell-mediated reactions

Type I

Type II

Type III

Type IV

Topical anesthetics

Anaphylaxis

IgE

Histamine release

Neomycin

Cicatricial pemphigoid is now referred to by what name in the BCSC Cornea book?

Atropine

Contact dermatitis

Chemosis

PK rejection

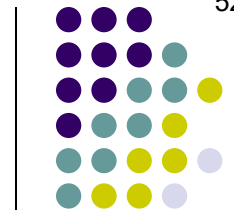
SLE

Red excematous periorbital skin

Peripheral ulcerative keratitis

Involves complement

Phlyctenulosis



Hypersensitivity Reactions of the Ocular Surface

Divvy 'em up

Anaphylaxis

Type I

Topical anesthetics

Anaphylaxis

IgE

Histamine release

Cytotoxic Ab

Type II

*Immune-complex
reactions*

Type III

*Cell-mediated
reactions*

Type IV

Neomycin

*Cicatricial pemphigoid is now referred to by what name in the
BCSC Cornea book?*

Mucous membrane pemphigoid (MMP)

Atropine

Contact dermatitis

Chemosis

PK rejection

SLE

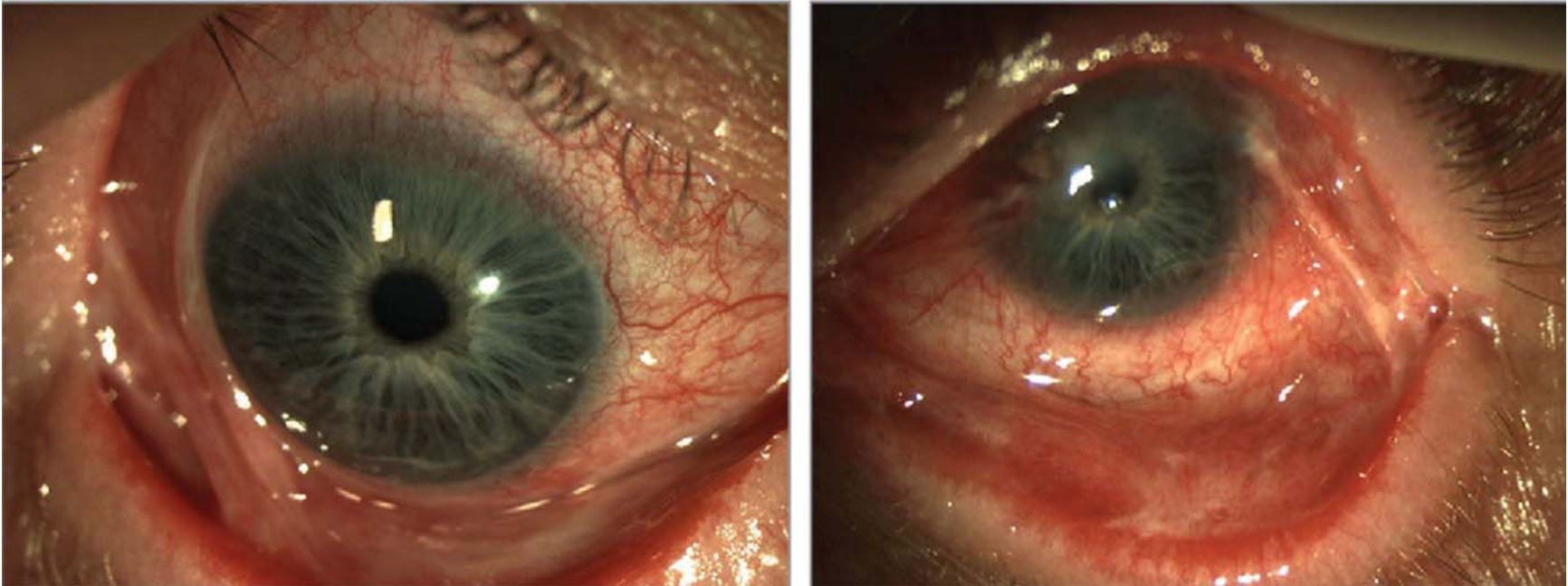
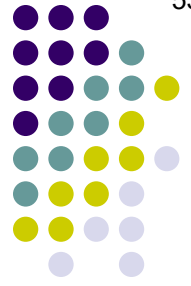
Red excematous periorbital skin

Peripheral ulcerative keratitis

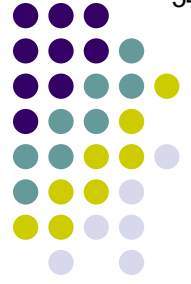
Involves complement

Phlyctenulosis

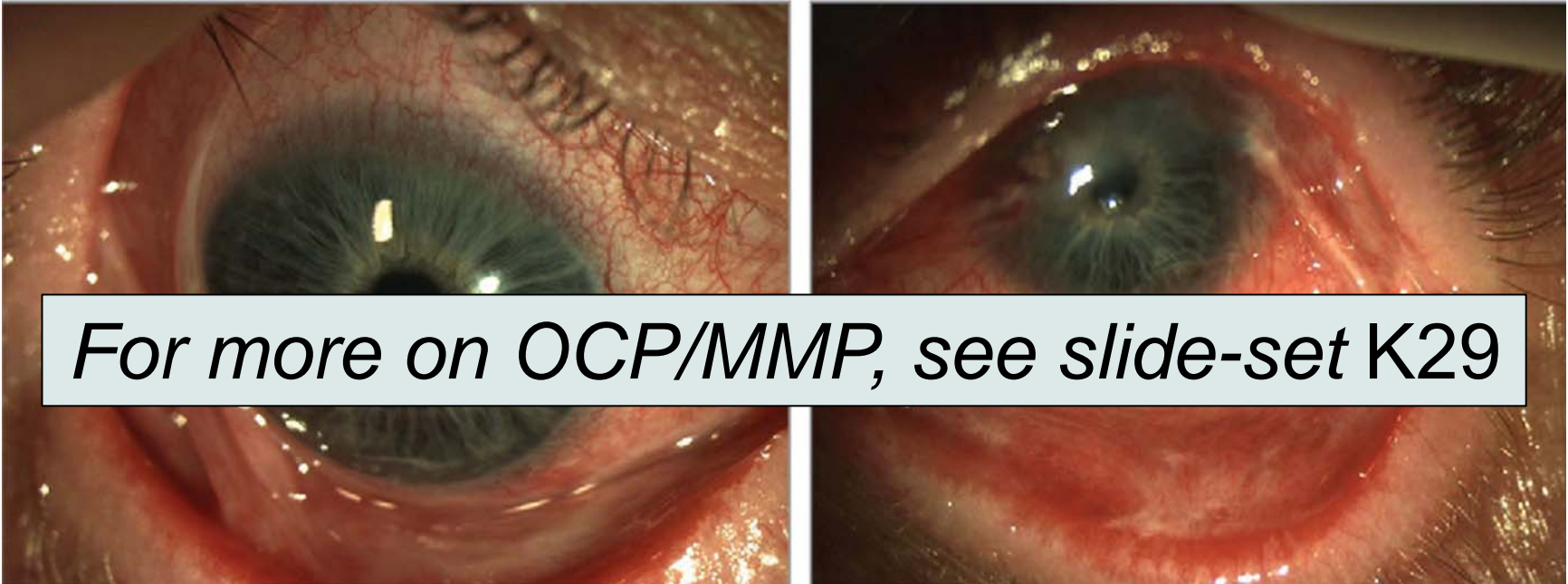
Hypersensitivity Reactions of the Ocular Surface
Divvy 'em up



OCP/MMP

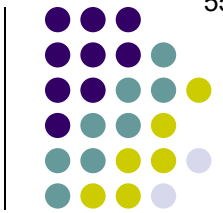


Hypersensitivity Reactions of the Ocular Surface
Divvy 'em up



For more on OCP/MMP, see slide-set K29

OCP/MMP



Hypersensitivity Reactions of the Ocular Surface
Divvy 'em up

Anaphylaxis

Type I

Topical anesthetics

Anaphylaxis

IgE

Histamine release

Cytotoxic Ab

Type II

Cicatricial pemphigoid

Mast-cell degranulation

Vasculitis

Atropine

Contact dermatitis

Chemosis

PK rejection

SLE

Red excematous periorbital skin

Peripheral ulcerative keratitis

Involves complement

Phlyctenulosis

Immune-complex reactions

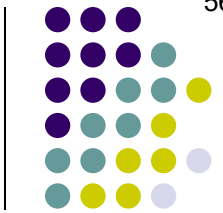
Type III

Cell-mediated reactions

Type IV

Neomycin





Hypersensitivity Reactions of the Ocular Surface
Divvy 'em up

Anaphylaxis

Type I

Topical anesthetics

Anaphylaxis

IgE

Histamine release

Mast-cell degranulation

Cytotoxic Ab

Type II

Cicatricial pemphigoid

Immune-complex reactions

Type III

Vasculitis

Atropine

Contact dermatitis

Chemosis

PK rejection

SLE

Red excematous periorbital skin

Peripheral ulcerative keratitis

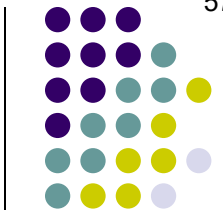
Involves complement

Phlyctenulosis

Cell-mediated reactions

Type IV

Neomycin



Hypersensitivity Reactions of the Ocular Surface
Divvy 'em up

Anaphylaxis

Type I

Topical anesthetics

Anaphylaxis

IgE

Histamine release

Mast-cell degranulation

Cytotoxic Ab

Type II

Cicatricial pemphigoid

Immune-complex reactions

Type III

Vasculitis

Atropine

Contact dermatitis

Chemosis

PK rejection

SLE

Red excematous periorbital skin

Peripheral ulcerative keratitis

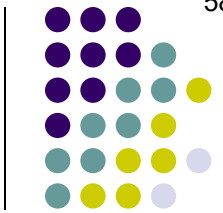
Involves complement

Phlyctenulosis

Cell-mediated reactions

Type IV

Neomycin



Hypersensitivity Reactions of the Ocular Surface
Divvy 'em up

Anaphylaxis

Type I

Topical anesthetics

Anaphylaxis

IgE

Histamine release

Mast-cell degranulation

Cytotoxic Ab

Type II

Cicatricial pemphigoid

Immune-complex reactions

Type III

Vasculitis

Contact dermatitis

Chemosis

PK rejection

SLE

Red excematous periorbital skin

Peripheral ulcerative keratitis

Involves complement

Phlyctenulosis

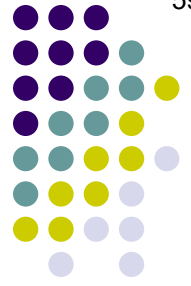
Cell-mediated reactions

Type IV

Neomycin

Atropine

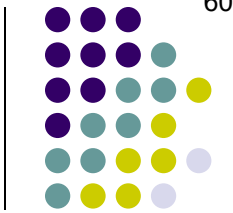
(No question on this slide—advance to the next one)



Hypersensitivity Reactions of the Ocular Surface *Divvy 'em up*



Patient using 1% atropine eye drops showing periorcular diffuse redness and swelling involving both the lids, skin erosions with focal crusting (black arrow), post inflammatory irregular hypopigmentation around lids, and madarosis of both lower lids, with erosion around lower eye lid. (b and c) Magnified picture of right and left eyes showing the typical signs of periorcular dermatitis



Hypersensitivity Reactions of the Ocular Surface
Divvy 'em up

Anaphylaxis

Type I

Topical anesthetics

Anaphylaxis

IgE

Histamine release

Mast-cell degranulation

Cytotoxic Ab

Type II

Cicatricial pemphigoid

Immune-complex reactions

Type III

Vasculitis

Contact dermatitis

Chemosis

PK rejection

SLE

Red exxematous periorbital skin

Peripheral ulcerative keratitis

Involves complement

Phlyctenulosis

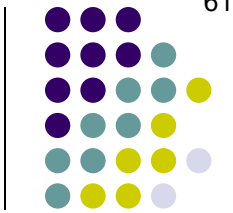
Cell-mediated reactions

Type IV

Neomycin

Atropine





Hypersensitivity Reactions of the Ocular Surface
Divvy 'em up

Anaphylaxis

Type I

Topical anesthetics

Anaphylaxis

IgE

Histamine release

Mast-cell degranulation

Cytotoxic Ab

Type II

Cicatricial pemphigoid

Immune-complex reactions

Type III

Vasculitis

Chemosis

PK rejection

SLE

Red excematous periorbital skin

Peripheral ulcerative keratitis

Involves complement

Phlyctenulosis

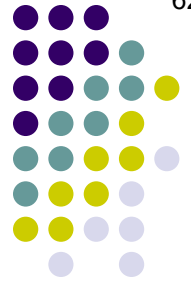
Cell-mediated reactions

Type IV

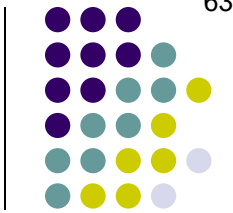
Neomycin

Atropine
Contact dermatitis

Hypersensitivity Reactions of the Ocular Surface
Divvy 'em up



Contact dermatitis



Hypersensitivity Reactions of the Ocular Surface *Divvy 'em up*

Anaphylaxis

Type I

Topical anesthetics

Anaphylaxis

IgE

Histamine release

Mast-cell degranulation

Chemosis

Cytotoxic Ab

Type II

Cicatricial pemphigoid

Immune-complex reactions

Type III

Vasculitis

PK rejection (*PK = Penetrating keratoplasty*)

SLE

Red excematous periorbital skin

Peripheral ulcerative keratitis

Involves complement

Phlyctenulosis

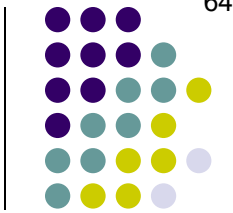
Cell-mediated reactions

Type IV

Neomycin

Atropine

Contact dermatitis



Hypersensitivity Reactions of the Ocular Surface
Divvy 'em up

Anaphylaxis

Type I

Topical anesthetics

Anaphylaxis

IgE

Histamine release

Mast-cell degranulation

Chemosis

Cytotoxic Ab

Type II

Cicatricial pemphigoid

(No question on this slide—advance)

SLE

Red excematous periorbital skin

Peripheral ulcerative keratitis

Involves complement

Phlyctenulosis

Immune-complex reactions

Type III

Vasculitis

Cell-mediated reactions

Type IV

Neomycin

Atropine
Contact dermatitis

PK rejection



Hypersensitivity Reactions of the Ocular Surface *Divvy 'em up*

I **Anaphylaxis**
Type I

II **Cytotoxic Ab reactions**
Type II

Immune-complex reactions
Type III

Cell-mediated reactions
Type IV

Topical anesthetics

Anaphylaxis
IgE
Histamine release

Mast-cell degranulation

Cicatricial pemphigoid

Vasculitis

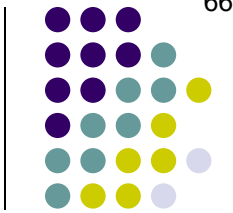
Atropine
Contact dermatitis

Chemosis

Which layer of the graft is involved in PK rejection?

PK rejection

Phlyctenulosis



Hypersensitivity Reactions of the Ocular Surface *Divvy 'em up*

I **Anaphylaxis**
Type I

II **Cytotoxic Ab reactions**
Type II

Immune-complex reactions
Type III

Cell-mediated reactions
Type IV

Topical anesthetics

Anaphylaxis
IgE
Histamine release

Mast-cell degranulation

Cicatricial pemphigoid

Vasculitis

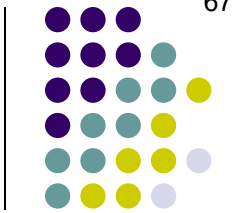
Atropine
Contact dermatitis

Chemosis

*Which layer of the graft is involved in PK rejection?
The endothelium*

PK rejection

Phlyctenulosis



Hypersensitivity Reactions of the Ocular Surface *Divvy 'em up*

I **Anaphylaxis**
Type I

II **Cytotoxic Ab reactions**
Type II

Immune-complex reactions
Type III

Cell-mediated reactions
Type IV

Topical anesthetics

Anaphylaxis
IgE
Histamine release

Mast-cell degranulation

Cicatricial pemphigoid

Vasculitis

Atropine
Contact dermatitis

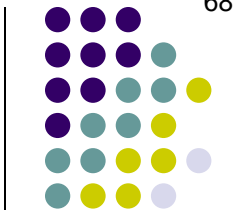
Chemosis

*Which layer of the graft is involved in PK rejection?
The endothelium*

What is the classic exam finding in endothelial rejection?

PK rejection

Phlyctenulosis



Hypersensitivity Reactions of the Ocular Surface *Divvy 'em up*

I **Anaphylaxis**
Type I

II **Cytotoxic Ab reactions**
Type II

Immune-complex reactions
Type III

Cell-mediated reactions
Type IV

Topical anesthetics

Anaphylaxis
IgE

Histamine release

Mast-cell degranulation

Cicatricial pemphigoid

Vasculitis

Neomycin

Atropine
Contact dermatitis

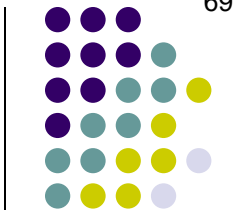
Chemosis

*Which layer of the graft is involved in PK rejection?
The endothelium*

*What is the classic exam finding in endothelial rejection?
A line of inflammatory precipitates on the endothelial surface*

PK rejection

Phlyctenulosis



Hypersensitivity Reactions of the Ocular Surface *Divvy 'em up*

I **Anaphylaxis**
Type I

II **Cytotoxic Ab reactions**
Type II

Immune-complex reactions
Type III

Cell-mediated reactions
Type IV

Topical anesthetics

Anaphylaxis
IgE
Histamine release

Mast-cell degranulation

Cicatricial pemphigoid

Vasculitis

Neomycin

Atropine
Contact dermatitis

Chemosis

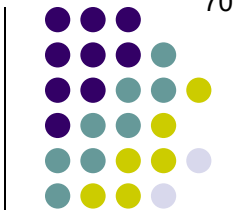
*Which layer of the graft is involved in PK rejection?
The endothelium*

*What is the classic exam finding in endothelial rejection?
A line of inflammatory precipitates on the endothelial surface*

What is the eponymous name for this finding?

PK rejection

Phlyctenulosis



Hypersensitivity Reactions of the Ocular Surface *Divvy 'em up*

I **Anaphylaxis**
Type I

II **Cytotoxic Ab reactions**
Type II

Immune-complex reactions
Type III

Cell-mediated reactions
Type IV

Topical anesthetics

Anaphylaxis
IgE

Histamine release

Mast-cell degranulation

Cicatricial pemphigoid

Vasculitis

Neomycin

Atropine
Contact dermatitis

Chemosis

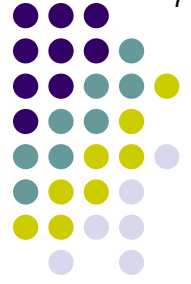
*Which layer of the graft is involved in PK rejection?
The endothelium*

*What is the classic exam finding in endothelial rejection?
A line of inflammatory precipitates on the endothelial surface*

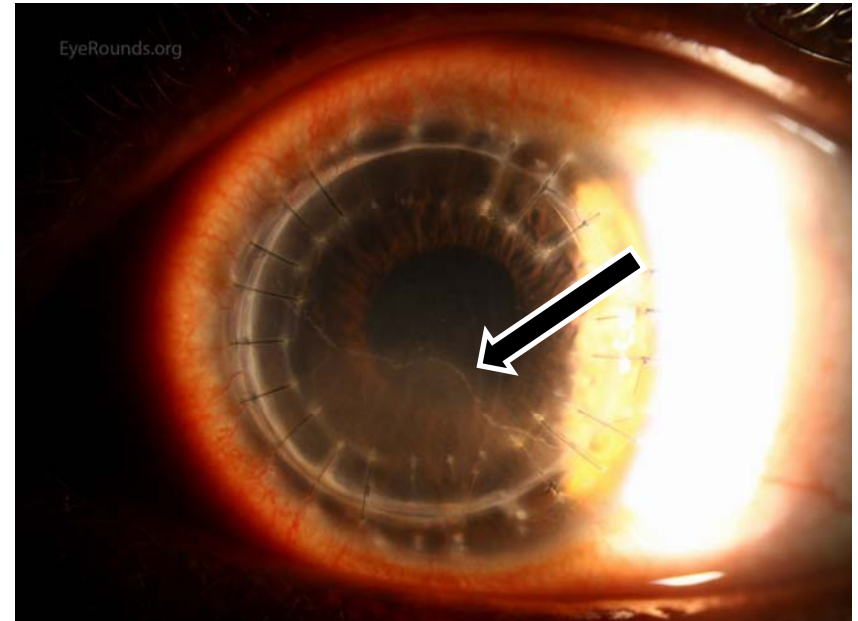
*What is the eponymous name for this finding?
A **Khodadoust line***

PK rejection

Phlyctenulosis



Hypersensitivity Reactions of the Ocular Surface
Divvy 'em up



Khodadoust line



Hypersensitivity Reactions of the Ocular Surface
Divvy 'em up

Anaphylaxis

Type I

Topical anesthetics

Anaphylaxis

IgE

Histamine release

Mast-cell degranulation

Chemosis

Cytotoxic Ab

Type II

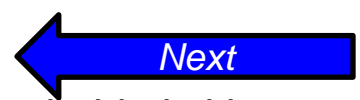
Cicatricial pemphigoid

Immune-complex reactions

Type III

Vasculitis

SLE



Red excematous periorbital skin

Peripheral ulcerative keratitis

Involves complement

Phlyctenulosis

Cell-mediated reactions

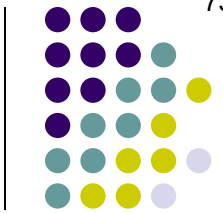
Type IV

Neomycin

Atropine

Contact dermatitis

PK rejection



Hypersensitivity Reactions of the Ocular Surface
Divvy 'em up

Anaphylaxis

Type I

Topical anesthetics

Anaphylaxis

IgE

Histamine release

Mast-cell degranulation

Chemosis

Cytotoxic Ab

Type II

Cicatricial pemphigoid

Immune-complex reactions

Type III

Vasculitis

SLE

Red excematous periorbital skin

Peripheral ulcerative keratitis

Involves complement

Phlyctenulosis

Cell-mediated reactions

Type IV

Neomycin

Atropine

Contact dermatitis

PK rejection



Hypersensitivity Reactions of the Ocular Surface
Divvy 'em up

Anaphylaxis

Type I

Topical anesthetics

Anaphylaxis

IgE

Histamine release

Mast-cell degranulation

Chemosis

Cytotoxic Ab

Type II

Cicatricial pemphigoid

Immune-complex reactions

Type III

Vasculitis

SLE

Peripheral ulcerative keratitis (PUK)

Involves complement

Phlyctenulosis

Cell-mediated reactions

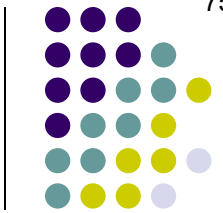
Type IV

Neomycin

Atropine
Contact dermatitis

PK rejection

Red excematous periorbital skin



Hypersensitivity Reactions of the Ocular Surface
Divvy 'em up

Anaphylaxis

Type I

Topical anesthetics

Anaphylaxis

IgE

Histamine release

Mast-cell degranulation

Chemosis

Cytotoxic Ab

Type II

Cicatricial pemphigoid

(No question here—¡Vamos!)

Involves complement
Phlyctenulosis

Immune-complex reactions

Type III

Vasculitis

SLE

PUK

Cell-mediated reactions

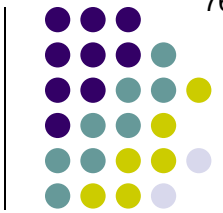
Type IV

Neomycin

Atropine
Contact dermatitis

PK rejection

Red excematous periorbital skin



Hypersensitivity Reactions of the Ocular Surface *Divvy 'em up*

Anaphylaxis

Cytotoxic Ab

Immune-complex reactions

Cell-mediated reactions

Type I

Type II

Type III

Type IV

Topical anesthetics

Neomycin

Anaphylaxis
IgE

Histamine release

Mast-cell degranulation

What classes of systemic conditions are associated with PUK?

Chemosis

ne
dermatitis
ction
matous
skin

PUK

Involves complement
Phlyctenulosis



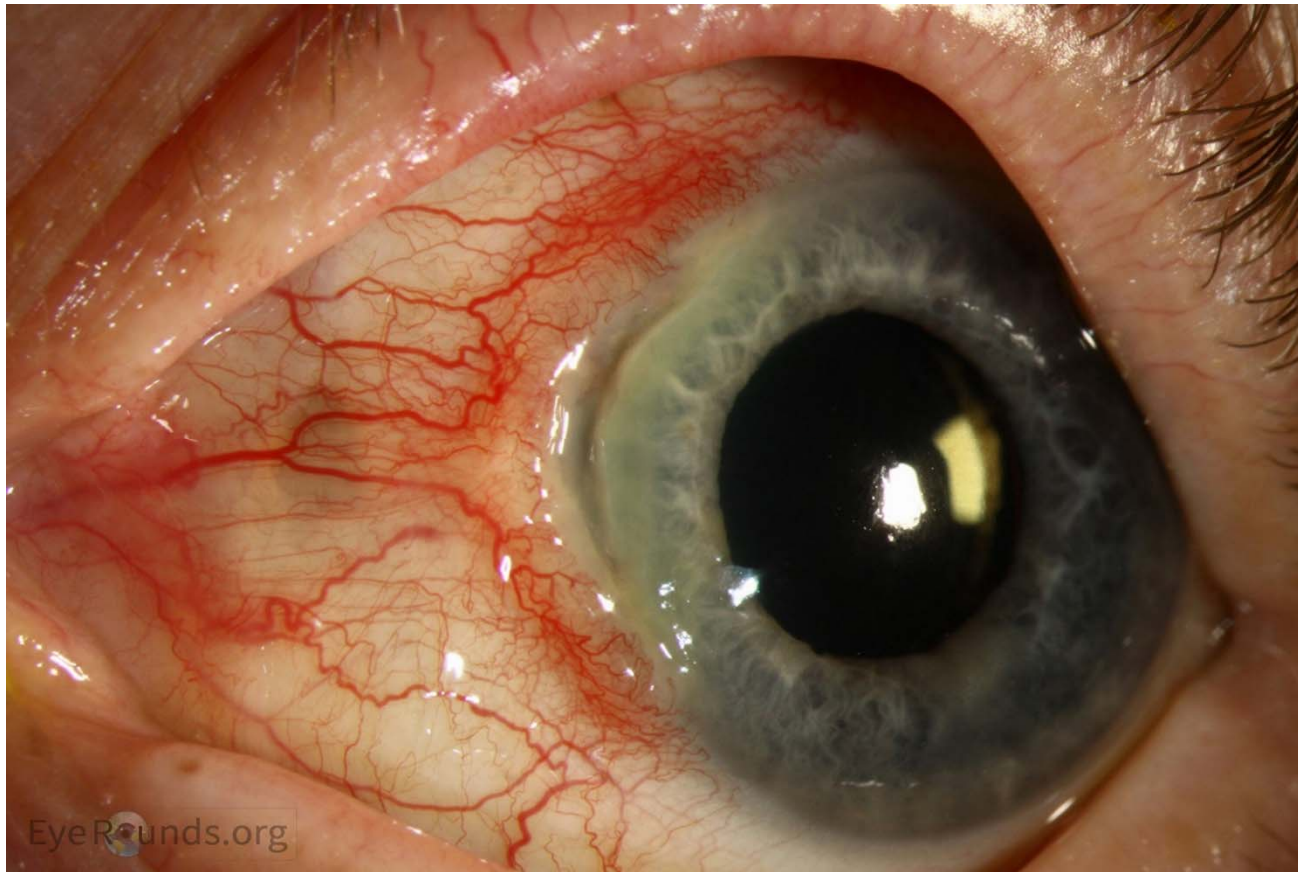
Hypersensitivity Reactions of the Ocular Surface Divvy 'em up

<i>Anaphylaxis</i>	<i>Cytotoxic Ab</i>	<i>Immune-complex reactions</i>	<i>Cell-mediated reactions</i>
<i>Type I</i>	<i>Type II</i>	<i>Type III</i>	<i>Type IV</i>
Topical anesthetics			
Anaphylaxis IgE			
Histamine release			
Mast-cell degranulation			
Chemosis			
		<p><i>What classes of systemic conditions are associated with PUK?</i> Connective-tissue diseases (CTDs) and vasculitides</p>	
		Involves complement Phlyctenulosis	Neomycin

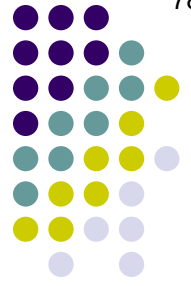
PUK

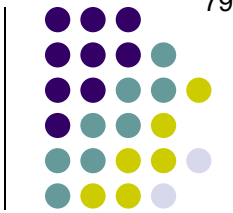
ne
dermatitis
ction
nathous
skin

Hypersensitivity Reactions of the Ocular Surface
Divvy 'em up



PUK 2ndry to CTD/vasculitis





Hypersensitivity Reactions of the Ocular Surface
Divvy 'em up

Anaphylaxis

Cytotoxic Ab

Immune-complex reactions

Cell-mediated reactions

Type I

Type II

Type III

Type IV

Topical anesthetics

Neomycin

Anaphylaxis

IgE

Histamine release

Mast-cell degranulation

What classes of systemic conditions are associated with PUK?
Connective-tissue diseases (CTDs) and vasculitides

With which CTDs and/or vasculitides has PUK been associated?

Chemosis

PUK

Involves complement

Phlyctenulosis

ne
dermatitis

ction

matous
skin



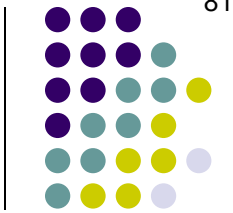
Hypersensitivity Reactions of the Ocular Surface Divvy 'em up

<i>Anaphylaxis</i>	<i>Cytotoxic Ab</i>	<i>Immune-complex reactions</i>	<i>Cell-mediated reactions</i>
<i>Type I</i>	<i>Type II</i>	<i>Type III</i>	<i>Type IV</i>
Topical anesthetics			Neomycin
Anaphylaxis IgE Histamine release			
Mast-cell degranulation			
Chemosis			
		Involves complement Phlyctenulosis	

What classes of systemic conditions are associated with PUK?
 Connective-tissue diseases (CTDs) and vasculitides

With which CTDs and/or vasculitides has PUK been associated?
 Pretty much all of them

PUK



Hypersensitivity Reactions of the Ocular Surface *Divvy 'em up*

Anaphylaxis

Cytotoxic Ab

Immune-complex reactions

Cell-mediated reactions

Type I

Type II

Type III

Type IV

Topical anesthetics

Anaphylaxis

IgE

Histamine release

Mast-cell degranulation

What classes of systemic conditions are associated with PUK?

Connective-tissue diseases (CTDs) and vasculitides

With which CTDs and/or vasculitides has PUK been associated?

Pretty much all of them

Which three conditions are most likely to present with PUK?

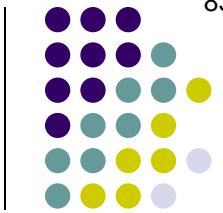
Chemosis

PUK

Involves complement

Phlyctenulosis

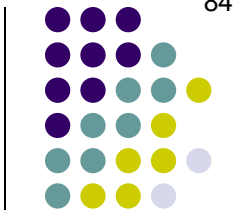
ne
dermatitis
ction
matous
skin



Hypersensitivity Reactions of the Ocular Surface *Divvy 'em up*

<i>Anaphylaxis</i>	<i>Cytotoxic Ab</i>	<i>Immune-complex reactions</i>	<i>Cell-mediated reactions</i>
<i>Type I</i>	<i>Type II</i>	<i>Type III</i>	<i>Type IV</i>
Topical anesthetics			Neomycin
Anaphylaxis IgE Histamine release			
Mast-cell degranulation		<p><i>What classes of systemic conditions are associated with PUK?</i> Connective-tissue diseases (CTDs) and vasculitides</p> <p><i>With which CTDs and/or vasculitides has PUK been associated?</i> Pretty much all of them</p> <p><i>Which three conditions are most likely to present with PUK?</i> Rheumatoid arthritis, Wegener's granulomatosis, and polyarteritis nodosa</p> <p><i>Of these three, which is most likely to be associated with PUK?</i></p>	
Chemosis			
		Involves complement Phlyctenulosis	

PUK



Hypersensitivity Reactions of the Ocular Surface *Divvy 'em up*

Anaphylaxis

Cytotoxic Ab

Immune-complex reactions

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Type I

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Topical anesthetics

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Chemosis

What classes of systemic conditions are associated with PUK?

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With which CTDs and/or vasculitides has PUK been associated?

Pretty much all of them

Which three conditions are most likely to present with PUK?

Rheumatoid arthritis, Wegener's granulomatosis, and polyarteritis nodosa

Of these three, which is most likely to be associated with PUK?

RA, by a substantial margin

PUK

Involves complement

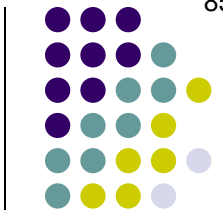
Phlyctenulosis

Neomycin

ne
dermatitis

ction

matous
skin



Hypersensitivity Reactions of the Ocular Surface
Divvy 'em up

Anaphylaxis

Cytotoxic Ab

Immune-complex reactions

Cell-mediated reactions

Type I

Type II

Type III

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Topical anesthetics

Neomycin

Anaphylaxis

IgE

Histamine release

Cicatricial pemphigoid

Mast-cell degranulation

Vasculitis

Atropine
Contact dermatitis

Chemosis

PK rejection

SLE

Red excematous periorbital skin

PUK



Involves complement
Phlyctenulosis



Hypersensitivity Reactions of the Ocular Surface
Divvy 'em up

Anaphylaxis

Type I

Topical anesthetics

Anaphylaxis

IgE

Histamine release

Mast-cell degranulation

Chemosis

Cytotoxic Ab

Type II

Cicatricial pemphigoid

Involves complement

Phlyctenulosis

Immune-complex reactions

Type III

Vasculitis

SLE

PUK

Cell-mediated reactions

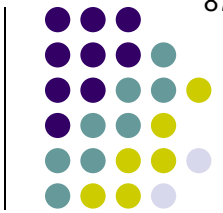
Type IV

Neomycin

Atropine
Contact dermatitis

PK rejection

Red excematous
periorbital skin



Hypersensitivity Reactions of the Ocular Surface
Divvy 'em up

Anaphylaxis

Type I

Topical anesthetics

Anaphylaxis

IgE

Histamine release

Mast-cell degranulation

Chemosis

Cytotoxic Ab

Type II

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Involves complement

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Type III

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PUK

Cell-mediated reactions

Type IV

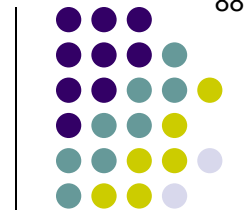
Neomycin

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Contact dermatitis

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Red excematous periorbital skin

Phlyctenulosis



Hypersensitivity Reactions of the Ocular Surface
Divvy 'em up

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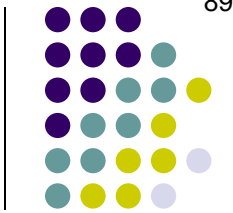
What is phlyctenulosis?

Atropine
Contact dermatitis

PK rejection

Red excematous
periorbital skin

Phlyctenulosis



Hypersensitivity Reactions of the Ocular Surface
Divvy 'em up

<i>Anaphylaxis</i>	<i>Cytotoxic Ab</i>	<i>Immune-complex reactions</i>	<i>Cell-mediated reactions</i>
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Topical anesthetics			Neomycin
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			PK rejection
			Red excematous periorbital skin

What is phlyctenulosis?
 An inflammatory condition characterized by the presence of phlyctenules

Phlyctenulosis



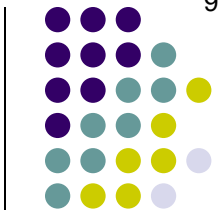
Hypersensitivity Reactions of the Ocular Surface *Divvy 'em up*

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OK, what are phlyctenules?

Phlyctenulosis



Hypersensitivity Reactions of the Ocular Surface

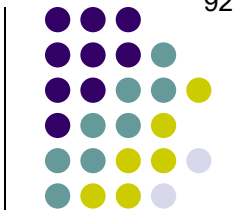
Divvy 'em up

<i>Anaphylaxis</i>	<i>Cytotoxic Ab</i>	<i>Immune-complex reactions</i>	<i>Cell-mediated reactions</i>
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What is phlyctenulosis?
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OK, what are phlyctenules?
 Nodules composed of chronic inflammatory cells

Phlyctenulosis



Hypersensitivity Reactions of the Ocular Surface *Divvy 'em up*

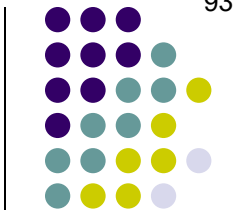
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What do phlyctenules look like?

Phlyctenulosis



Hypersensitivity Reactions of the Ocular Surface *Divvy 'em up*

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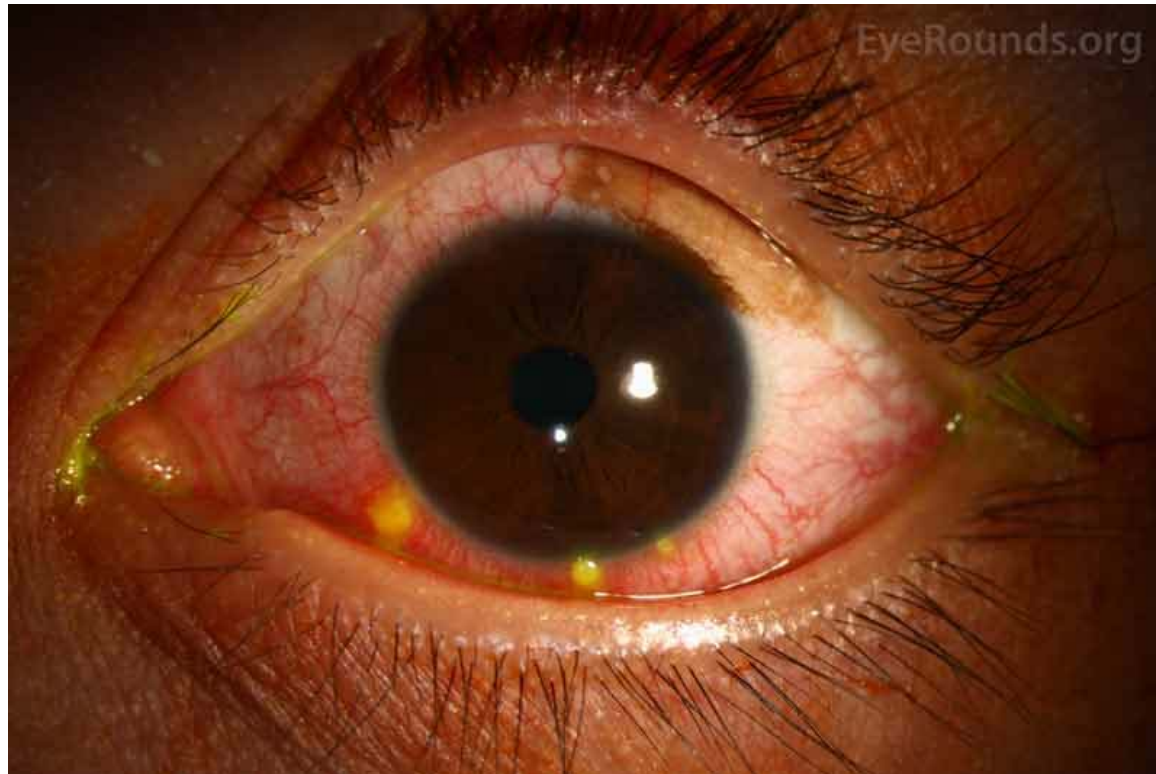
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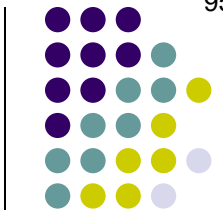
What do phlyctenules look like?
They are small nodules, gray or yellow in color, that are associated with exuberantly hyperemic vessels

Phlyctenulosis

Hypersensitivity Reactions of the Ocular Surface
Divvy 'em up



Phlyctenules



Hypersensitivity Reactions of the Ocular Surface *Divvy 'em up*

<i>Anaphylaxis</i>	<i>Cytotoxic Ab</i>	<i>Immune-complex reactions</i>	<i>Cell-mediated reactions</i>
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Topical anesthetics			Neomycin
Anaphylaxis IgE	Cytotoxic		

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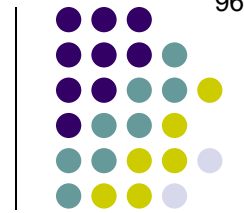
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Where are phlyctenules located?

- Atropine
- Contact dermatitis
- PK rejection
- Red excematous periorbital skin

Phlyctenulosis



Hypersensitivity Reactions of the Ocular Surface *Divvy 'em up*

Anaphylaxis

Cytotoxic Ab

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Type I

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Topical anesthetics

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Where are phlyctenules located?

They can be on the conj, at the limbus or on the cornea

Atropine
Contact dermatitis

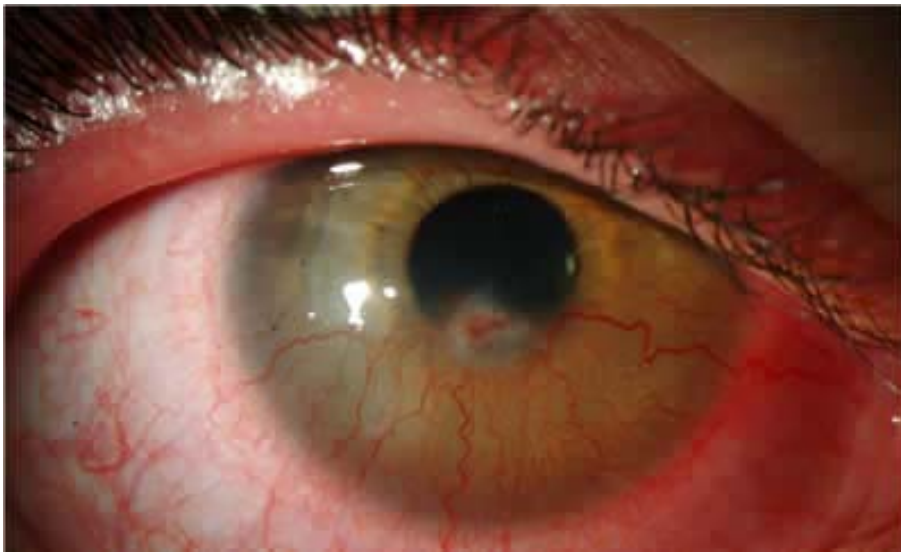
PK rejection

Red excematous periorbital skin

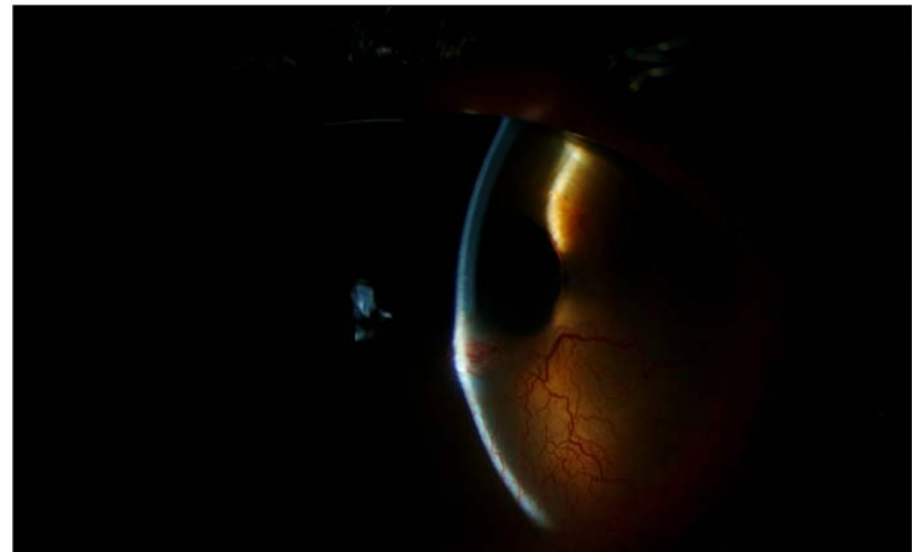
Phlyctenulosis



Hypersensitivity Reactions of the Ocular Surface
Divvy 'em up

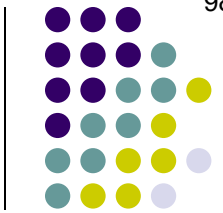


Phlyctenule



Same phlyctenule (pic to show elevation)

Corneal phlyctenule



Hypersensitivity Reactions of the Ocular Surface *Divvy 'em up*

<i>Anaphylaxis</i>	<i>Cytotoxic Ab</i>	<i>Immune-complex reactions</i>	<i>Cell-mediated reactions</i>
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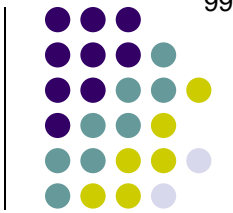
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Where are phlyctenules located?
 They can be on the conj, at the limbus or on the cornea

What is the inciting antigen?

Phlyctenulosis



Hypersensitivity Reactions of the Ocular Surface *Divvy 'em up*

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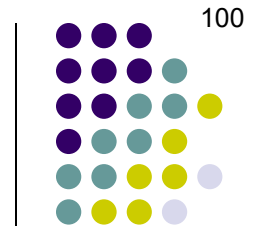
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What is the inciting antigen?
 In developed nations, usually bug

Phlyctenulosis

Hypersensitivity Reactions of the Ocular Surface

Divvy 'em up



Anaphylaxis

Cytotoxic Ab

Immune-complex reactions

Cell-mediated reactions

Type I

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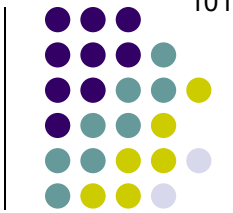
In developed nations, usually *S aureus*

Atropine
Contact dermatitis

PK rejection

Red excematous periorbital skin

Phlyctenulosis



Hypersensitivity Reactions of the Ocular Surface *Divvy 'em up*

<i>Anaphylaxis</i>	<i>Cytotoxic Ab</i>	<i>Immune-complex reactions</i>	<i>Cell-mediated reactions</i>
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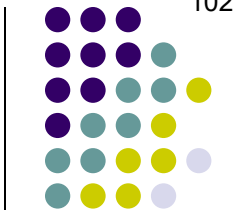
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Phlyctenulosis



Hypersensitivity Reactions of the Ocular Surface Divvy 'em up

<i>Anaphylaxis</i>	<i>Cytotoxic Ab</i>	<i>Immune-complex reactions</i>	<i>Cell-mediated reactions</i>
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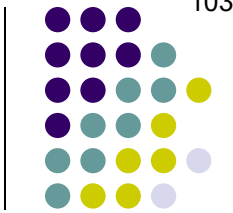
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Phlyctenulosis



Hypersensitivity Reactions of the Ocular Surface Divvy 'em up

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IgE	Cytotoxic		

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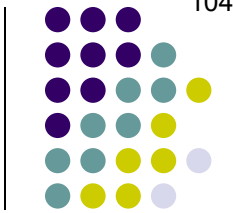
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What is the inciting antigen?

In developed nations, usually *S aureus* ; however, in developing nations it is often TB (especially in cases involving classic at-risk pop. (two words))

- Atropine
- Contact dermatitis
- PK rejection
- Red excematous periorbital skin

Phlyctenulosis



Hypersensitivity Reactions of the Ocular Surface *Divvy 'em up*

<i>Anaphylaxis</i>	<i>Cytotoxic Ab</i>	<i>Immune-complex reactions</i>	<i>Cell-mediated reactions</i>
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Phlyctenulosis