

Agenda



What are lipases ?



General usage



EXAMPLE

Flavour and
baking



Conclusion



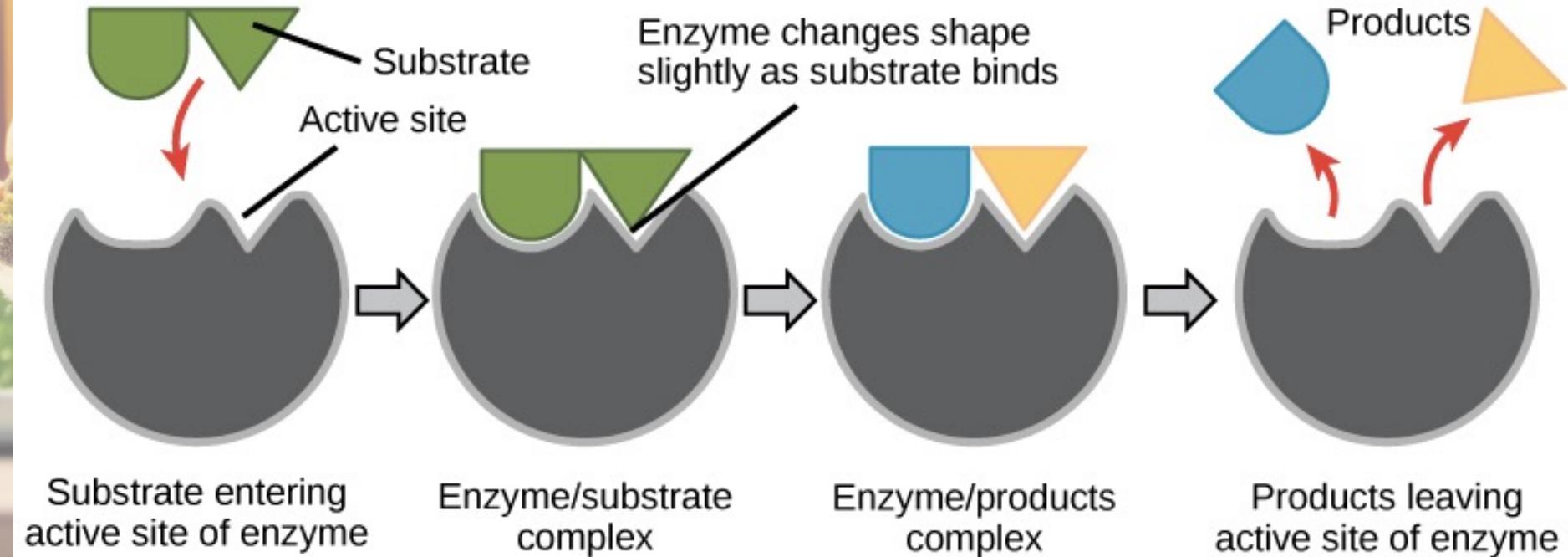
Lipases are among the most widely used enzymes in biocatalysis.

Enzymes are proteins that act as biological catalysts by accelerating chemical reactions.

The use of enzymes as industrial catalysts is rising

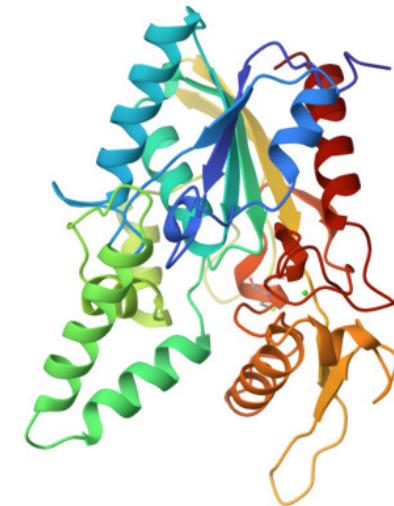
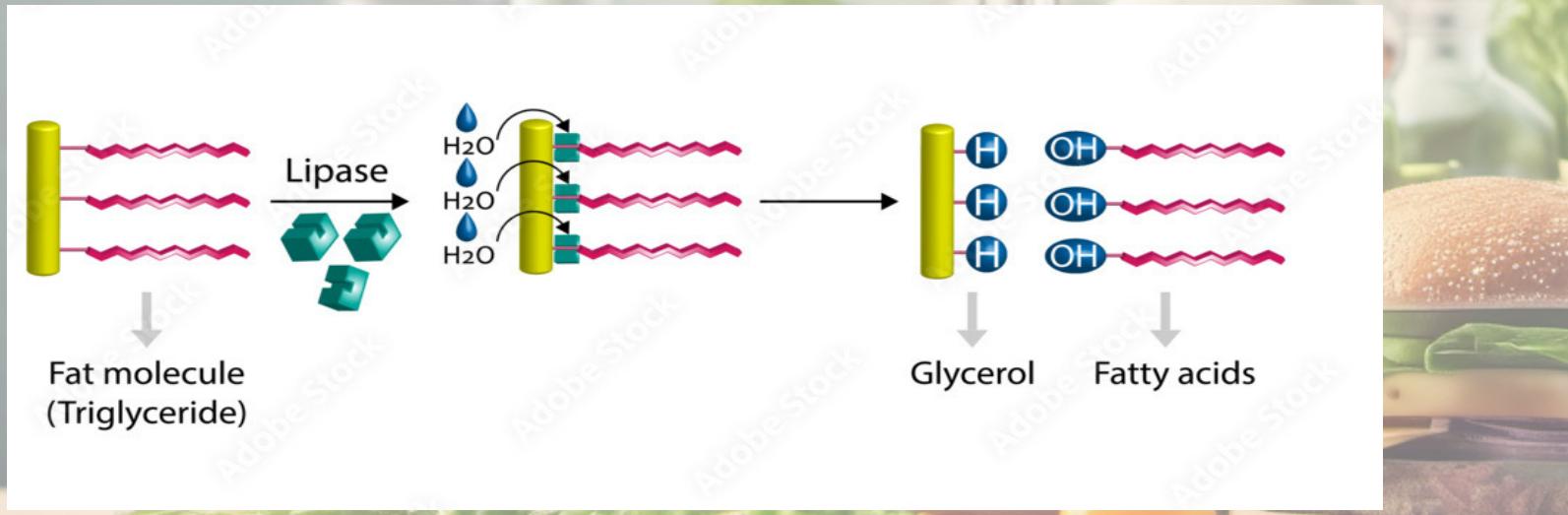
Enzymes:

- ✓ Efficient
- ✓ Allow working in mild conditions
- ✓ Selective
- ✓ Specific



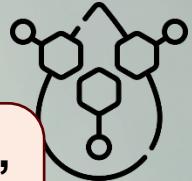
Lipases

The biological function of lipases is the hydrolysis of triglycerides to produce free fatty acids and glycerol.



- ✓ Lipases are produced by various organisms, including microorganisms, plants, and animals.
- ✓ Microbial lipases have received great attention

Lipases



Lipases can also catalyze different reactions such as esterification, acidolysis, interesterification, transesterification, aminolysis, perhydrolysis, etc.

Hydrolysis



Synthesis

Esterification



Transesterification



Lipases are essential components in the modern industrial process due to their ability to catalyze these reactions.

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In which fields are lipases used ?

Textile

Food
industry

Agri-
culture

Bio-
diesel

Environ-
ment

Pharma-
ceutical

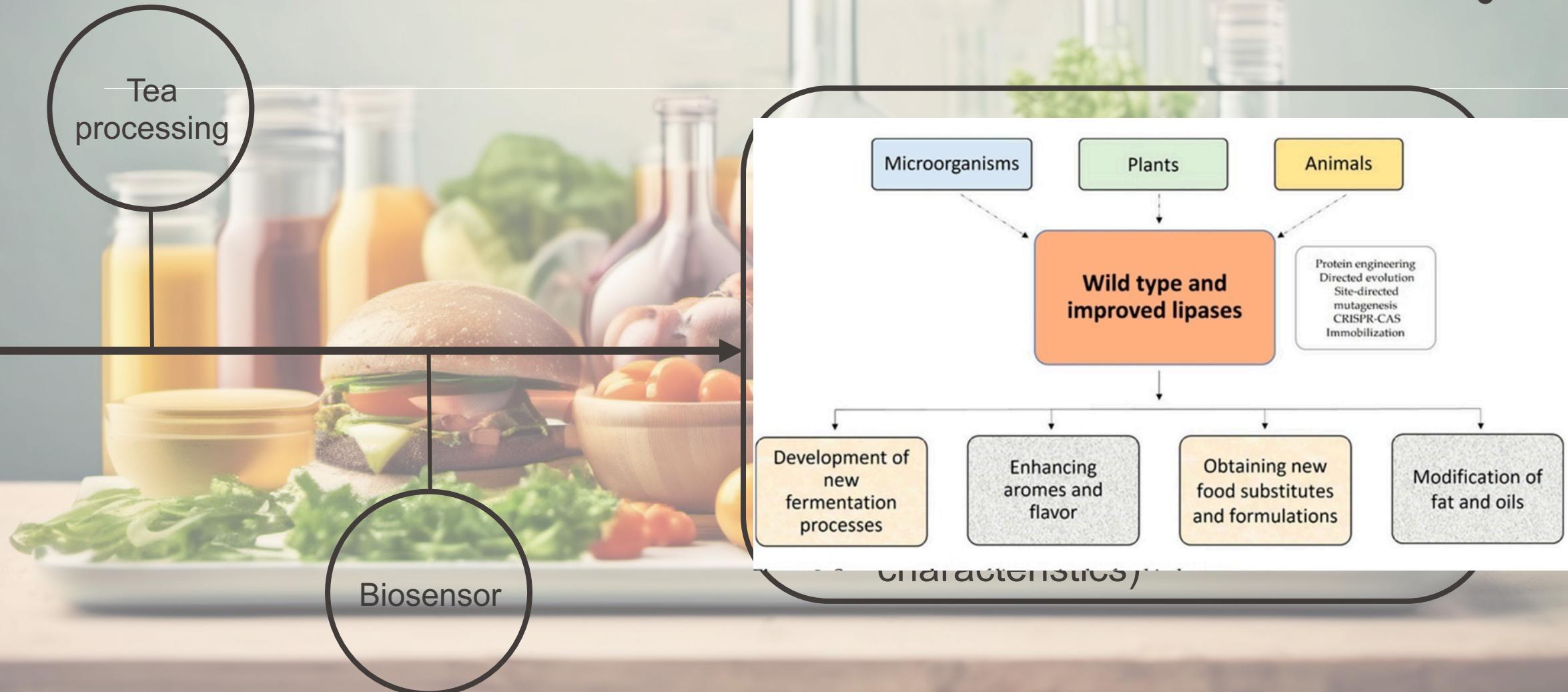


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Biotech-Based Synthesis of Flavor Esters

The production of low molecular weight flavor esters is of great importance in food Industry.

The flavor and fragrance market is expected to expand at a compound annual growth rate (CAGR) of 4.7% to \$35 billion from 2021 to 2027.

Production of Flavor esters:

1. Natural Sources  Low Concentration, High cost 
2. Chemical Synthesis  Can not be labeled as “Natural”, Low Chiral Purity 
3. Biocatalysis  Can be labeled as “Natural”, High Chiral Purity 

Biotech-Based Synthesis of Flavor Esters

The significant demand for these esters has boosted the need for greener production routes and food safety

Esterification



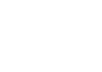
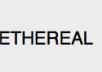
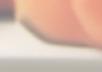
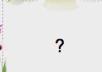
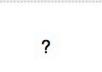
Transesterification



Esters

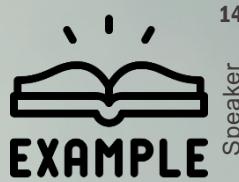
Table of esters and their smells

from the alcohol (first word)

	methyl 1 carbon	ethyl 2 carbons	propyl 3 carbons	2-methyl propyl-	butyl 4 carbons	pentyl 5 carbons	hexyl 6 carbons	benzyl benzene ring	heptyl 7 carbons	octyl 8 carbons	nonyl 9 carbons
methanoate 1 carbon	ETHEREAL 		ETHEREAL 								?
ethanoate 2 carbons											
propanoate 3 carbons											?
2-methyl propanoate 4 carbons, branched		ETHEREAL 									?
butanoate 4 carbons											?
pentanoate 5 carbons				ETHEREAL 							?
hexanoate 6 carbons											
benzanoate benzene ring											?
heptanoate 7 carbons					?						?
salicylate from salicylic acid								DIFFERENT PEOPLE PERCEIVE DIFFERENT AROMAS!	?		?
octanoate 8 carbons											
nonanoate 9 carbons											?
cinnamate											?
decanoate 10 carbons							?	?	?	?	?

from the carboxylic acid (second word)





Alcohol	Acyl donor
2-Phenylethanol	HCOOEt CH ₃ CH ₂ COOEt CH ₃ CH ₂ CH ₂ COOEt (CH ₃) ₂ CHCOOEt (CH ₃) ₂ CHCH ₂ COOEt
Cinnamyl alcohol	HCOOEt CH ₃ COOEt CH ₃ CH ₂ COOEt CH ₃ CH ₂ CH ₂ COOEt (CH ₃) ₂ CHCOOEt (CH ₃) ₂ CHCH ₂ COOEt
Geraniol	HCOOEt CH ₃ COOEt CH ₃ CH ₂ COOEt CH ₃ CH ₂ CH ₂ COOEt (CH ₃) ₂ CHCOOEt (CH ₃) ₂ CHCH ₂ COOEt
<i>n</i> -Hexanol	HCOOEt CH ₃ COOEt CH ₃ CH ₂ COOEt CH ₃ CH ₂ CH ₂ COOEt (CH ₃) ₂ CHCOOEt (CH ₃) ₂ CHCH ₂ COOEt
Isoamyl alcohol	HCOOEt CH ₃ COOEt CH ₃ CH ₂ COOEt CH ₃ CH ₂ CH ₂ COOEt (CH ₃) ₂ CHCOOEt (CH ₃) ₂ CHCH ₂ COOEt



Ester main flavour property

Floral-apricot
 Floral-peach
 Plum-pear
 Floral-rose
 Fruity-berry
 Balsam-green
 Floral-sweet
 Fruity-spicy
 Fruity-floral
 Apple-banana
 Rose-apple
 Rose
 Rose-lavender
 Fruity
 Fruity-apricot
 Rose-apricot
 Rose-apple
 Apple
 Fruity-pear
 Earthy-metallic
 Apricot-pineapple
 Green-sweet
 Green-fruity
 Black currant
 Banana-pear
 Pineapple-apricot
 Fruity
 Sweet-fruity
 Sweet-fruity

Example: *Baking*

Main purposes of lipase

Make dough smoother

Increase product volume

Improve stability of the dough

Improve the softness

Release pigment contained in the flour

Lipases used

LIP100: hydrolyzed triglycerides in flour to increase the softness and whiteness of the bread.

LIP400: hydrolyzed phospholipids in flour to increase the stability of the dough and give bigger volume.

LIP500: contains both phospholipase and triglyceride lipase

1. <https://labinsights.nl/en/article/role-and-application-of-lipase-in-bakery-products/#.~.text=There%20are%20three%20main%20lipases.more%20commonly%20used%20baking%20enzymes>, visited on 14.03.24
2. <https://www.yimingbiotechnology.com/products/lipase/> visited on 14.03.24
3. <https://en.angelyeast.com/blog/enzymes/application-of-annzyme-baking-enzyme-in-bread.html> visited on 14.03.24
4. <https://bakerpedia.com/ingredients/lipase/>, visited on 14.03.24

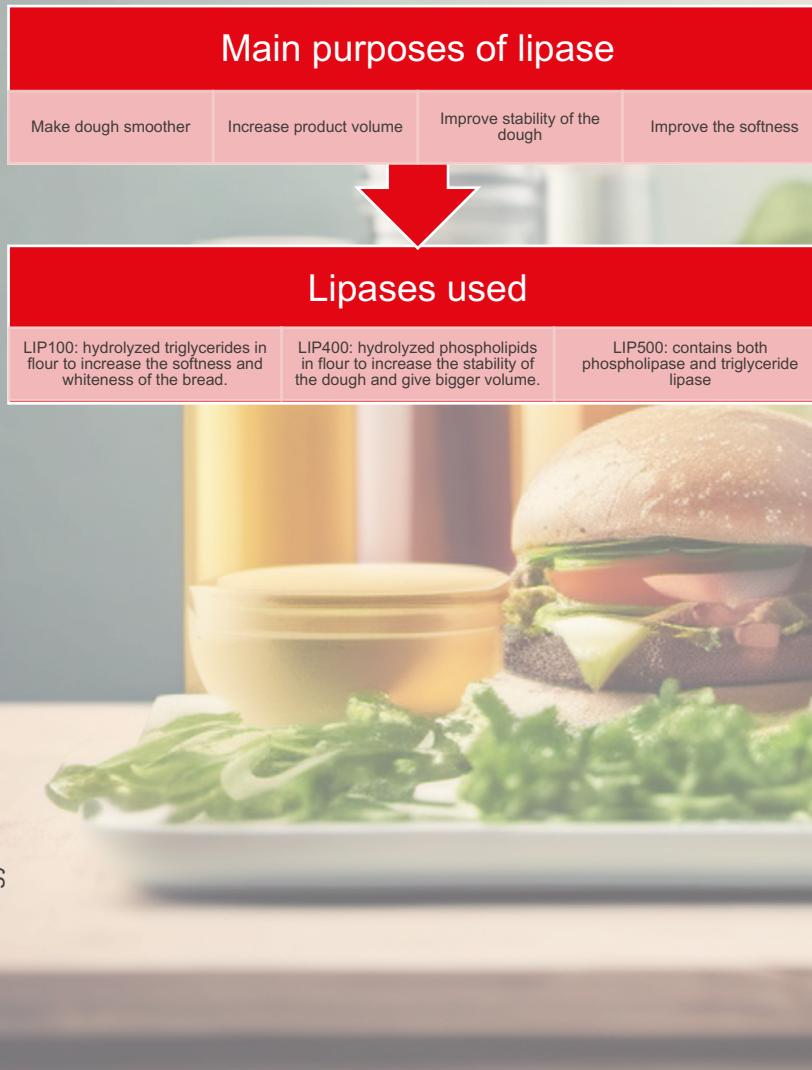
Example: *Baking*

Main purposes of lipase

Make dough smoother	Increase product volume	Improve stability of the dough	Improve the softness
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Lipases used

LIP100: hydrolyzed triglycerides in flour to increase the softness and whiteness of the bread.	LIP400: hydrolyzed phospholipids in flour to increase the stability of the dough and give bigger volume.	LIP500: contains both phospholipase and triglyceride lipase
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Applications in a broad range of fields/industries

New products with high added value in the food and nutraceutical industry.

Big Marketplace with high expected growth rates

Improved organoleptic properties

Lipases are the most applied enzyme family to produce flavor and fragrances.

In food nutrition, mostly used in dairy product



Questions ?





Find the flavour!

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