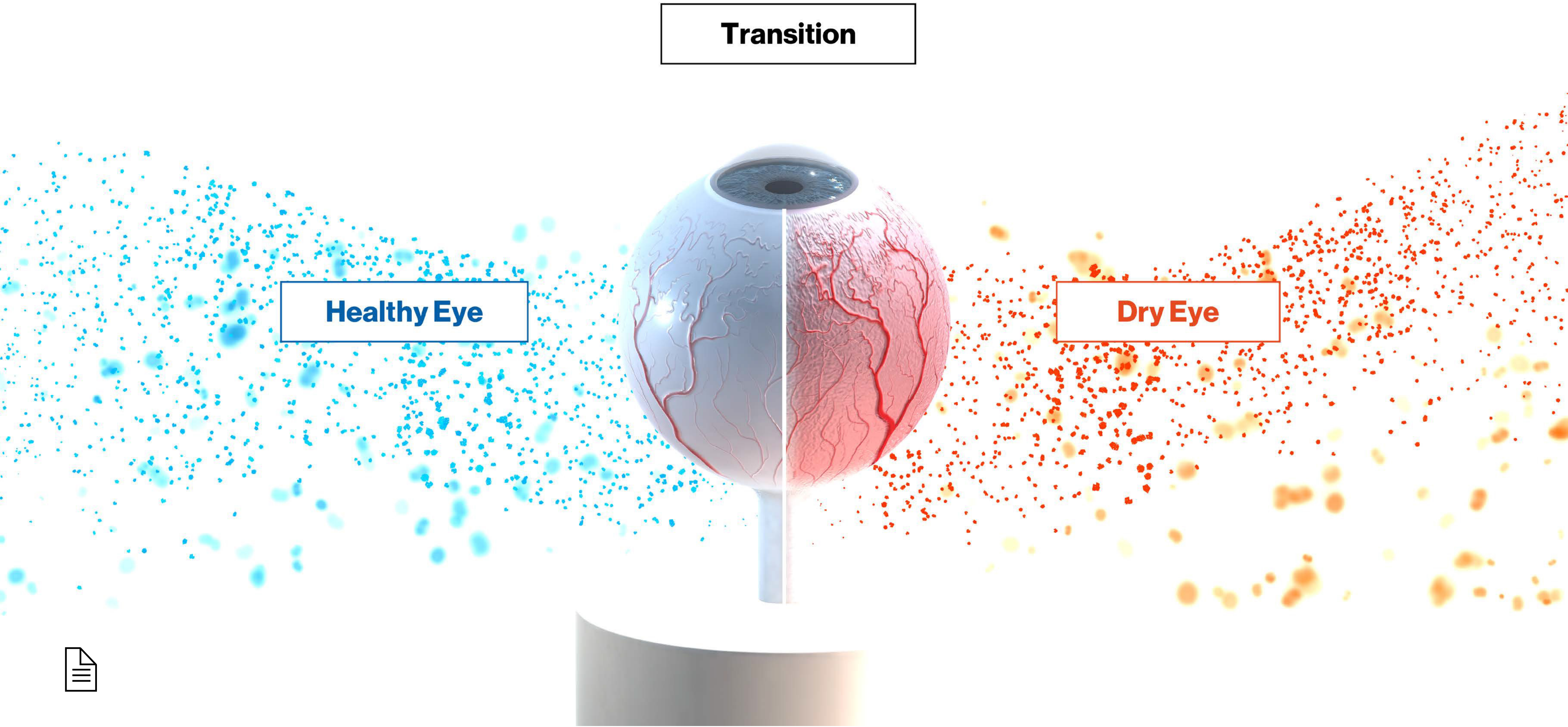


Dry Eye Disease (DED)

Development, symptoms, and triggers



Dry Eye Disease (DED)

Development, symptoms, and triggers

Healthy Eye

Overview

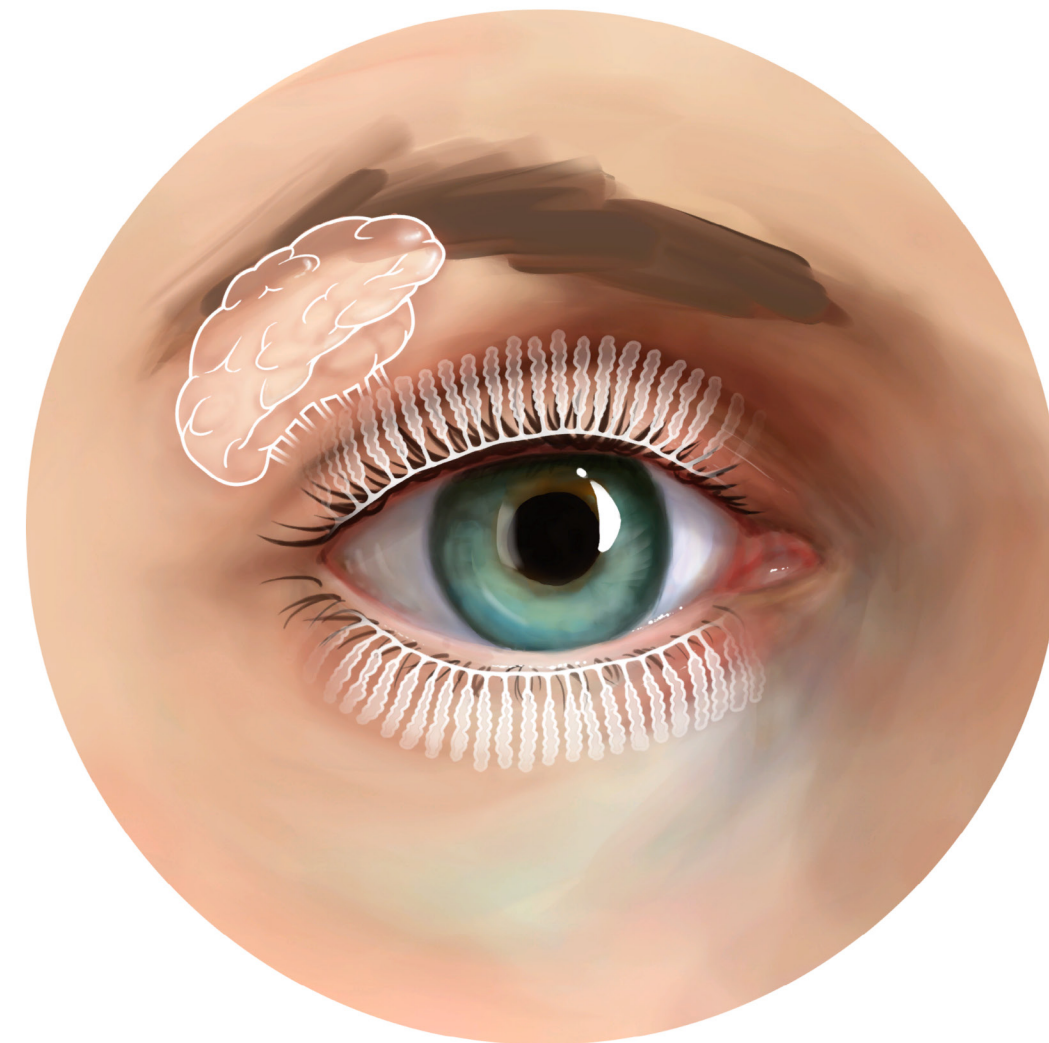
Ocular adnexa (adjacent to eye)¹

- Eyelids
- Lacrimal system
- Orbit
- Connecting muscles and nerves

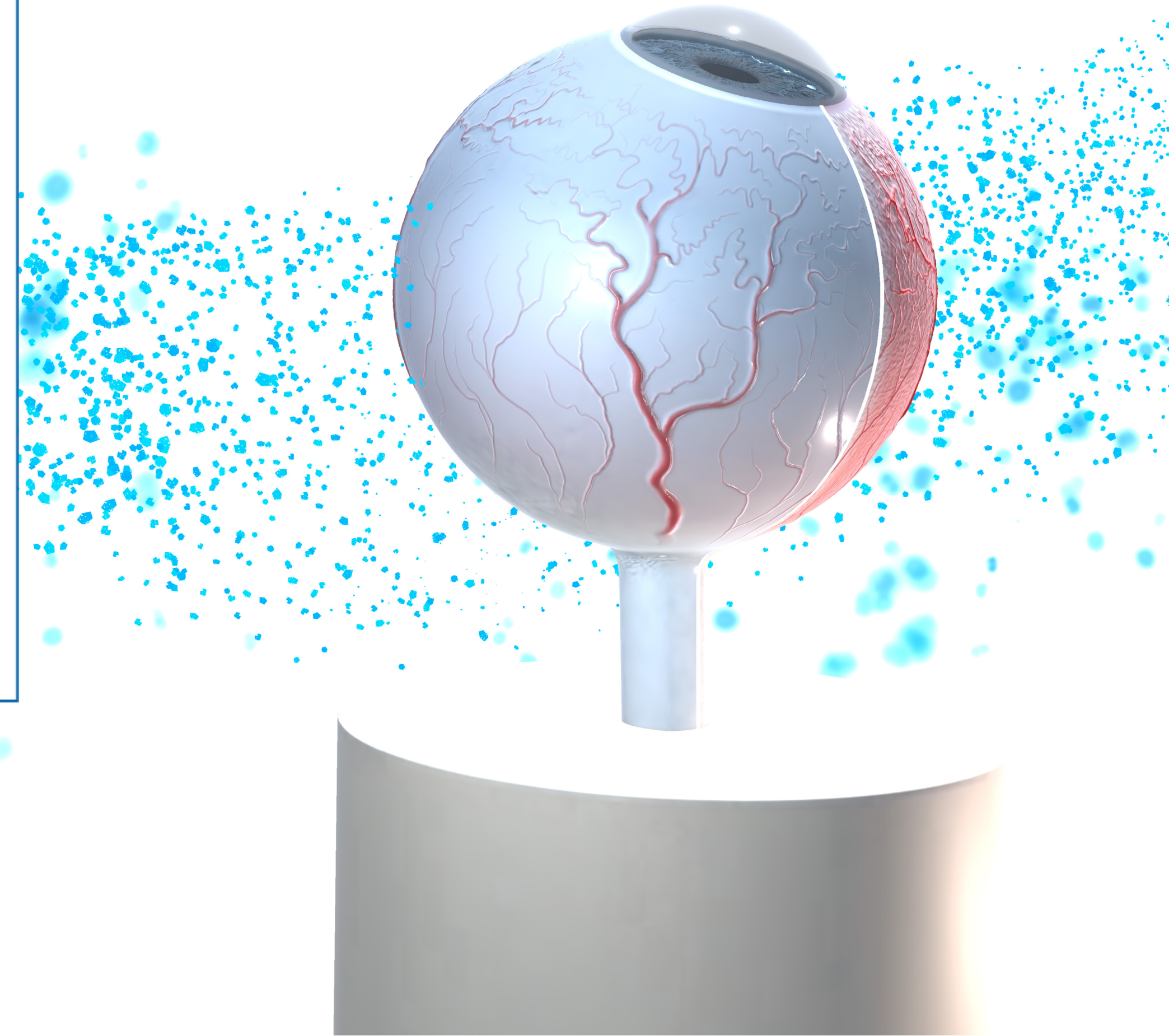
Ocular surface¹

- Cornea
- Conjunctiva
- Tear film

Meibomian glands¹



Teardrop Composition

















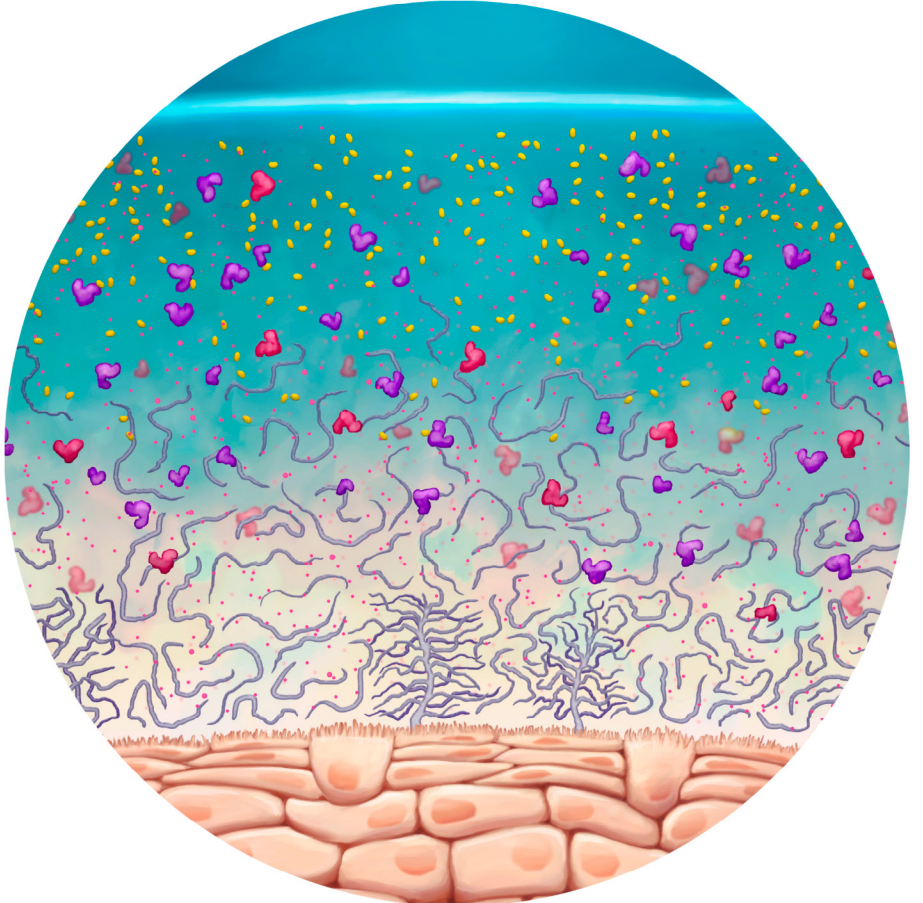







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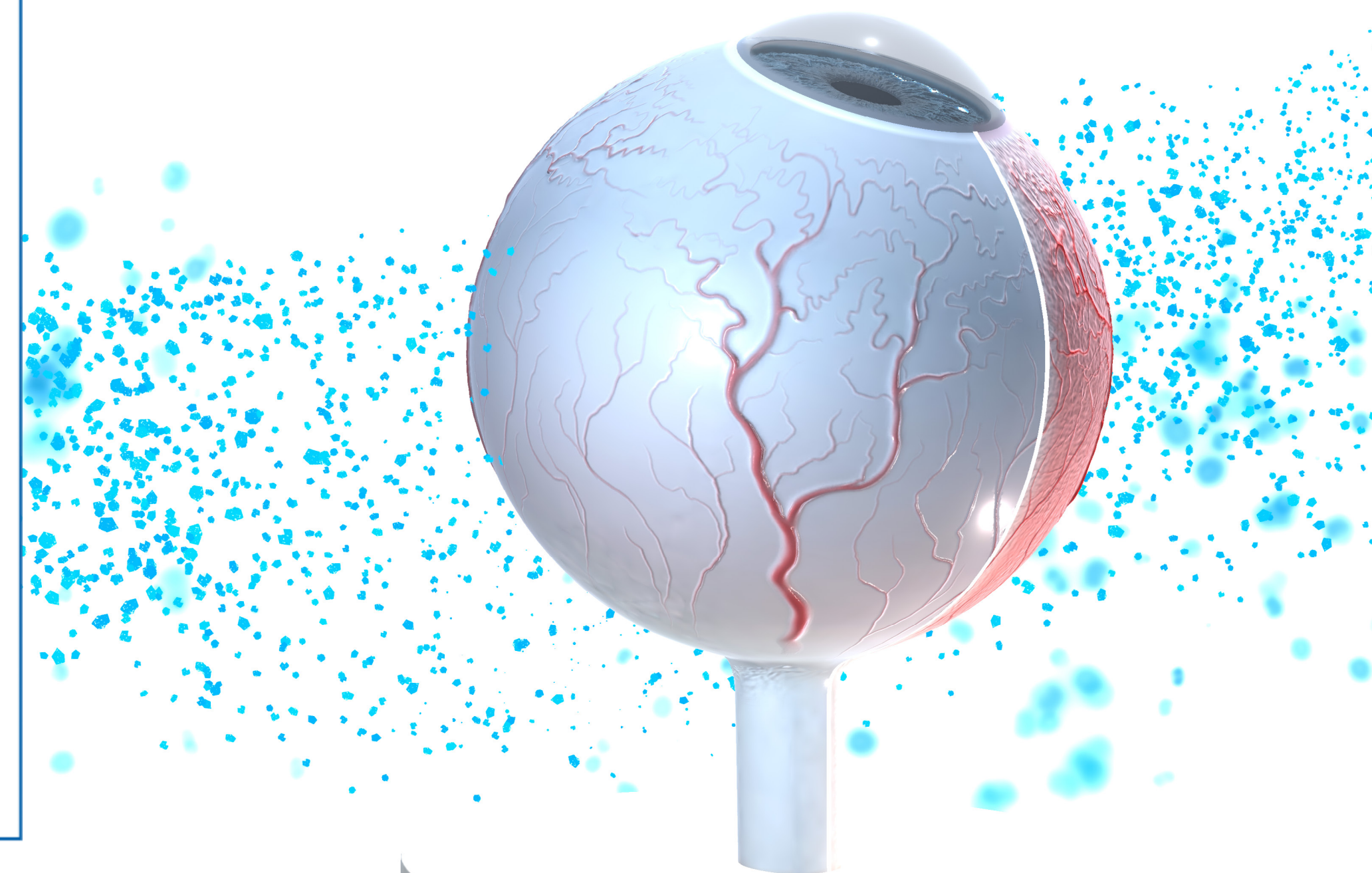


Dry Eye Disease (DED)

Development, symptoms, and triggers

Healthy Eye

Overview	Teardrop Composition																		
<p>Tears provide²:</p> <ul style="list-style-type: none">• Ocular surface homeostasis by preserving smooth optical surface• Maintenance of corneal and conjunctival epithelia• Protection from environment and microbial infections <p>Legend:</p> <table><tr><td></td><td>Tear film</td><td></td><td>Pro-inflammatory cytokines</td><td></td><td>Soluble mucin 5AC</td></tr><tr><td></td><td>Proteases</td><td></td><td>Electrolytes (Na⁺)</td><td></td><td>Epithelial cells</td></tr><tr><td></td><td>Antimicrobial proteins</td><td></td><td></td><td></td><td></td></tr></table>		Tear film		Pro-inflammatory cytokines		Soluble mucin 5AC		Proteases		Electrolytes (Na ⁺)		Epithelial cells		Antimicrobial proteins					
	Tear film		Pro-inflammatory cytokines		Soluble mucin 5AC														
	Proteases		Electrolytes (Na ⁺)		Epithelial cells														
	Antimicrobial proteins																		



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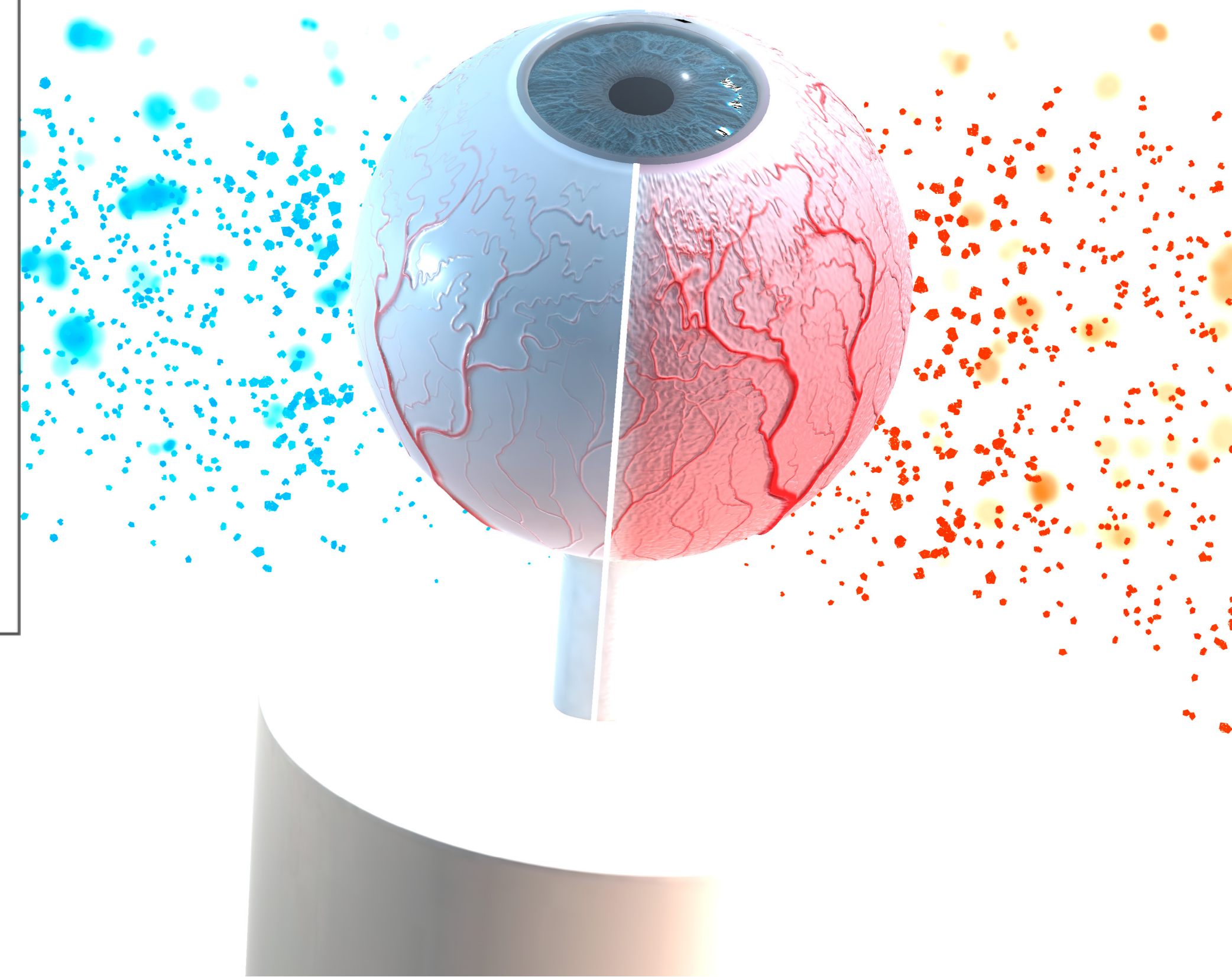
Transition

Overview

Various Factors That Impact Tear Film Function

- Numerous factors can make the tear film dysfunctional, causing a number of changes to the eye surface^{3,4}
- A prompt adaptive corrective response from the eye surface system is needed to compensate for tear film dysfunction, otherwise damage may begin in the form of a vicious self-sustaining cycle^{3,4}




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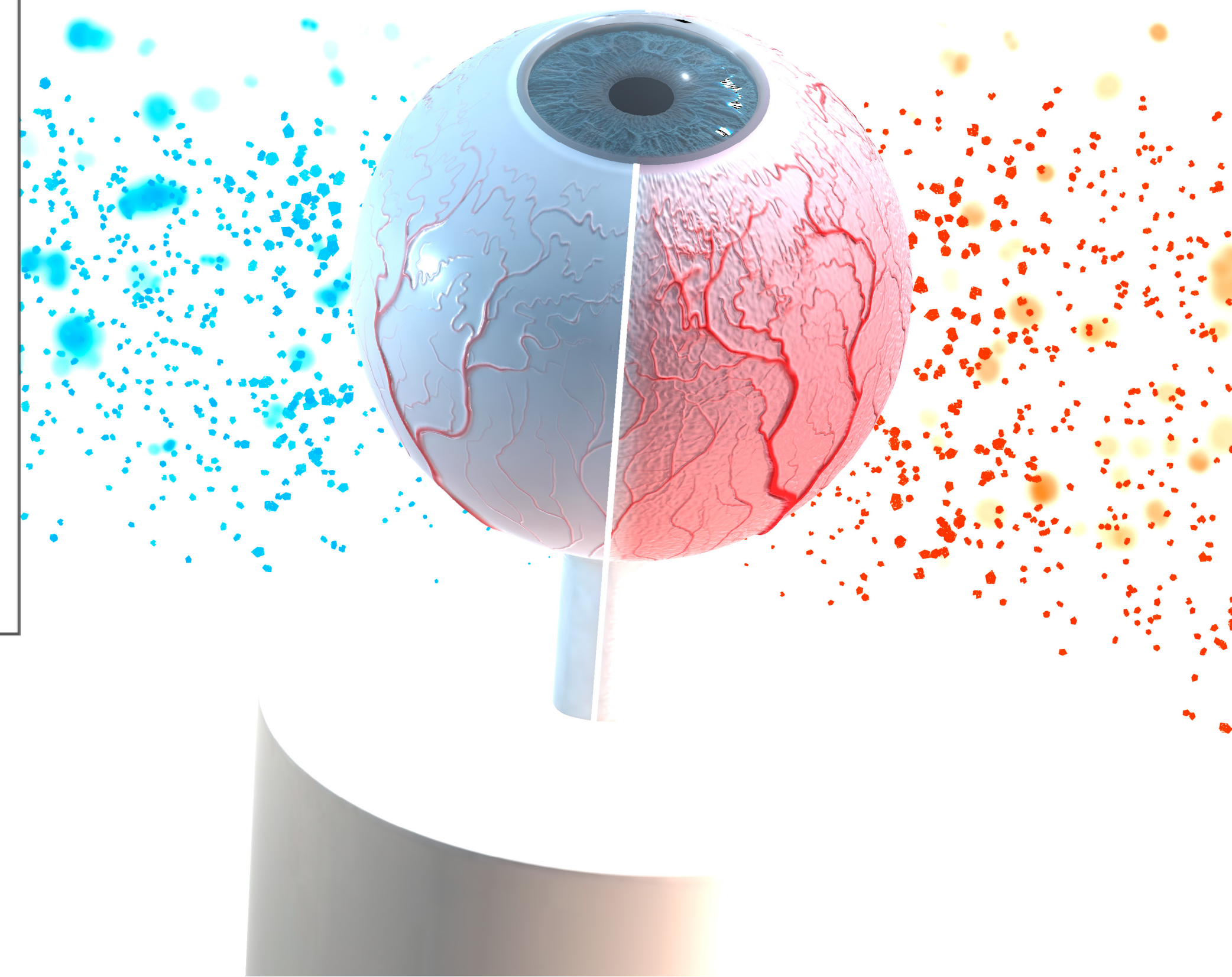
Dry Eye Disease (DED)

Development, symptoms, and triggers

Transition

Overview	Various Factors That Impact Tear Film Function	
	<ul style="list-style-type: none">• Age⁵• Sex⁶	<ul style="list-style-type: none">• Ethnicity⁶• Low blink rate⁵
	<ul style="list-style-type: none">• Computer work⁵• Environment⁵• Contact lenses⁵	<ul style="list-style-type: none">• Refractive surgery⁵• Systemic drugs⁵
	<ul style="list-style-type: none">• Infection⁵• Systemic diseases⁵• Allergy⁵• Neurotropic deficiencies⁵	<ul style="list-style-type: none">• Meibomian gland disease⁶• Autoimmune disease⁵• Lid margin irregularities⁵

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Dry Eye Disease (DED)

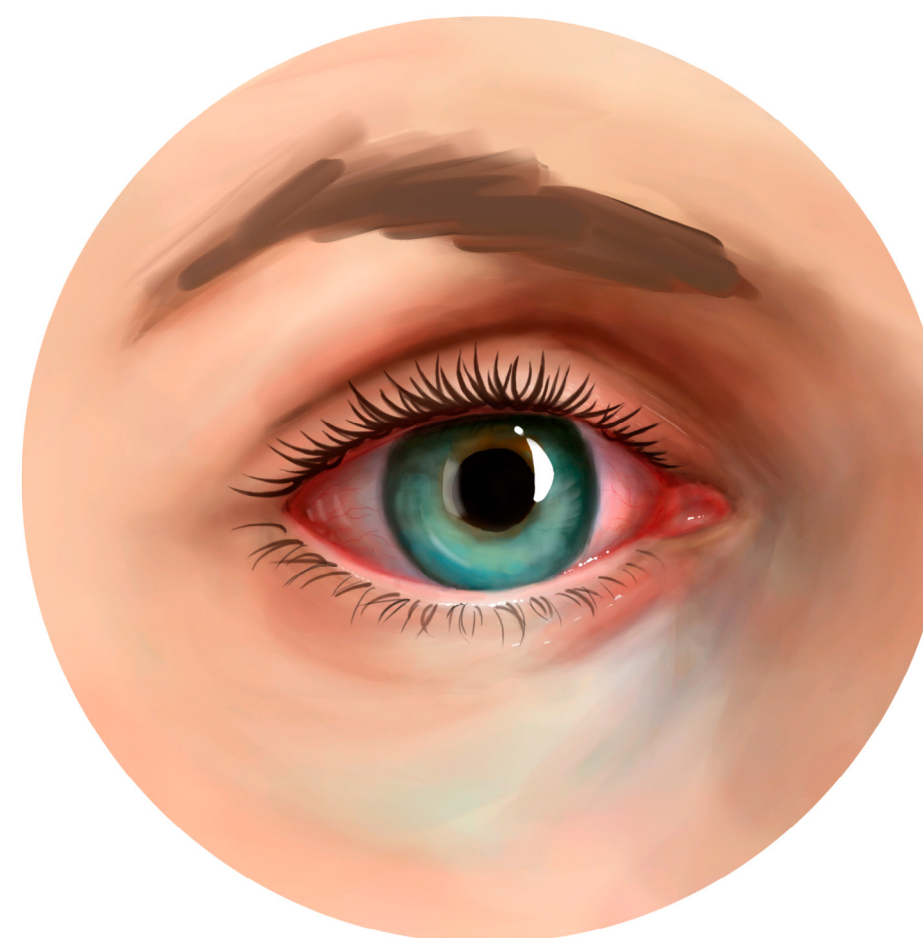
Development, symptoms, and triggers

Dry Eye

Overview

Teardrop Composition

Tear Film Breakup Time



- Dry Eye Disease (DED), also known as keratoconjunctivitis sicca, can develop due to tear hyperosmolarity, tear film dysfunction, and lack of adaptation^{1,7,8}
- Loss of tear film homeostasis along with ocular symptoms can occur due to tear film instability, hyperosmolarity, ocular surface inflammation/damage, and neurosensory abnormalities, all of which can drive DED pathogenesis⁹
- Patient symptoms may include light sensitivity, foreign body sensation, pain, dryness, and irritation¹

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Dry Eye Disease (DED)

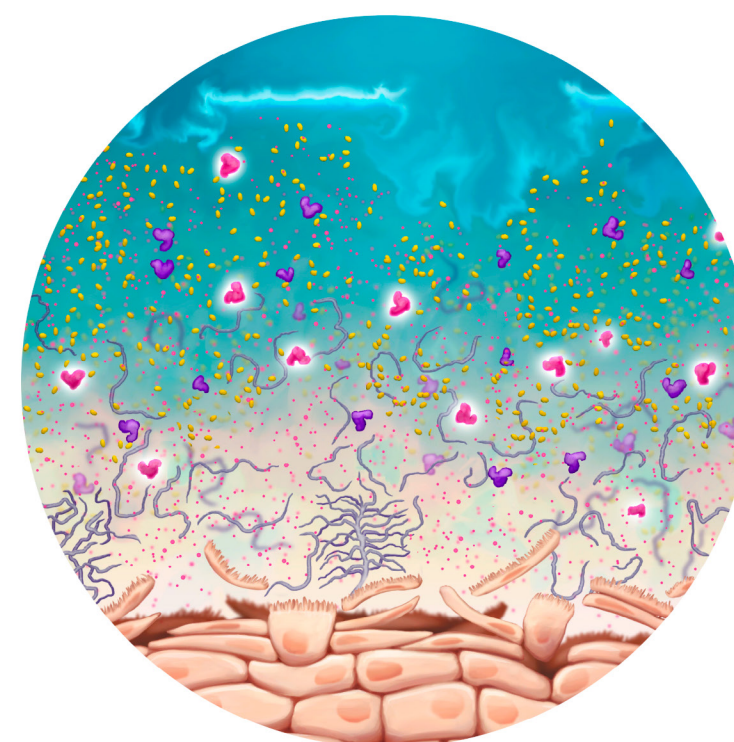
Development, symptoms, and triggers

Dry Eye

Overview

Teardrop Composition

Tear Film Breakup Time



The tear film is composed of a muco-aqueous phase overlaid by a lipid layer^{2,9}:

- Mucins – produced by conjunctival goblet cells
 - Provide viscosity and stability during blink cycle in the muco-aqueous layer
- Aqueous – produced by lacrimal glands
 - Provide a complex mixture of water, proteins, electrolytes, etc. in the muco-aqueous phase
- Lipids – produced by meibomian glands
 - Maintain smooth optical surface
 - Prevent evaporation of the lipid layer



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Dry Eye Disease (DED)

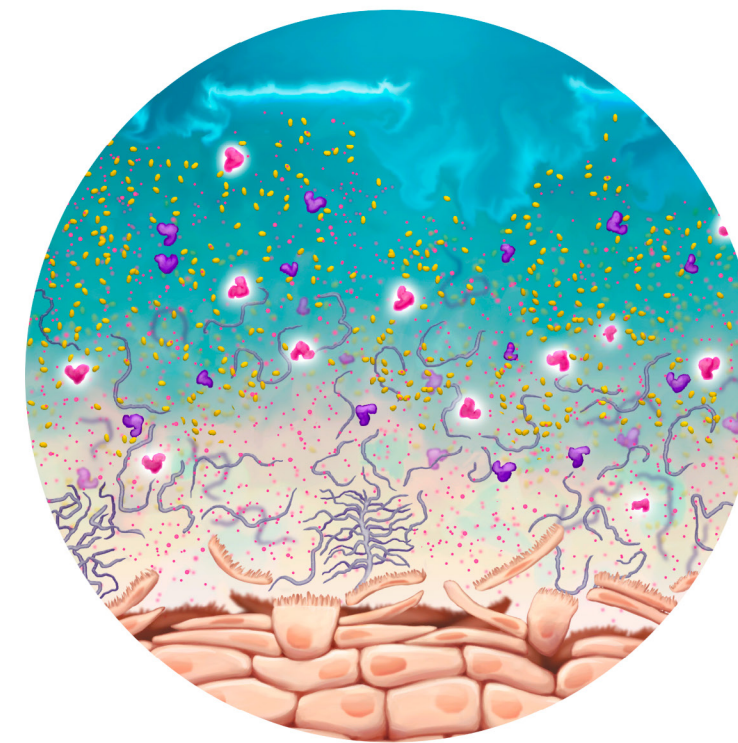
Development, symptoms, and triggers

Dry Eye

Overview

Teardrop Composition

Tear Film Breakup Time



Tears in a chronic dry eye patient can be characterized by¹⁰:

- Hyperosmolarity
- Decrease in soluble mucin 5AC
 - Due to loss of goblet cells
 - Impacts viscosity of tear film
- Lower concentrations of antimicrobial proteins (lactoferrin and lysozyme)
- Increased pro-inflammatory cytokines (IL-1 and TNF- α)
- Activated proteases
 - Degrade extracellular matrix and epithelial tight junctions



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Dry Eye Disease (DED)

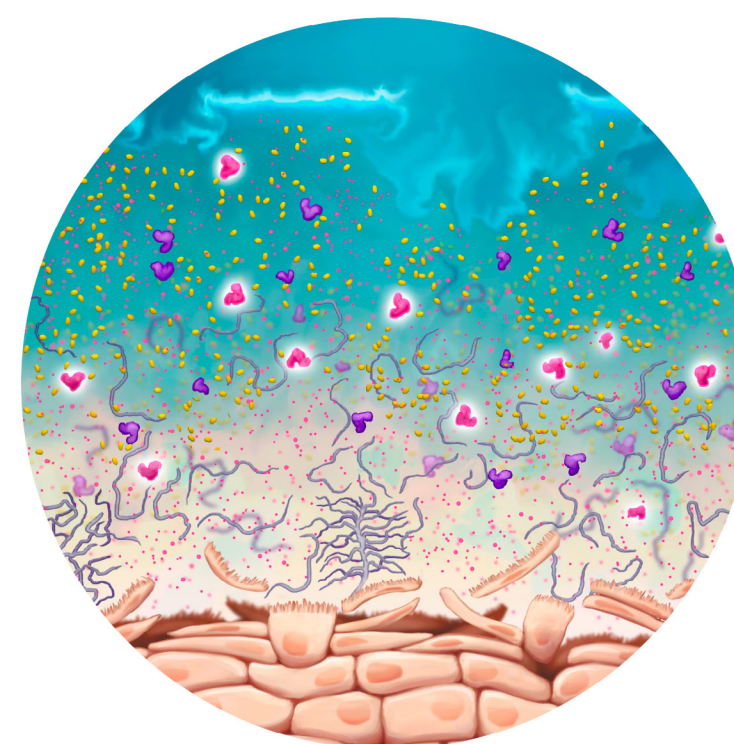
Development, symptoms, and triggers

Dry Eye







Overview

Teardrop Composition

Tear Film Breakup Time



Legend:

-  Tear film
-  Proteases
-  Antimicrobial proteins
-  Pro-inflammatory cytokines
-  Electrolytes (Na+)
-  Soluble mucin 5AC
-  Epithelial cells



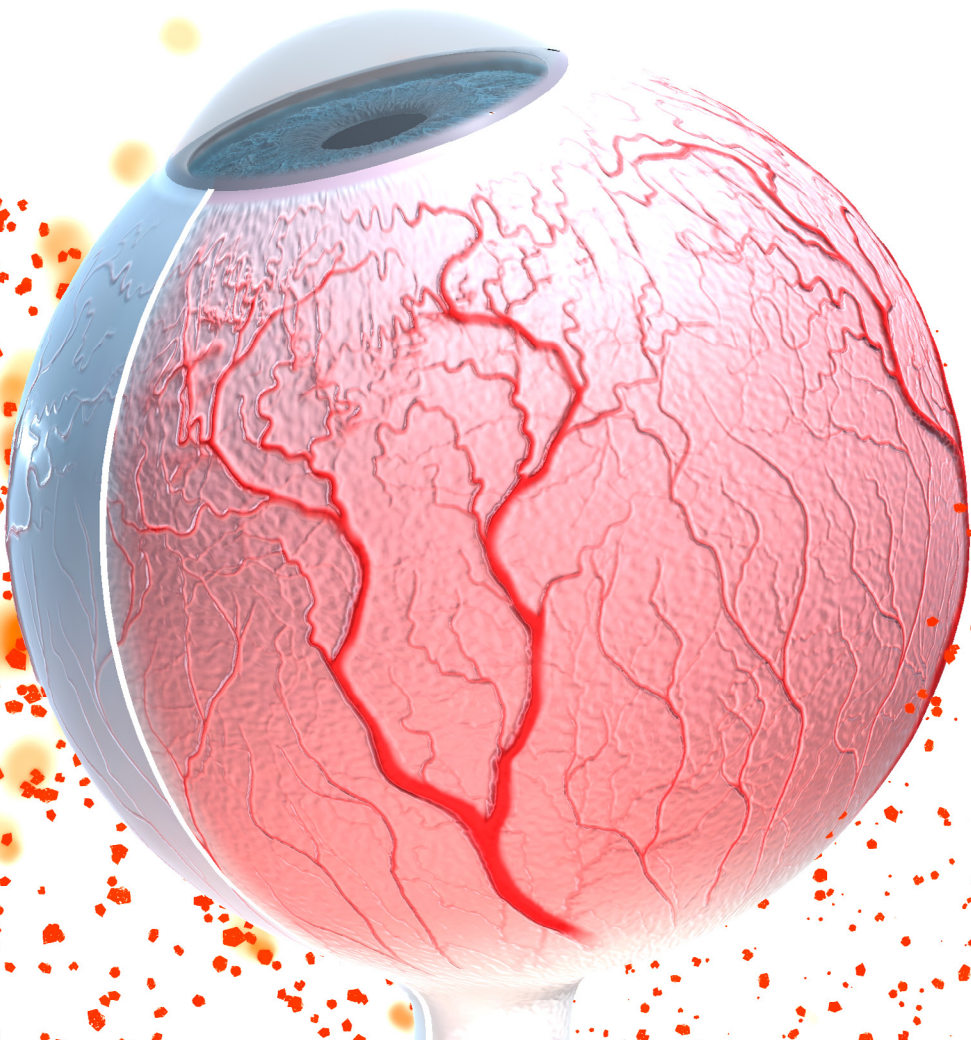

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Dry Eye Disease (DED)

Development, symptoms, and triggers

Dry Eye

Overview	Teardrop Composition	Tear Film Breakup Time
  <ul style="list-style-type: none">• Tear film breakup time (TBUT) is a method to assess tear film stability^{11,12}<ul style="list-style-type: none">- Fluorescein is instilled into the eye and the development of the first dry spot is observed- A short TBUT of less than 10 seconds is a sign of abnormal tear film		

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References



1. Clayton JA. Dry Eye. *N Engl J Med*. 2018;378(23):2212-2223.
2. Peters E, Colby, K. The Tear Film. In: Tasman W, Jaeger EA eds. *Duane's Ophthalmology, 2009 Edition*. Lippincott Williams & Wilkins; 2008. Accessed September 9, 2019.
3. Baudouin C, Aragona P, VanSetten G, et al. *Br J Ophthalmol*. 2014; 98(9):1168-1176.
4. Baudouin C, Messmer EM, Aragona P, et al. *Br J Ophthalmol*. 2016;100(3):300-306.
5. Rolando M, Cantera E, Mencucci R, et al. *Int Ophthalmol*. 2018;38(2):875-895.
6. Stapleton F, Alves M, Bunya VY, et al. *Ocul Surf*. 2017;15(3):334-365.
7. Craig JP, Nichols KK, Akpek EK, et al. *Ocul Surf*. 2017;15(3):276-283.
8. Aragona P, Rolando M. *Br J Ophthalmol*. 2013;97:955-960.
9. Craig JP, Nelson JD, Azar DT, et al. *Ocul Surf*. 2017;15(4):802-812.
10. Pflugfelder S, Beuerman R, Stern ME. *Dry Eye and Ocular Surface Disorders. 1st ed* Boca Raton. CRC Press; 2004.
11. Dibajnia P, Mohammadinia M, Moghadasin M, Amiri MA. *Iran J Psychiatry*. 2012;7(4):191-193.
12. Eye Rounds.org. <https://webey.opthth.uiowa.edu/eyeforum/atlas/pages/TBUT/index.htm>. Accessed September 9, 2019.