

당 질



Fig. 16-CO, p.434

당질이란?

- $C_nH_{2n}O_n$ 의 일반식을 갖는다.
- 포도당, 과당, 설탕, 녹말, 글리코겐이 이에 속한다.

당질의 분류

1. Monosaccharide

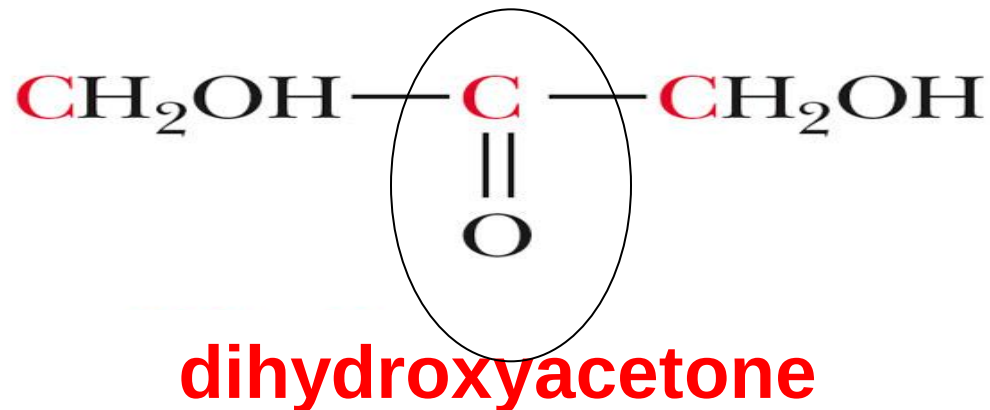
2. Oligosaccharide

3. Polysaccharide

1) 단당류의 구조

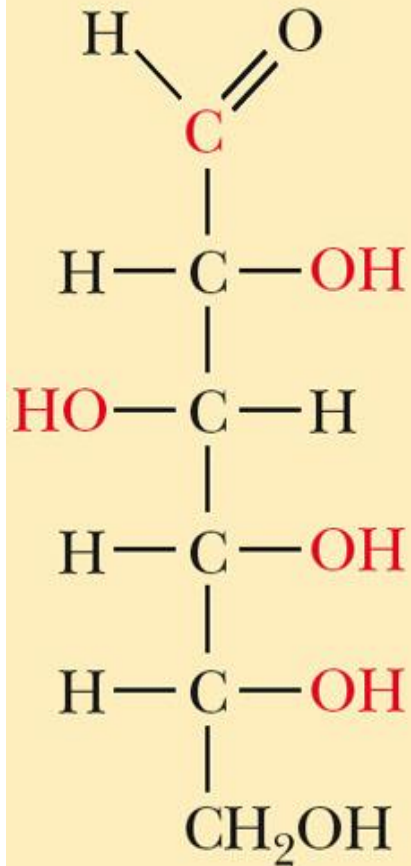
Aldose와 ketose

(a)

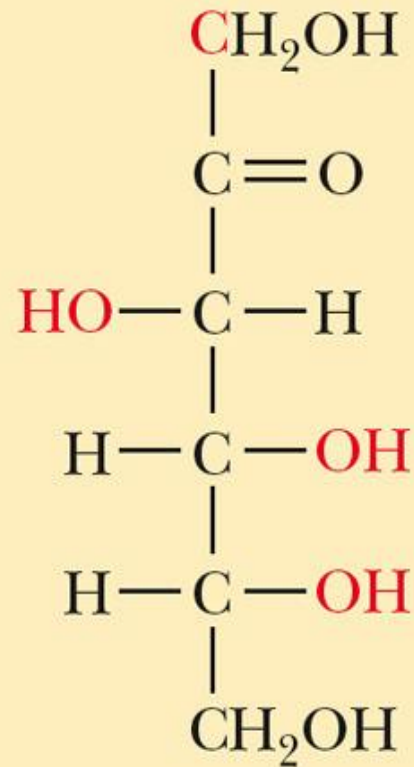


Aldose 와 ketose

Carbon
number



D-Glucose
(an aldose)



D-Fructose
(a ketose)

1

2

3

4

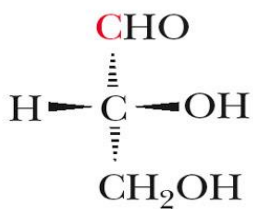
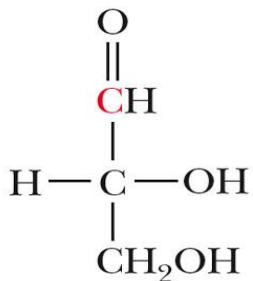
5

6

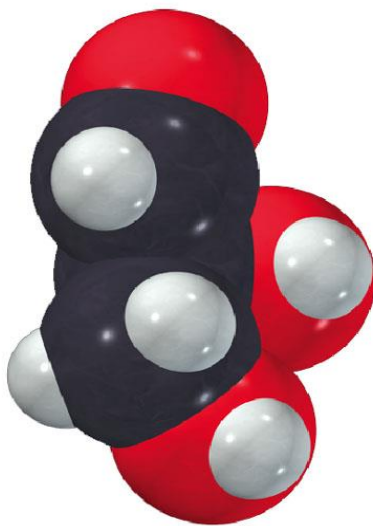
1) 단당류의 구조

D-sugar와 L-sugar

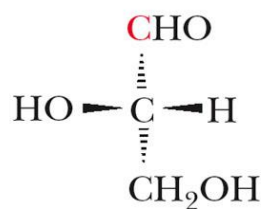
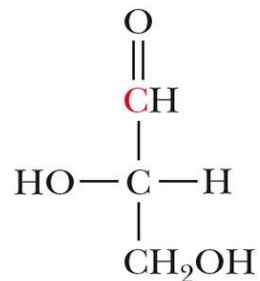
(b)



D-Glyceraldehyde



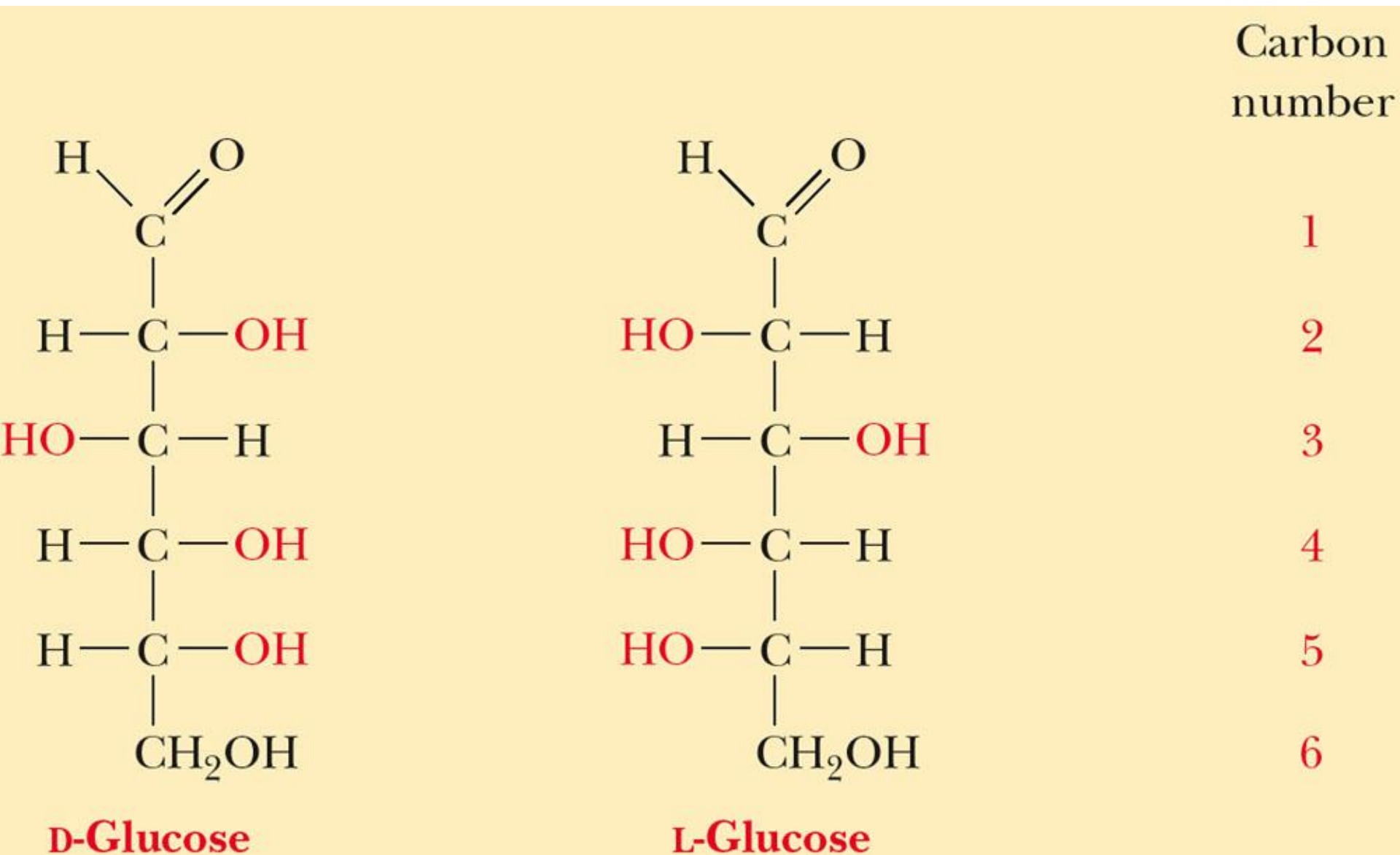
(c)



L-Glyceraldehyde

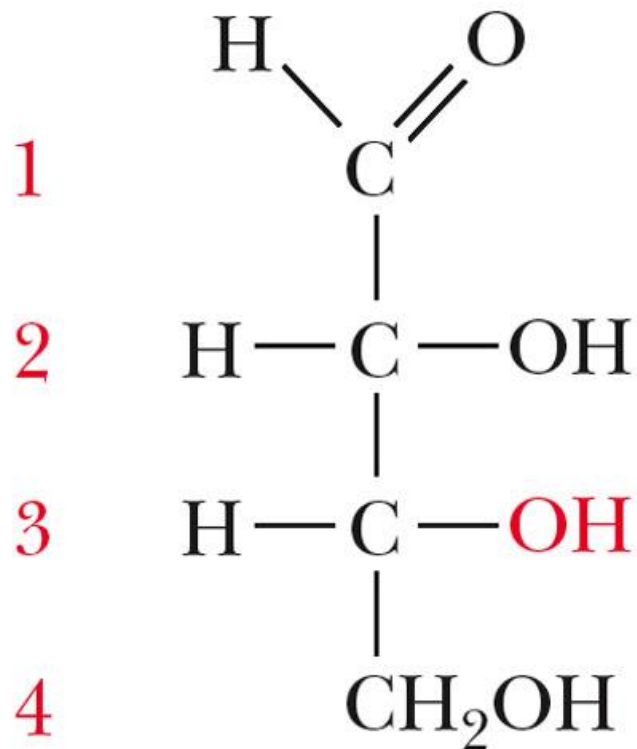


D-glucose와 L-glucose

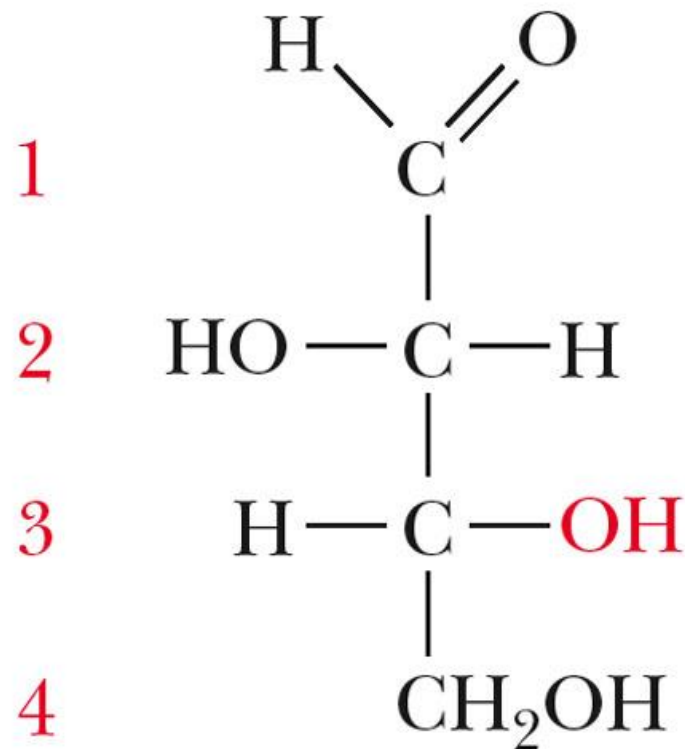


Stereoisomers of an aldotetrose

(a)



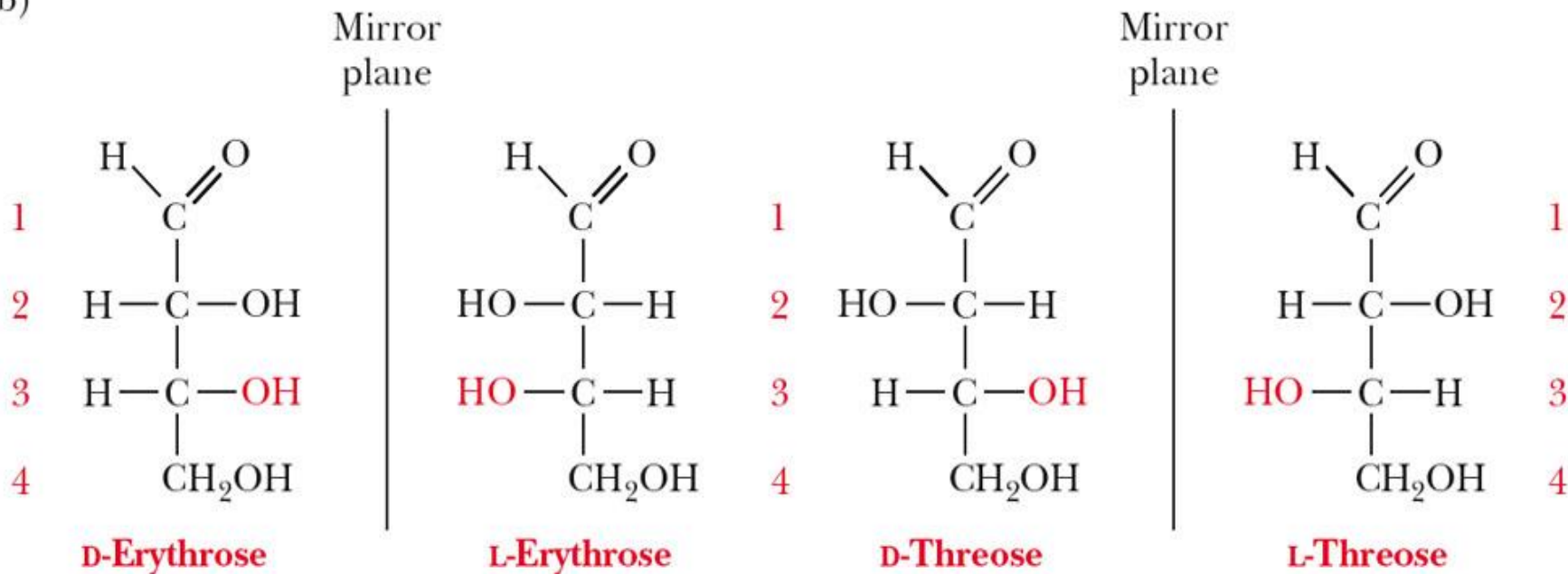
D-Erythrose



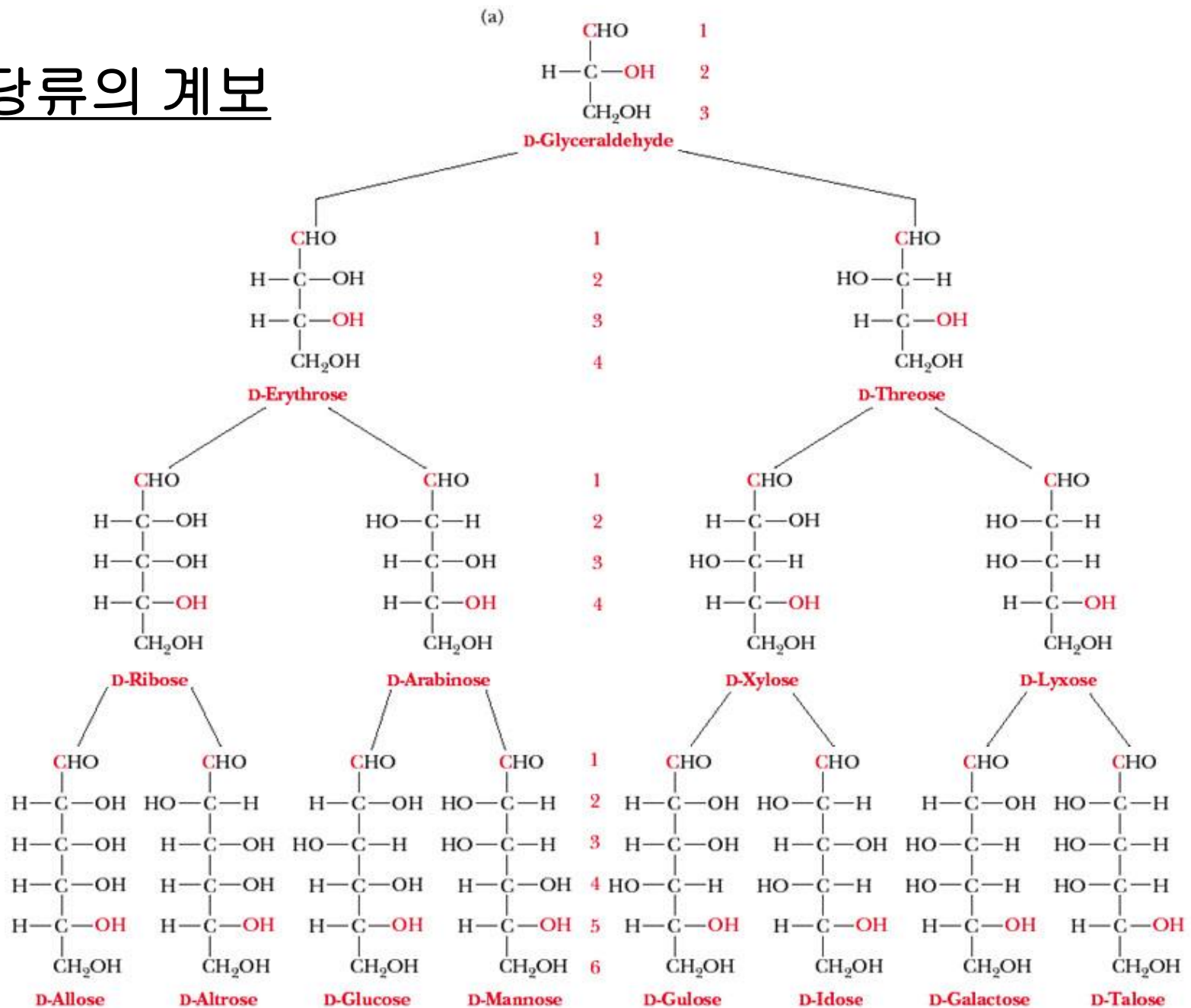
D-Threose

Stereoisomers of an aldotetrose

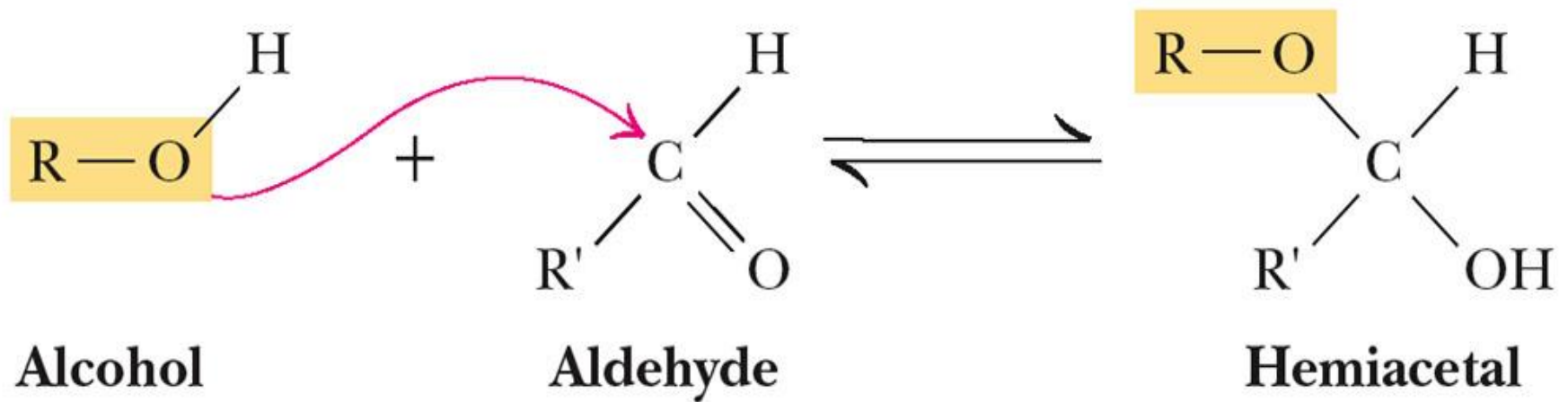
(b)



단당류의 계보

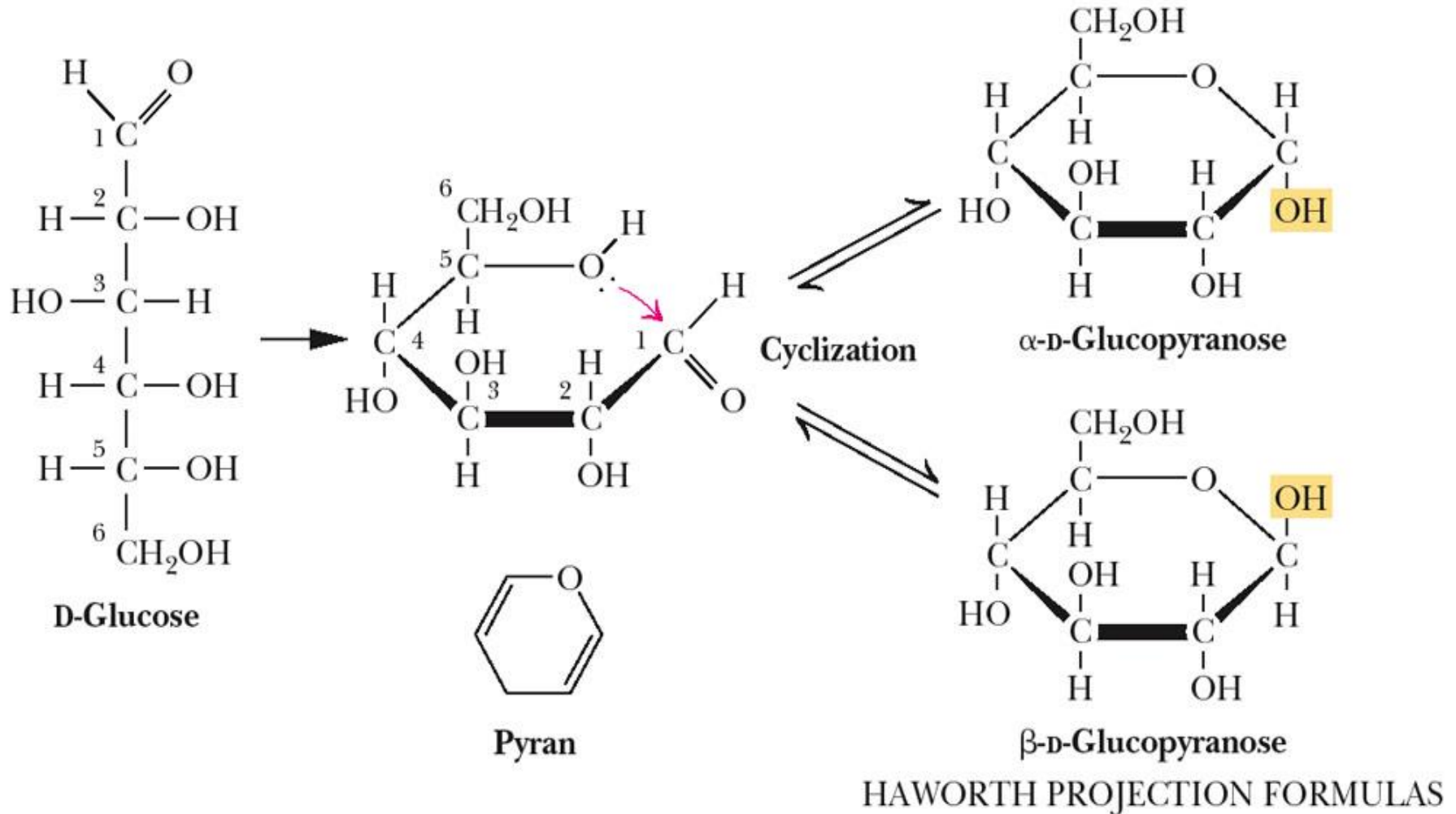


2) 당의 수용액에서의 반응



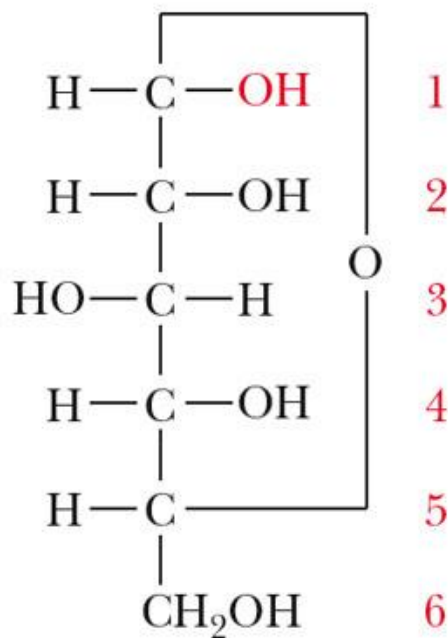
© 2006 Brooks/Cole - Thomson

당의 수용액에서의 존재 형태



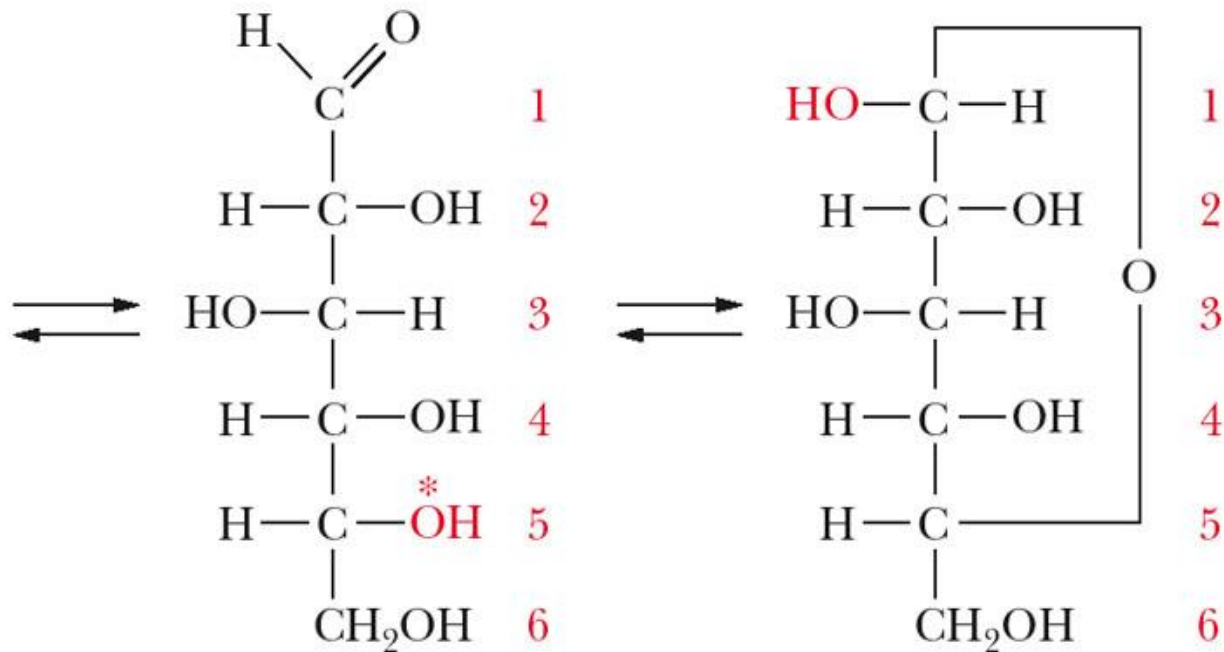
당의 수용액에서의 존재 형태

α -Configuration
OH to right of
anomeric carbon



α -D-Glucose

β -Configuration
OH to left of
anomeric carbon

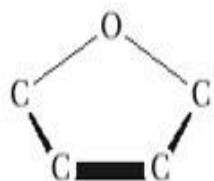


β -D-Glucose

*Reacts with $\text{CH}=\text{O}$
to form hemiacetal
Open chain form

Haworth representations of sugar structures

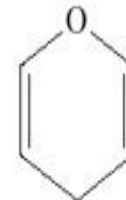
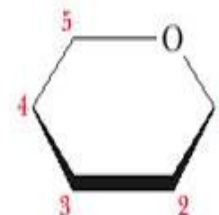
(a)



Furan

Haworth representations
of furanose structures

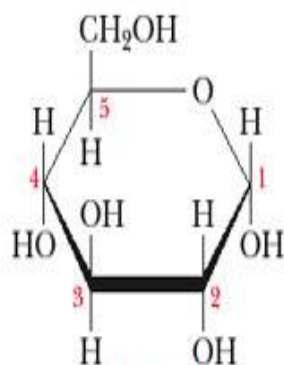
(b)



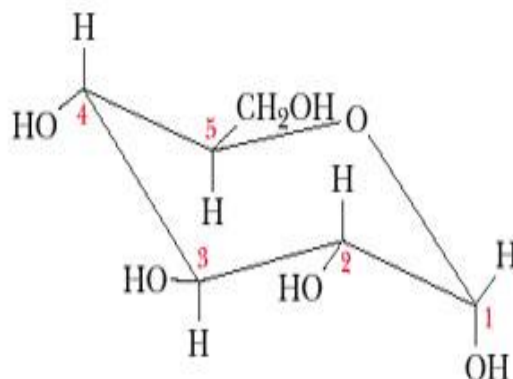
Pyran

Haworth representations
of pyranose structures

(c)



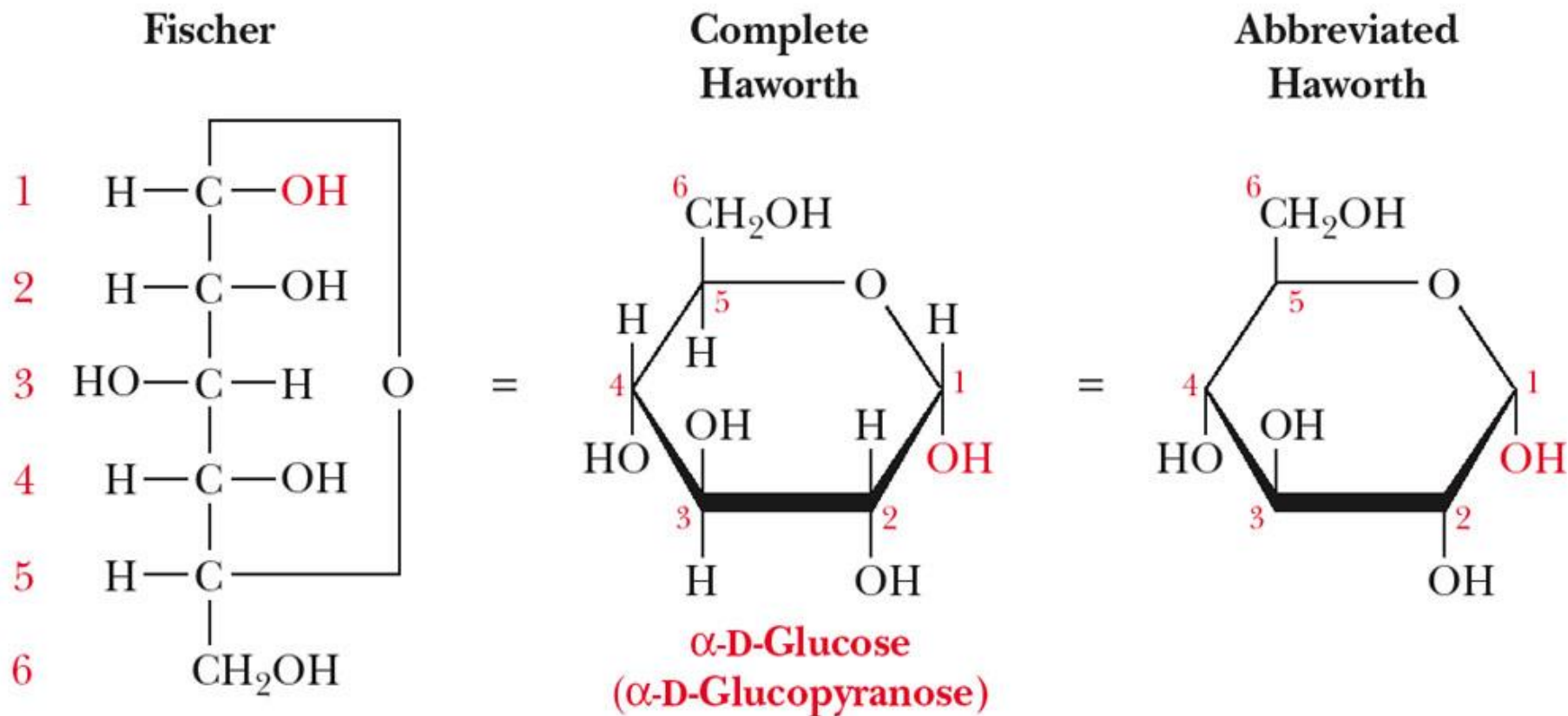
Haworth
(α -D-Glucose)



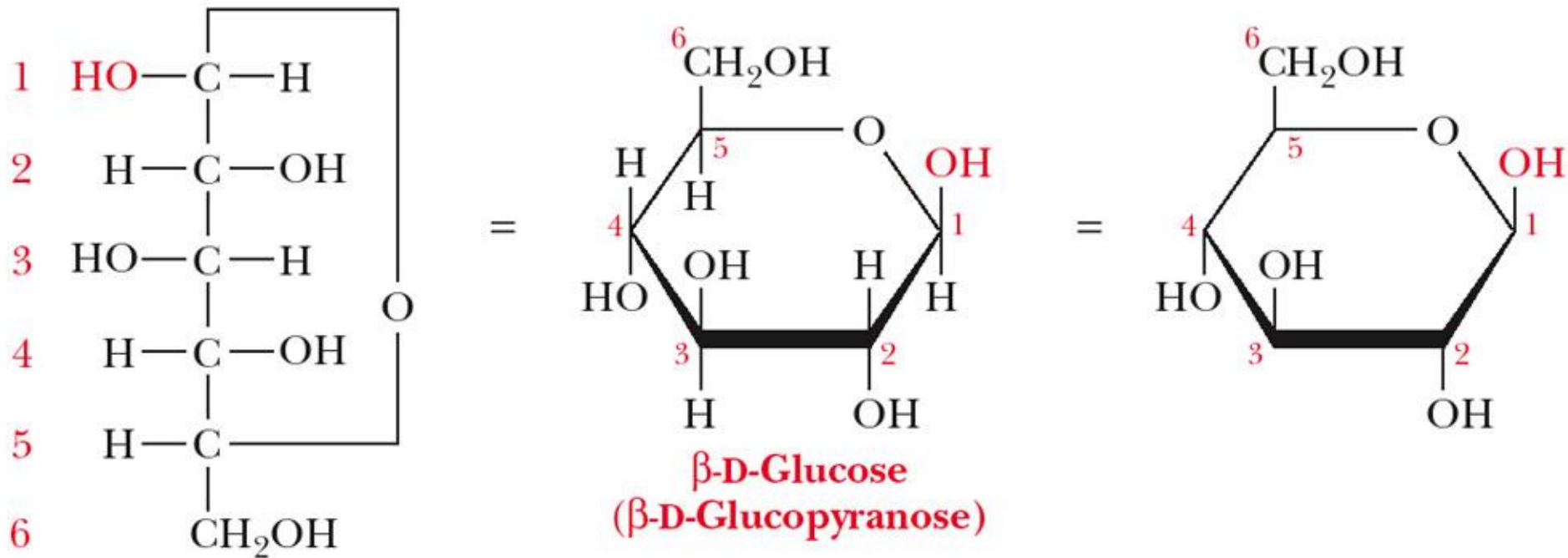
Chair conformation



A comparison of the Fischer, complete Haworth, and abbreviated Haworth representations of α -D-glucose

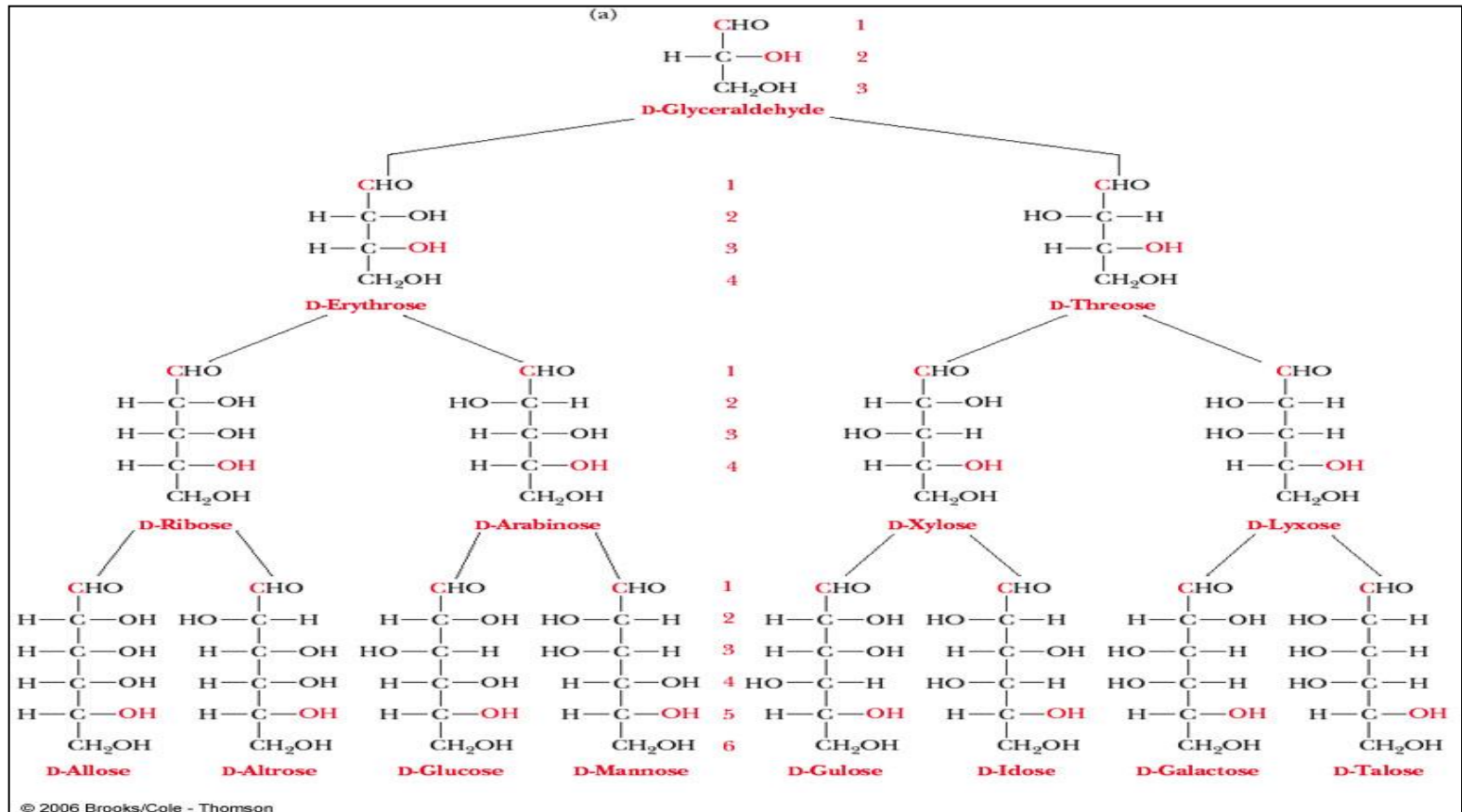


A comparison of the Fischer, complete Haworth, and abbreviated Haworth representations of β -D-glucose



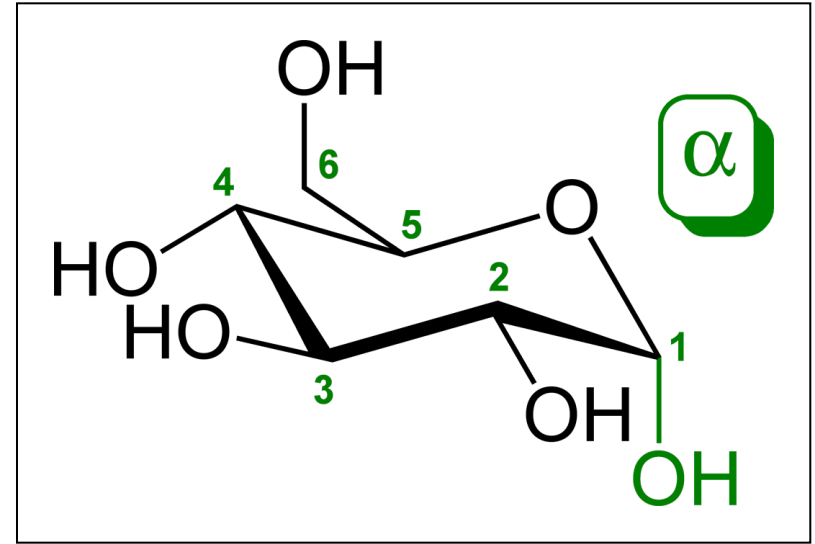
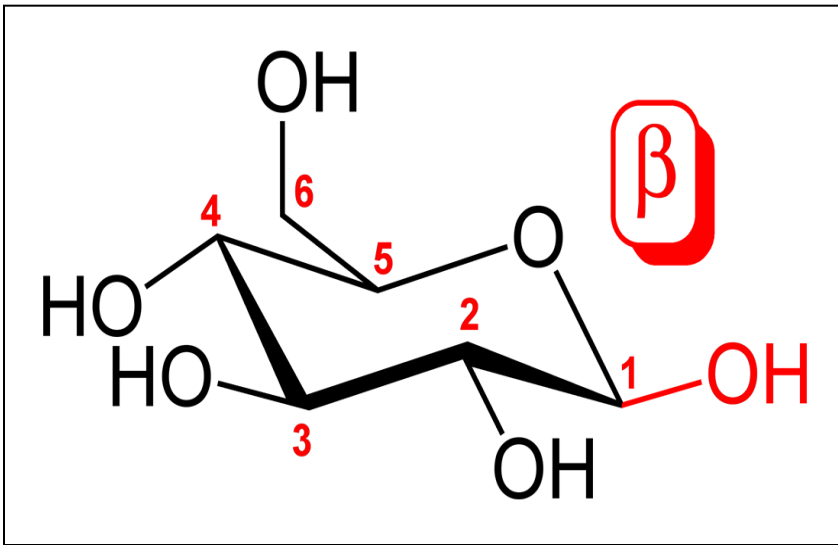
3) 당의 이성체

- epimer : 하나의 비대칭 탄소원자에서 구조가 다른 부분입체 이성질체를 말한다.

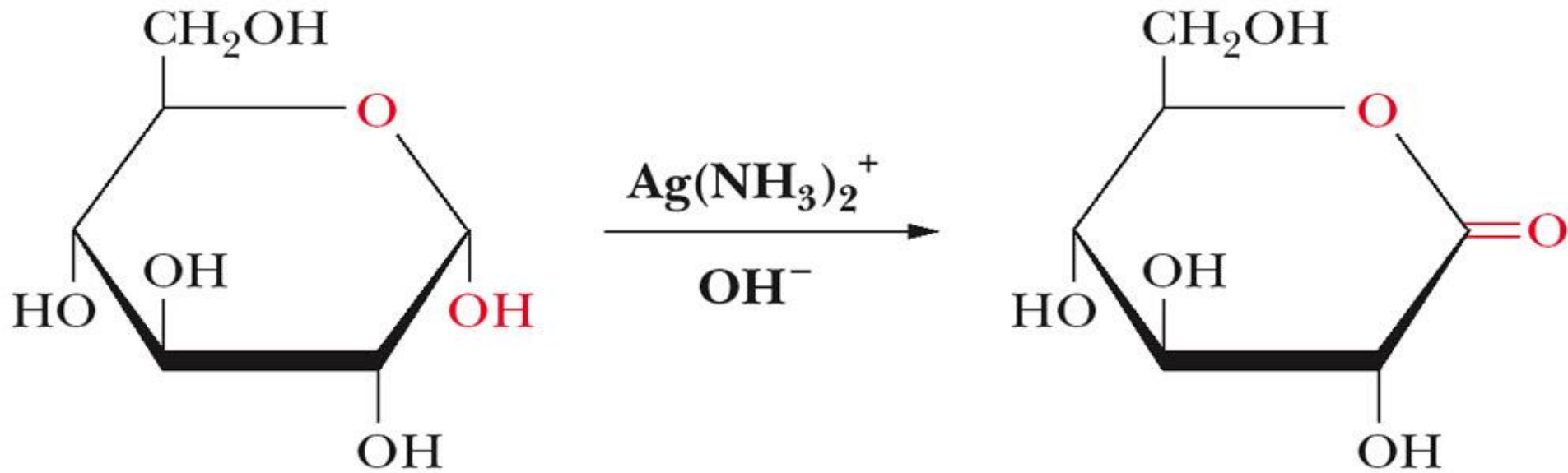


3) 당의 이성체

- anomer : 고리화 반응에서 한 탄소에 붙은 수소원자와 수산화기의 위치가 바뀐 부분입체 이성질체. 에피머의 하나다.



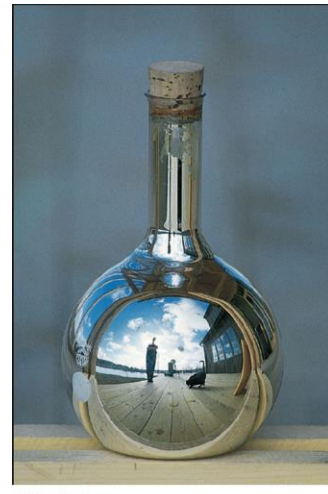
4) 당의 산화반응



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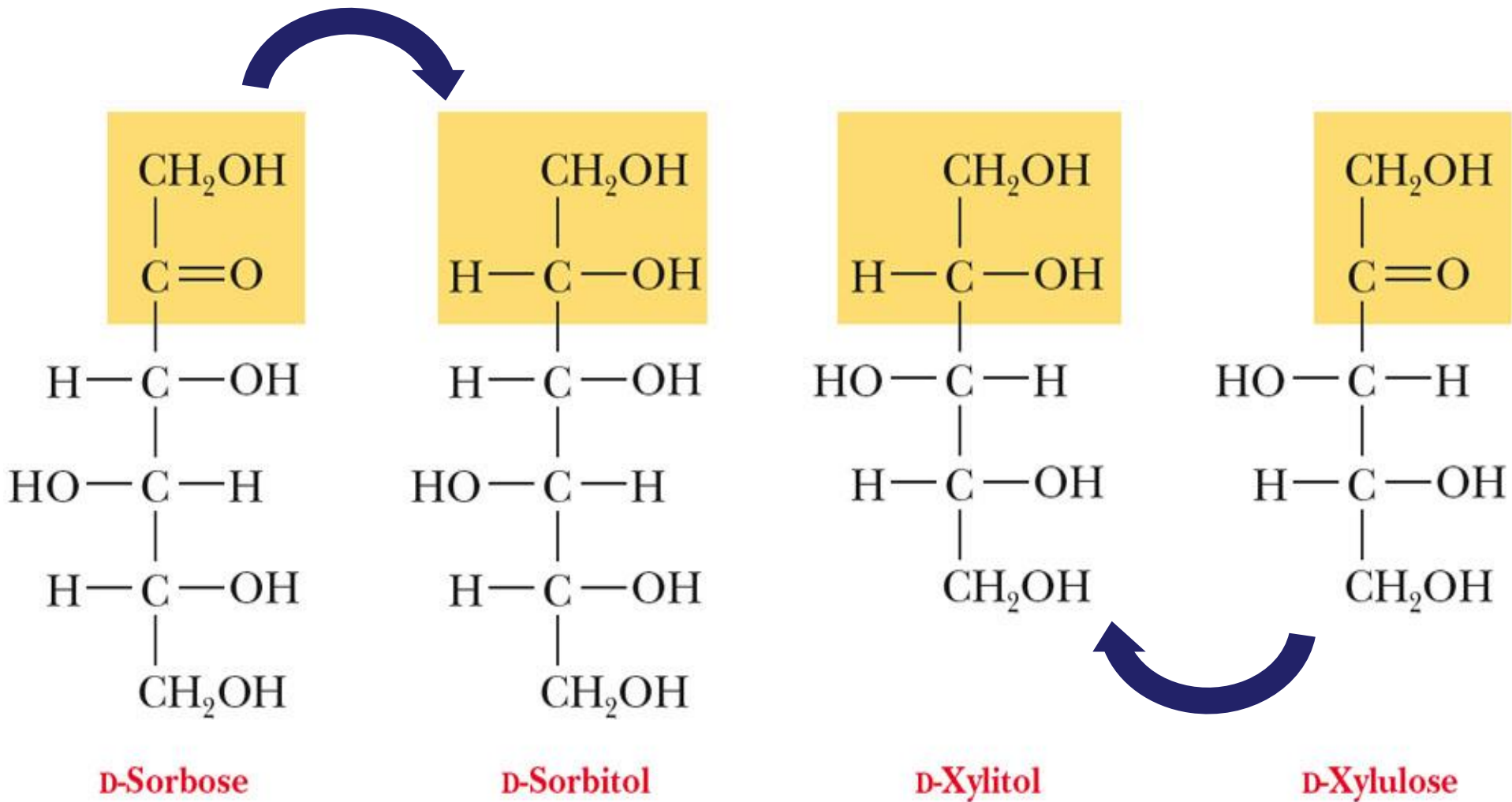
은거울 제작의 원리

By adding Tollens reagent to an aldehyde, a silver mirror has been deposited in the inside of this flask.



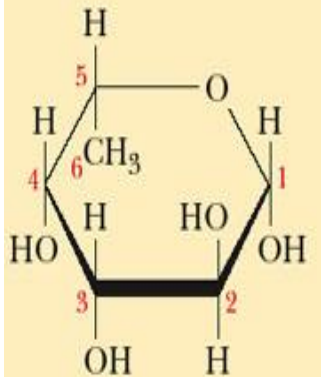
© 2006 Brooks/Cole - Thomson

5) 당의 환원반응

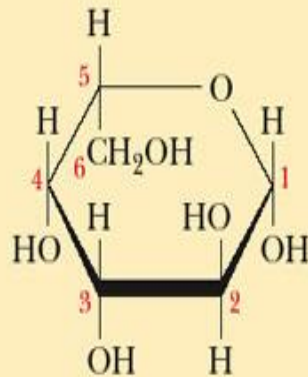


6) Deoxy sugar

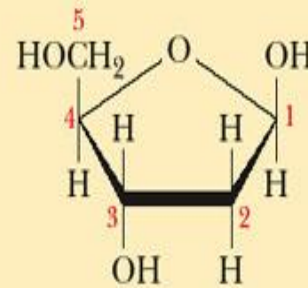
- 혈액형을 결정하는 당단백 구성
- DNA 구성 당



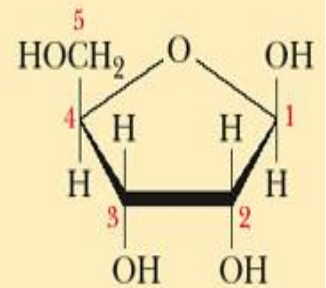
β -L-Fucose
(6-Deoxy- β -L-galactose)



β -L-Galactose

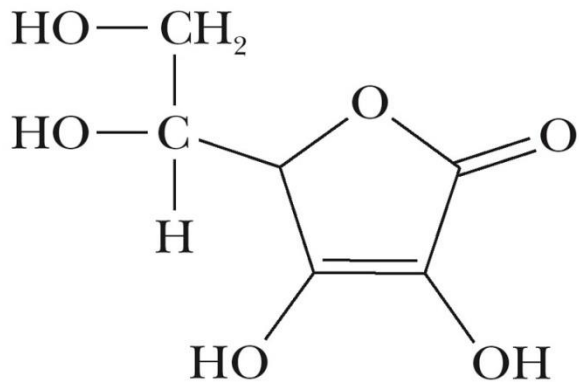


β -D-Deoxyribose
(2-Deoxy- β -D-ribose)



β -D-Ribose

7) 비타민 C는 포도당으로부터 합성된다

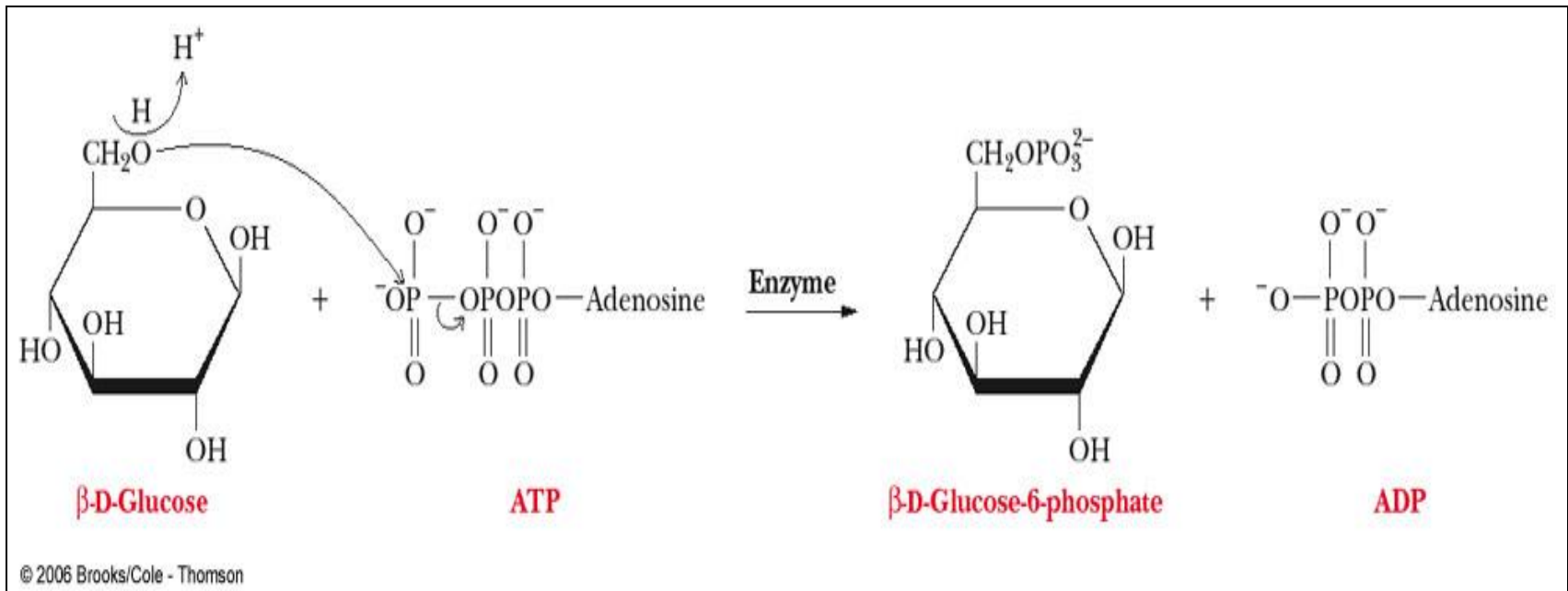


**Ascorbic acid
(Vitamin C)**

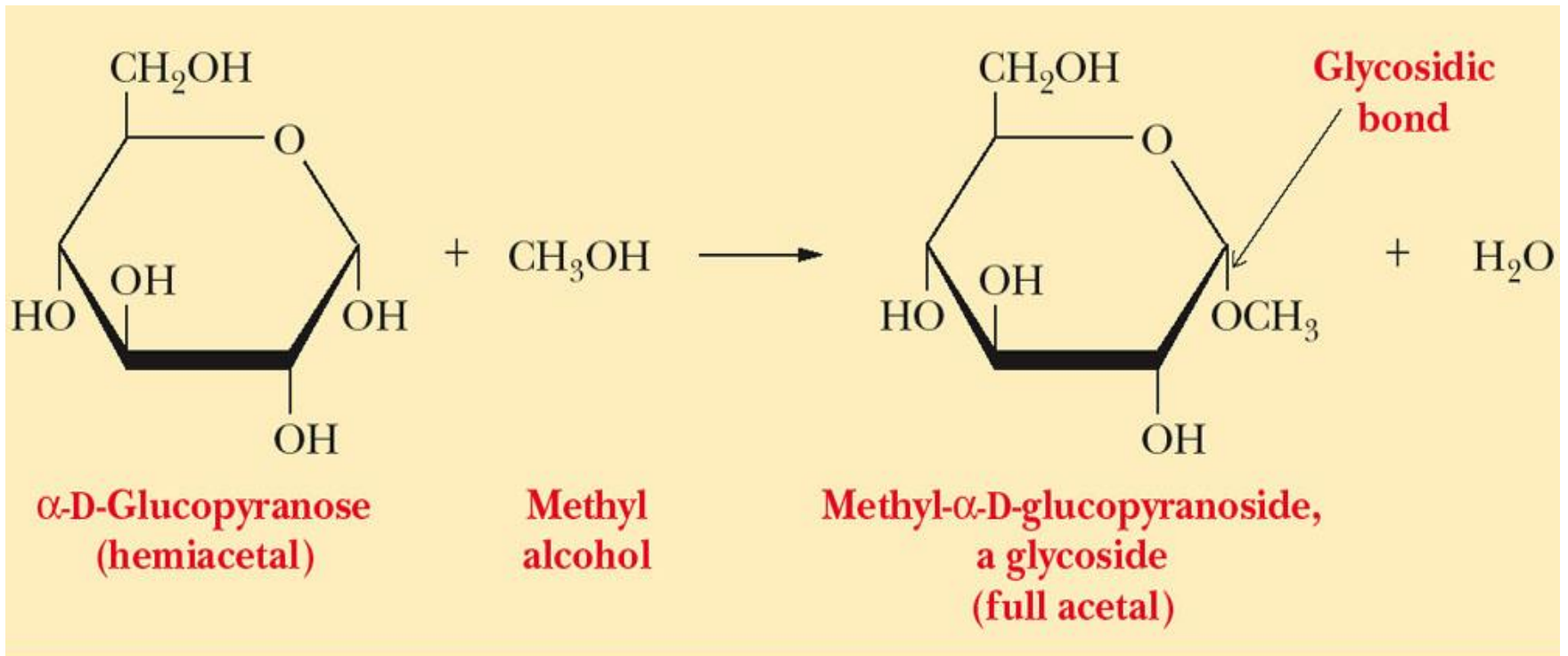
- 비타민 C의 중요성
- 비타민 C가 많이 들어있는 식품 혹은 좋은 급원은 무엇일까?

8) 에스테르화 반응

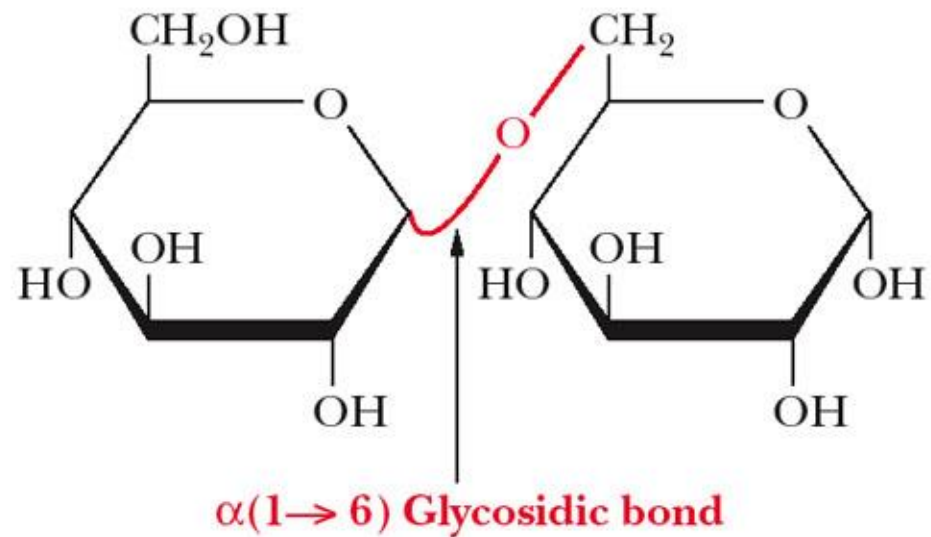
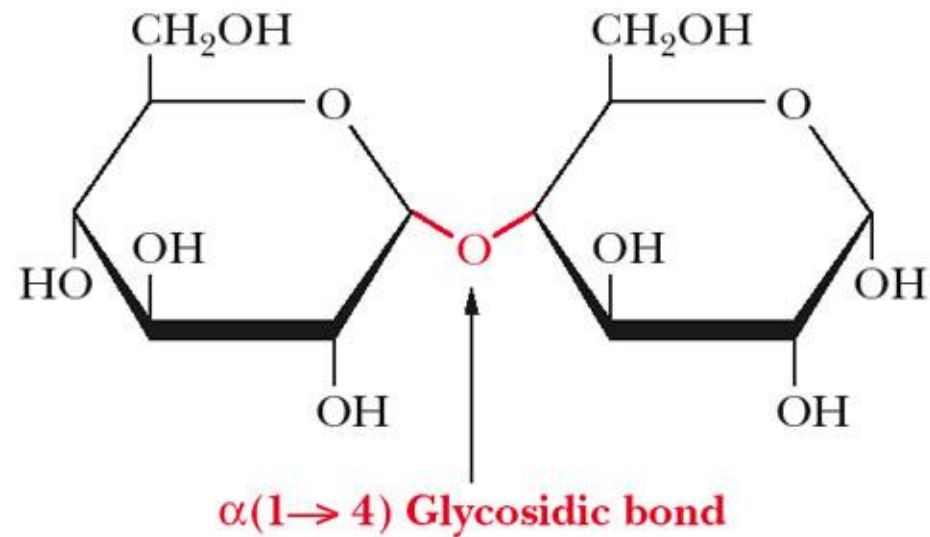
a phosphate ester of glucose



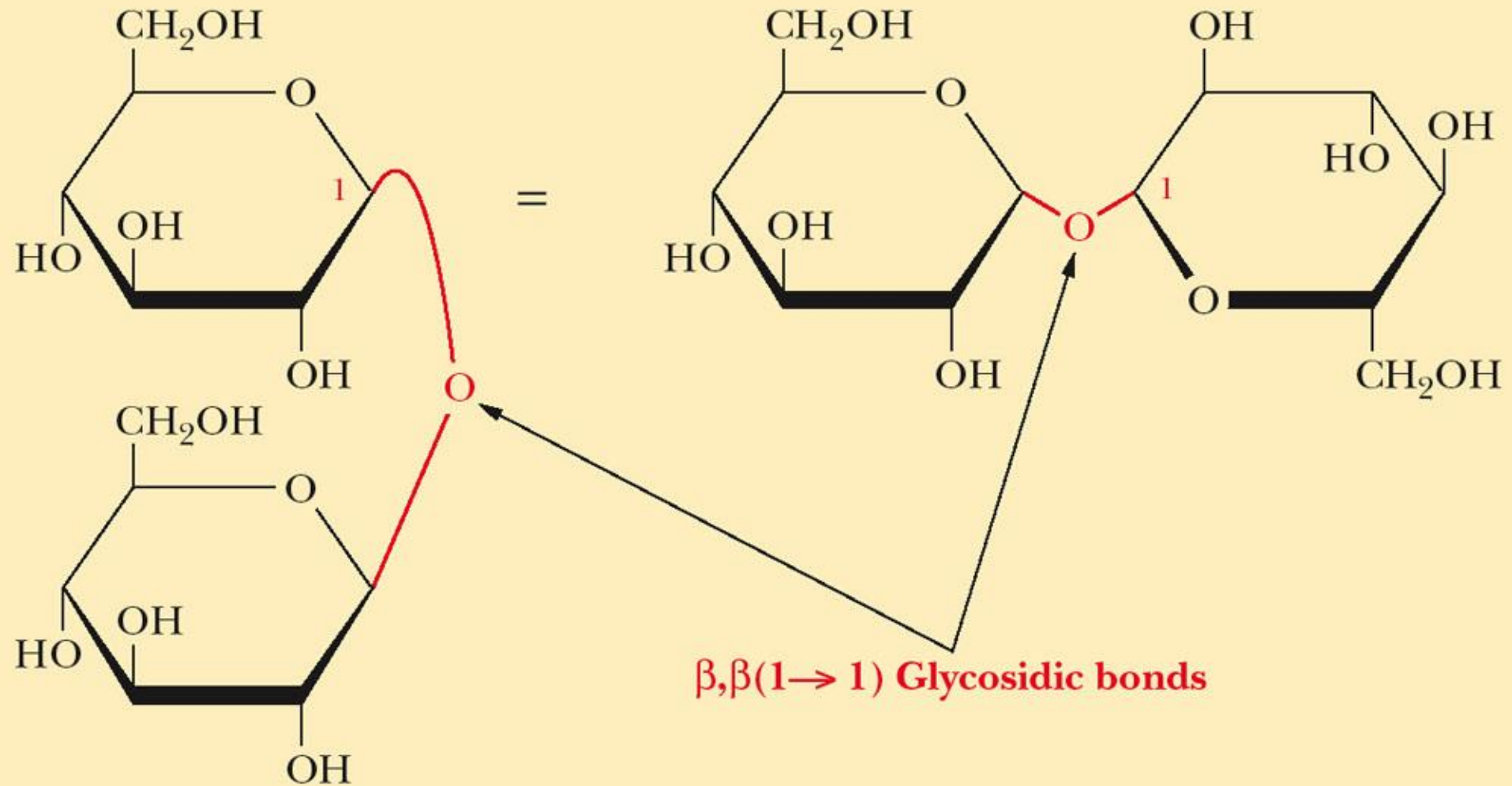
9) Glycoside 생성반응



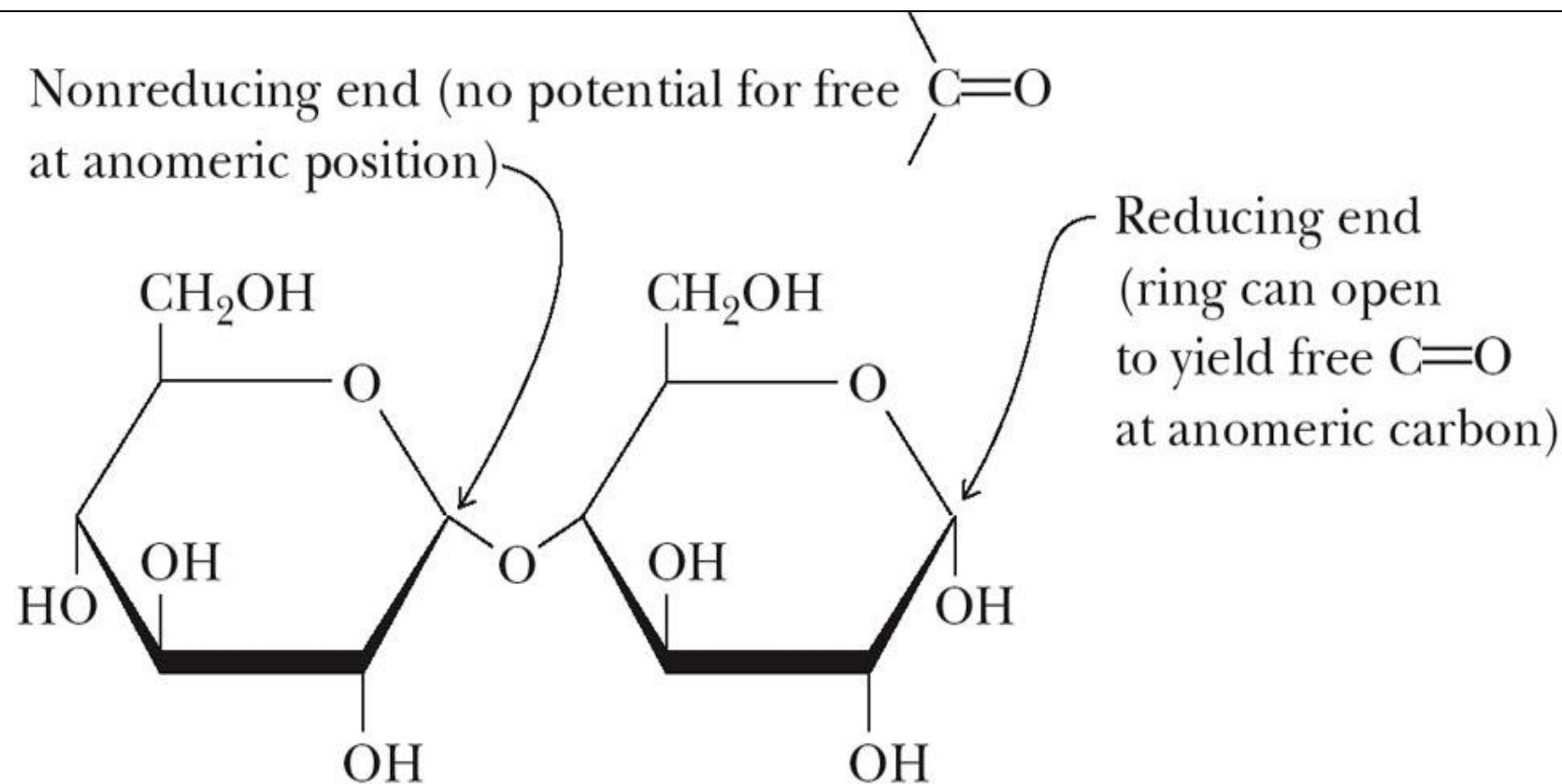
Glycoside



Glycoside

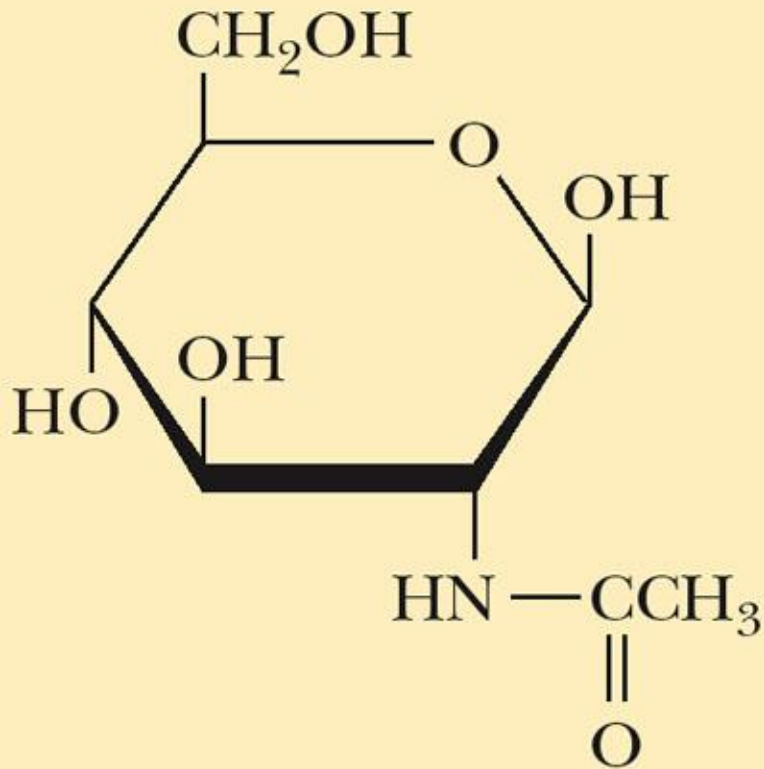


a reducing sugar because of the presence of a free anomeric aldehyde carbonyl or potential aldehyde group.

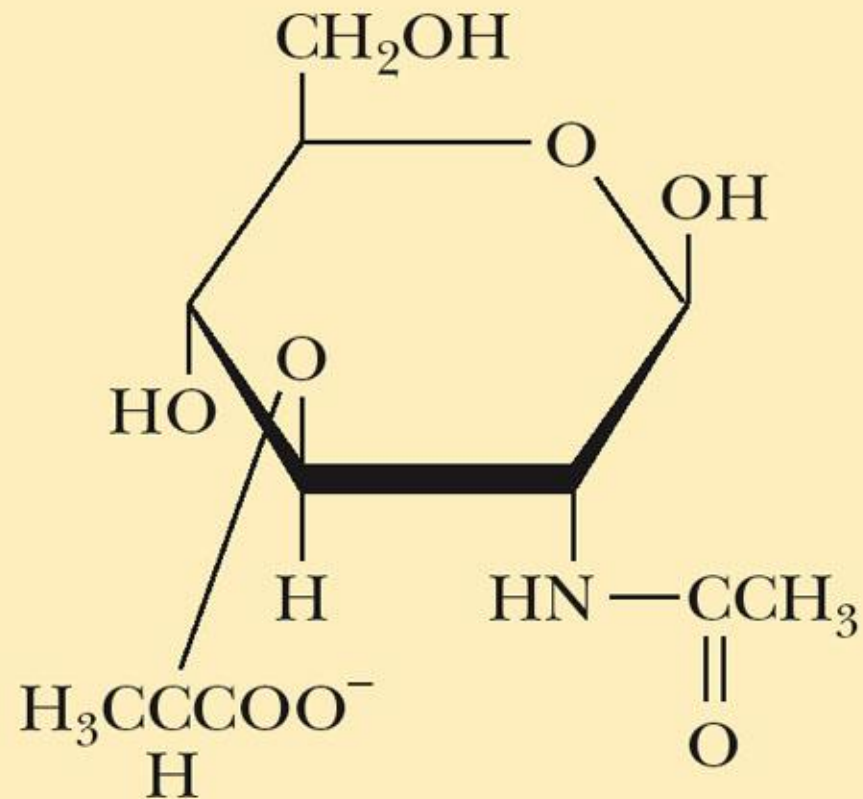


Dimer of α -D-glucose with $\alpha(1 \rightarrow 4)$ linkage

10) 당의 유도체 (아미노당)



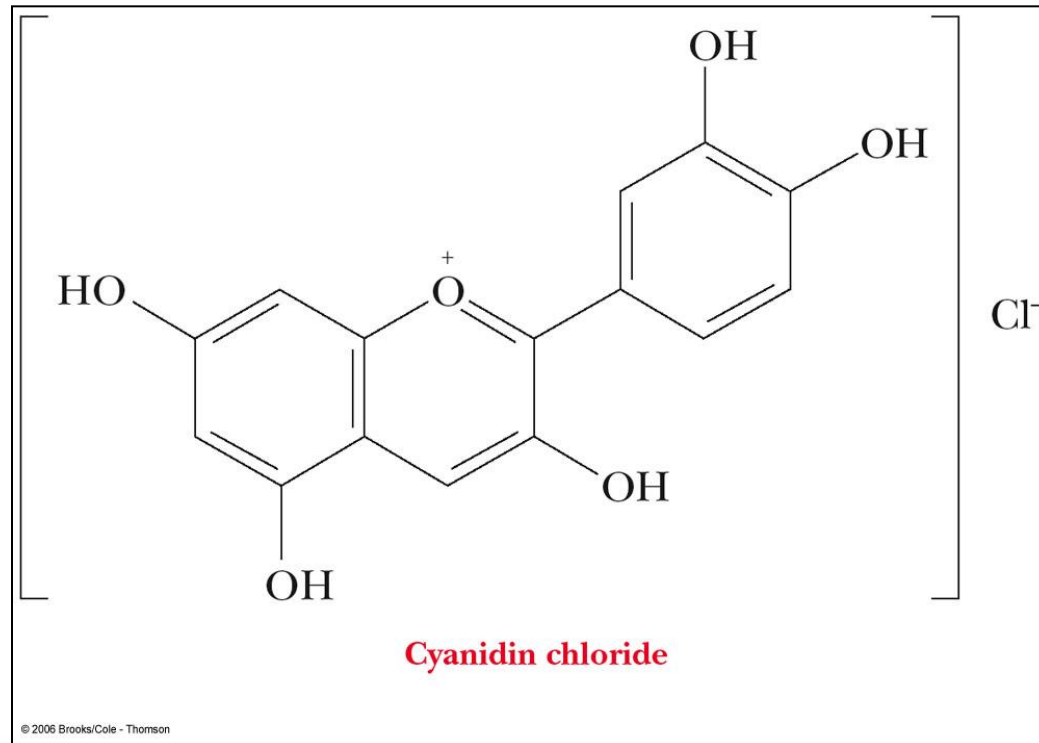
N-Acetyl- β -D-glucosamine



N-Acetylmuramic acid

꽃의 색깔(안토시아)

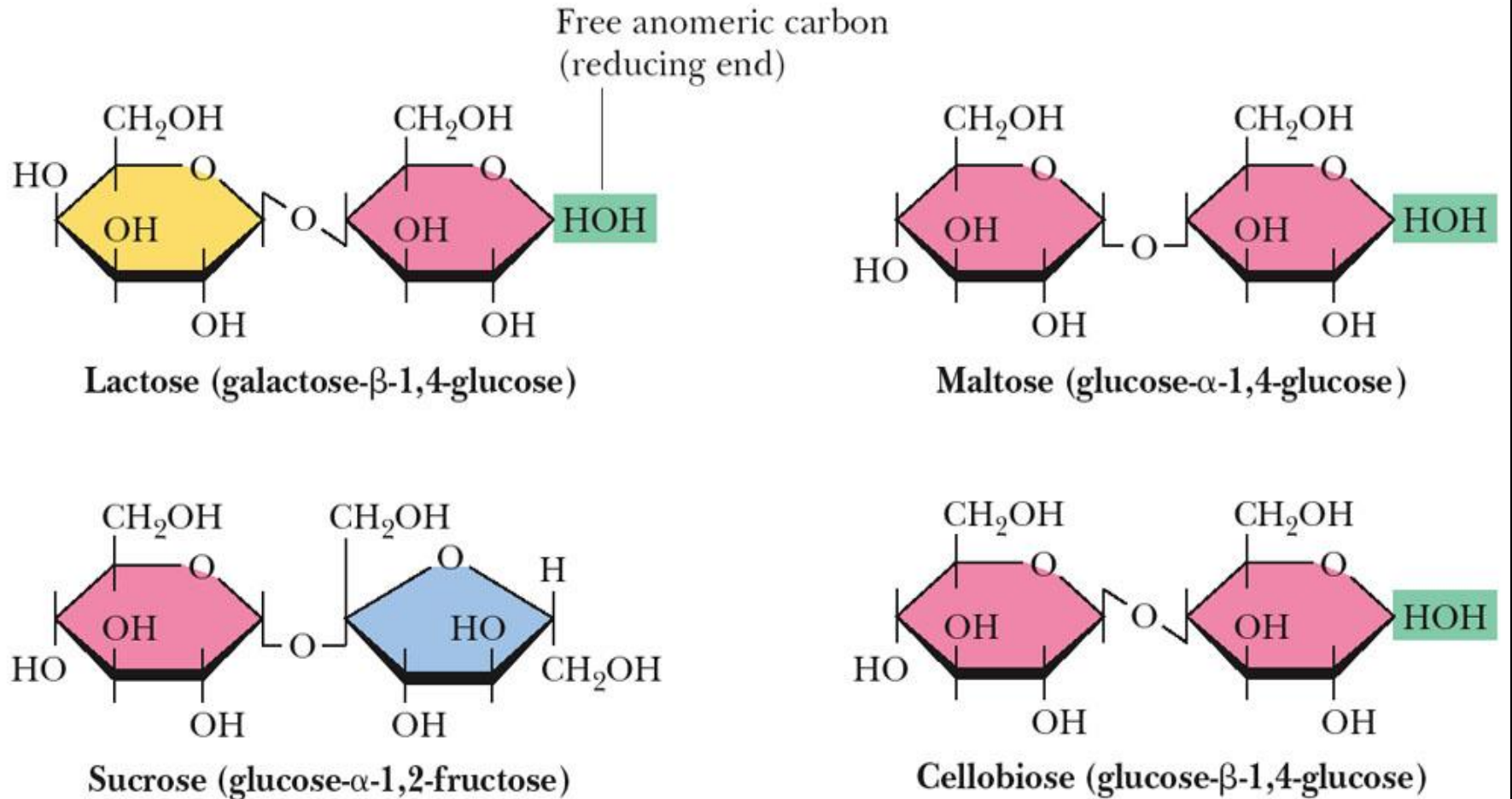
- 당과 결합되어 있다
- Water-soluble (수용성)



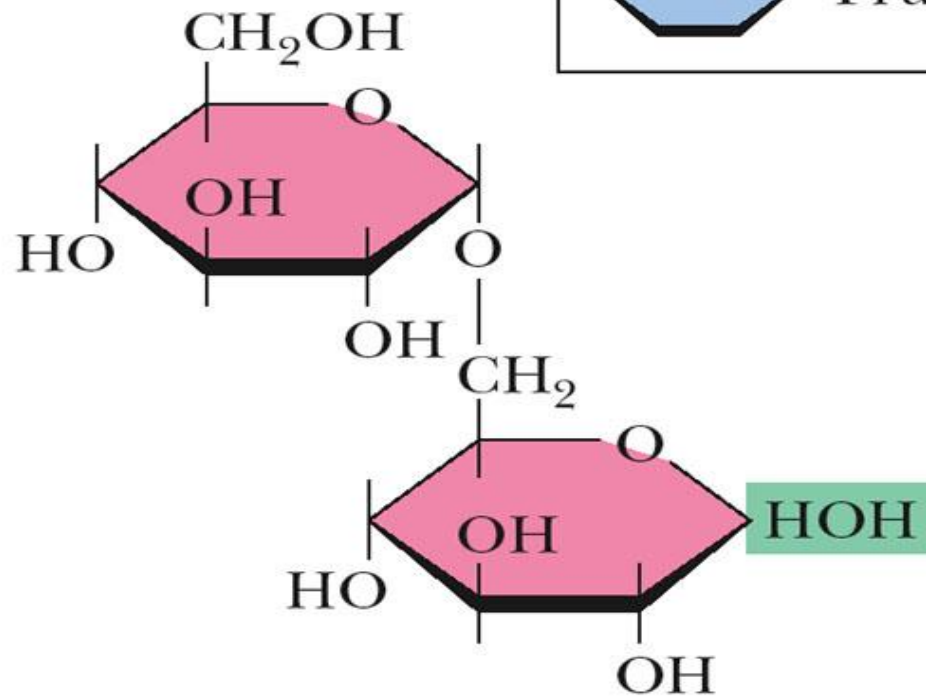
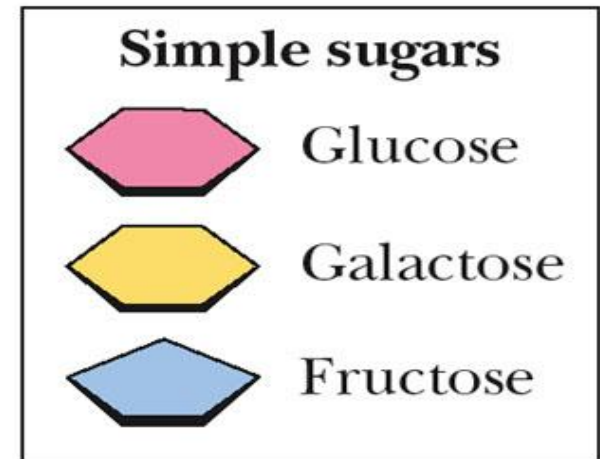
중요한 2당류

- Sucrose (설탕)
- Lactose (유당)
- Maltose (맥아당)
- Cellobiose
- Isomaltose

중요한 2당류



중요한 2당류



Isomaltose (glucose- α -1,6-glucose)

유당 불내증이란?

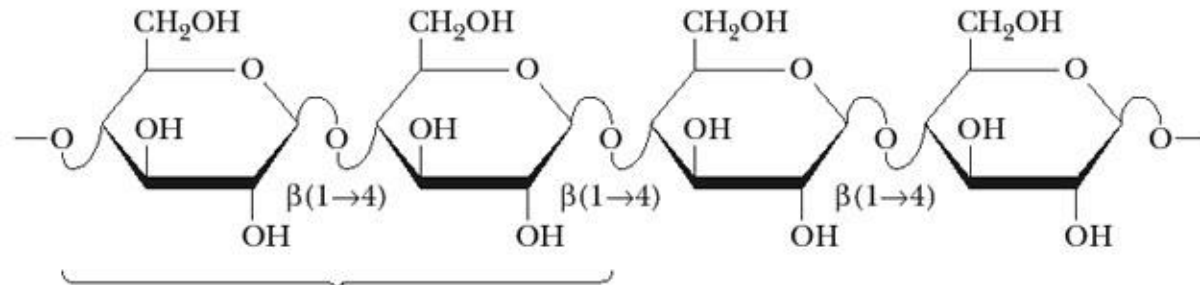
- 소장 Lactase의 결여
- 대장 박테리아 lactase에 의해 분해되어 수소가스, CO_2 , 유기산 생성
- 설사, 복부팽창 등 유발
- Soy milk, lactose-free milk 섭취로 예방 가능



다 당 류

- Cellulose
- Starch
- Glycogen
- Chitin
- Peptidoglycan
- Pectin
- Lignin
- Glycosaminoglycans

Cellulose



Repeating disaccharide
in cellulose
(β -cellobiose)



H-bonds

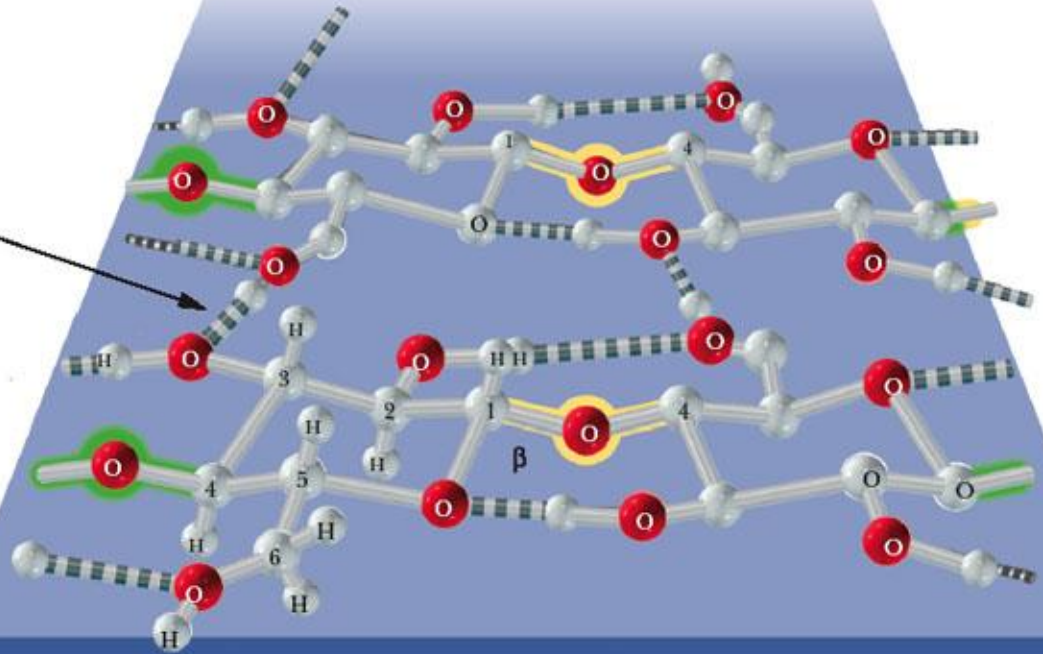
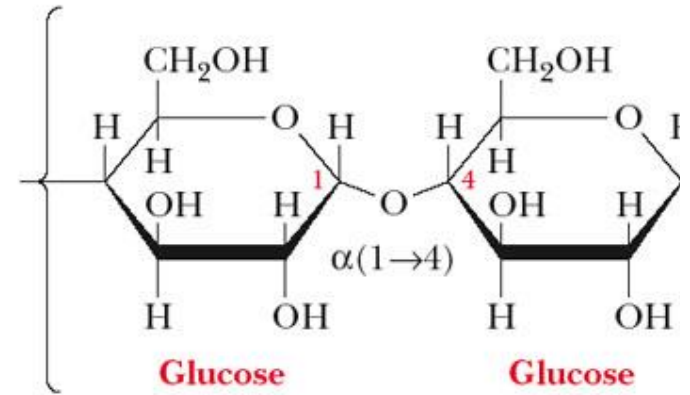
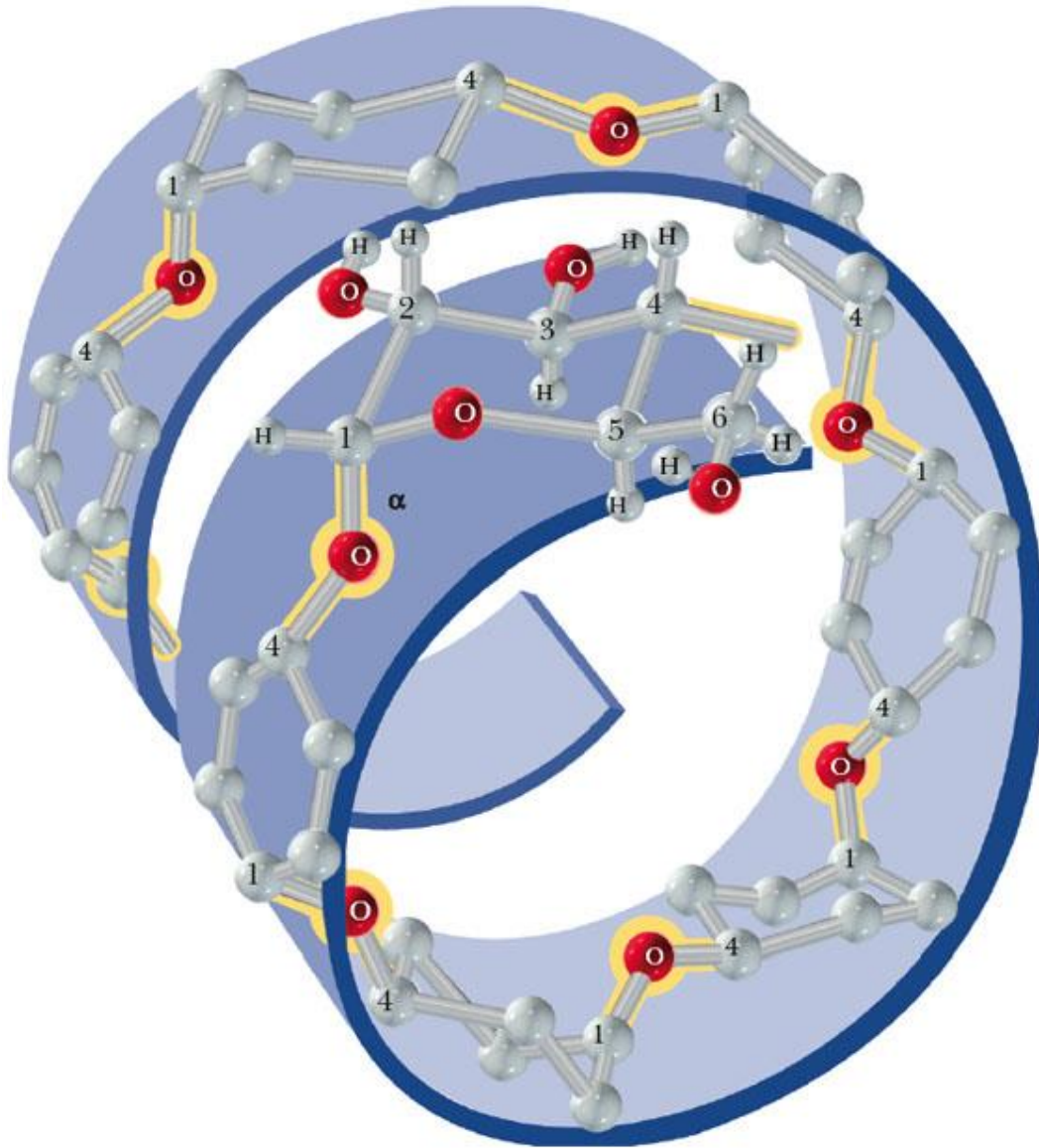
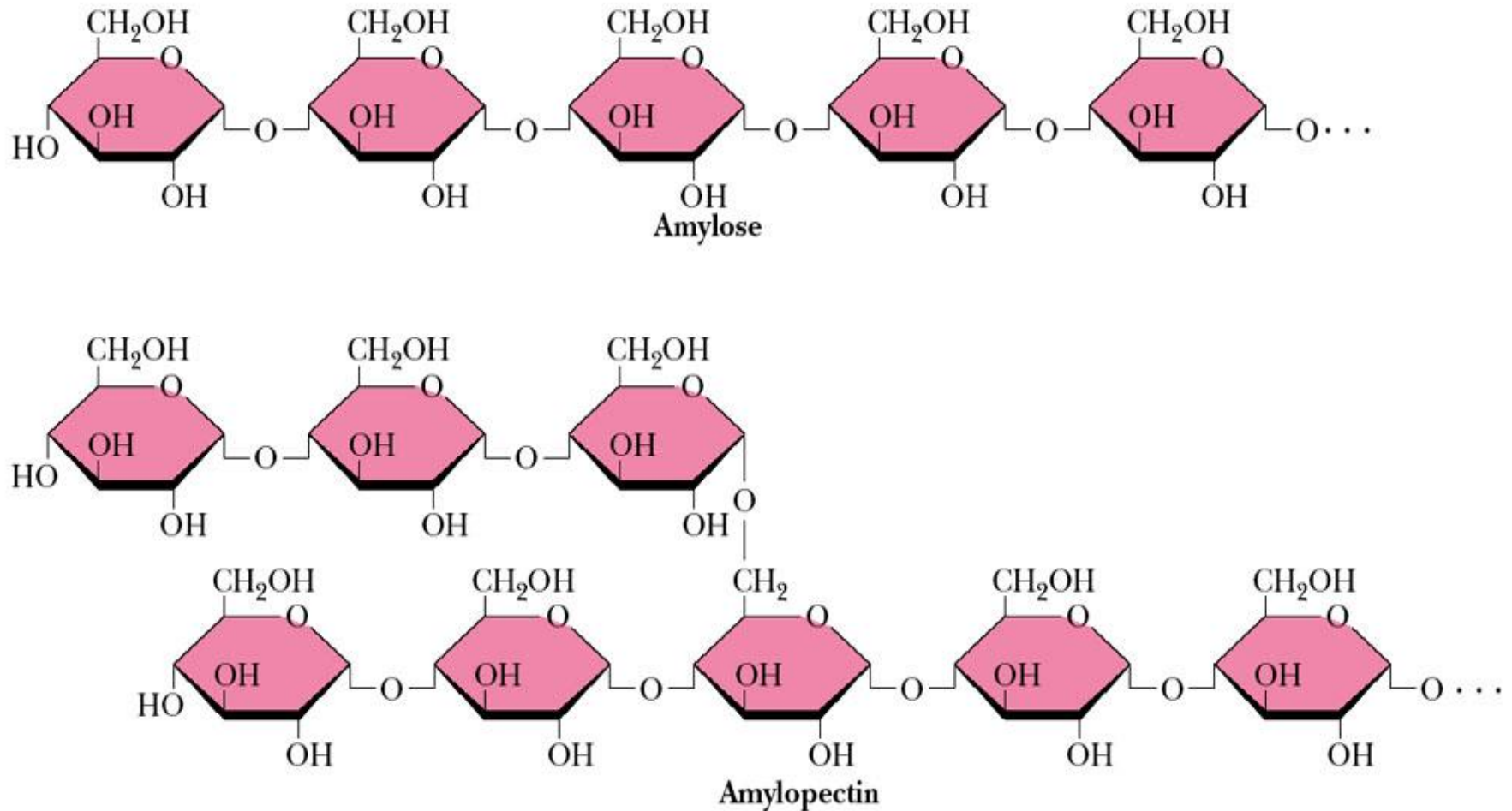


Fig. 16-19, p.451



Starch

Starch - amylose와 amylopectin



The starch-iodine complex

Amylose occurs as a helix with six residues per turn.

the iodine molecules are parallel to the long axis of the helix.

Four turns of the helix are shown here.

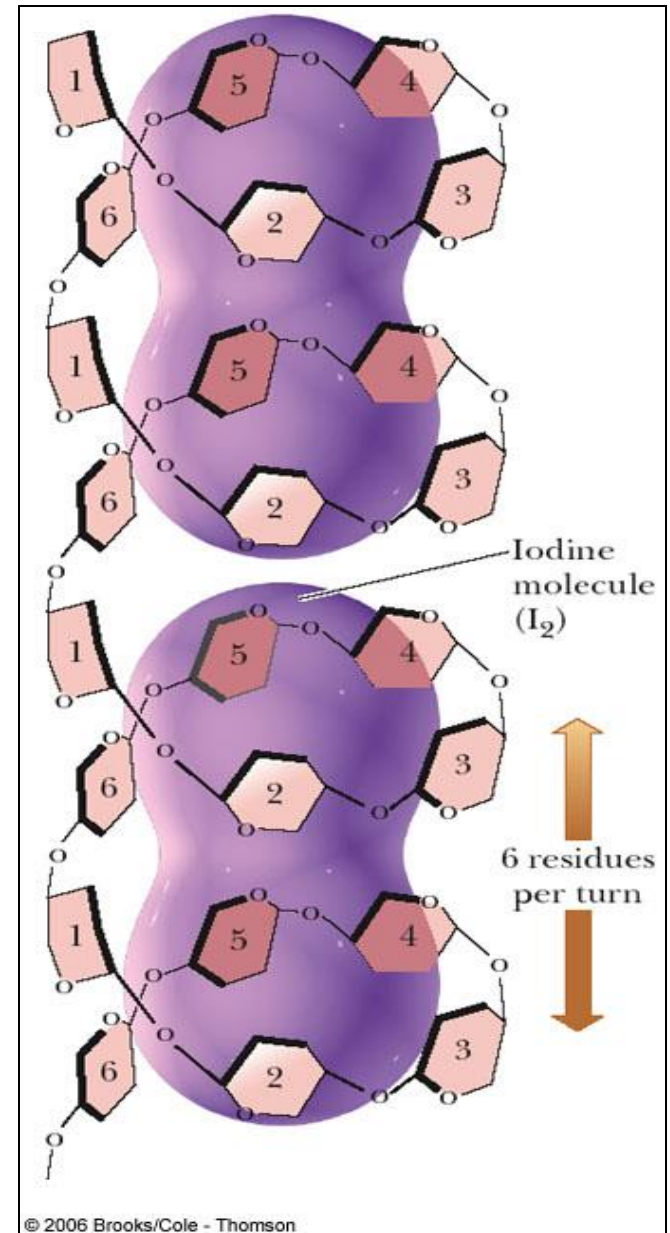
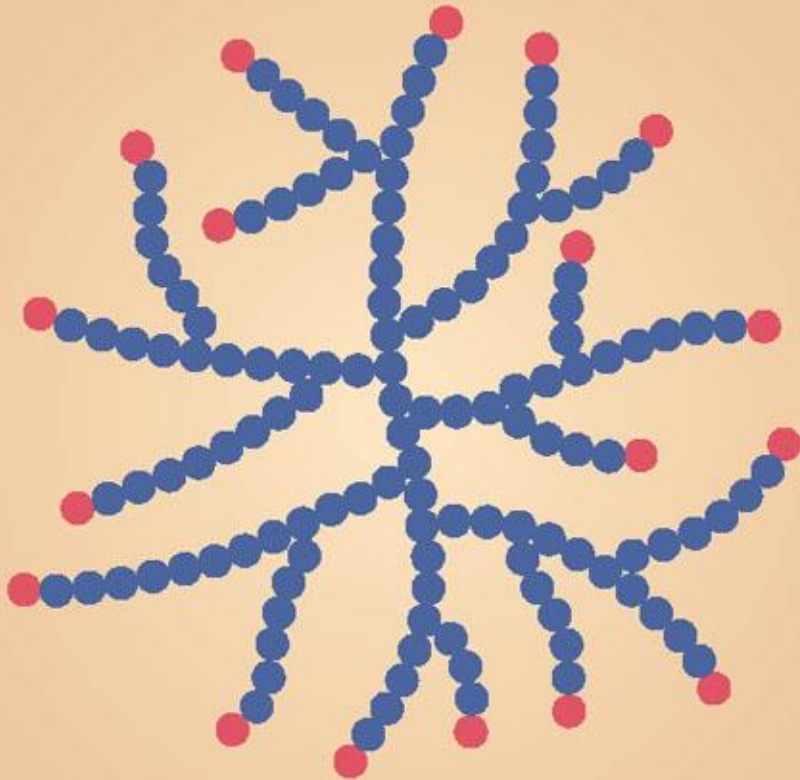
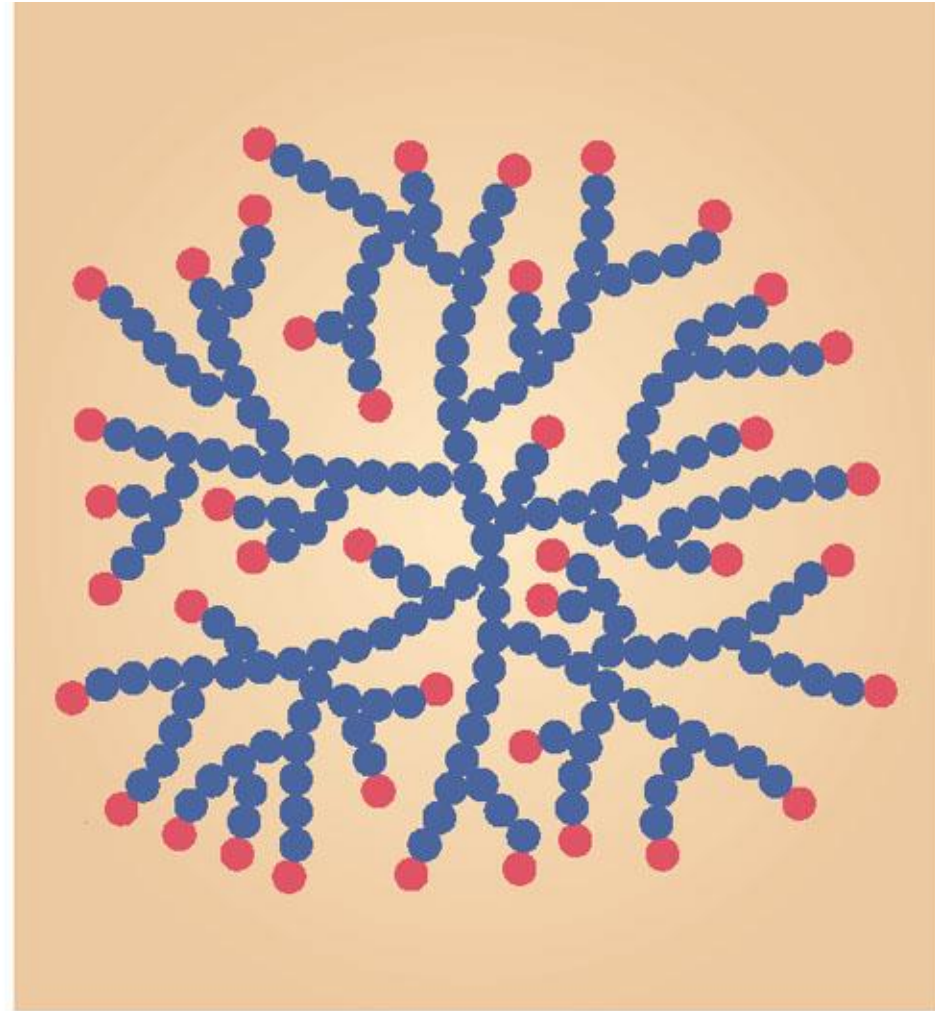


Fig. 16-22, p.453

Amylopectin과 glycogen의 구조비교

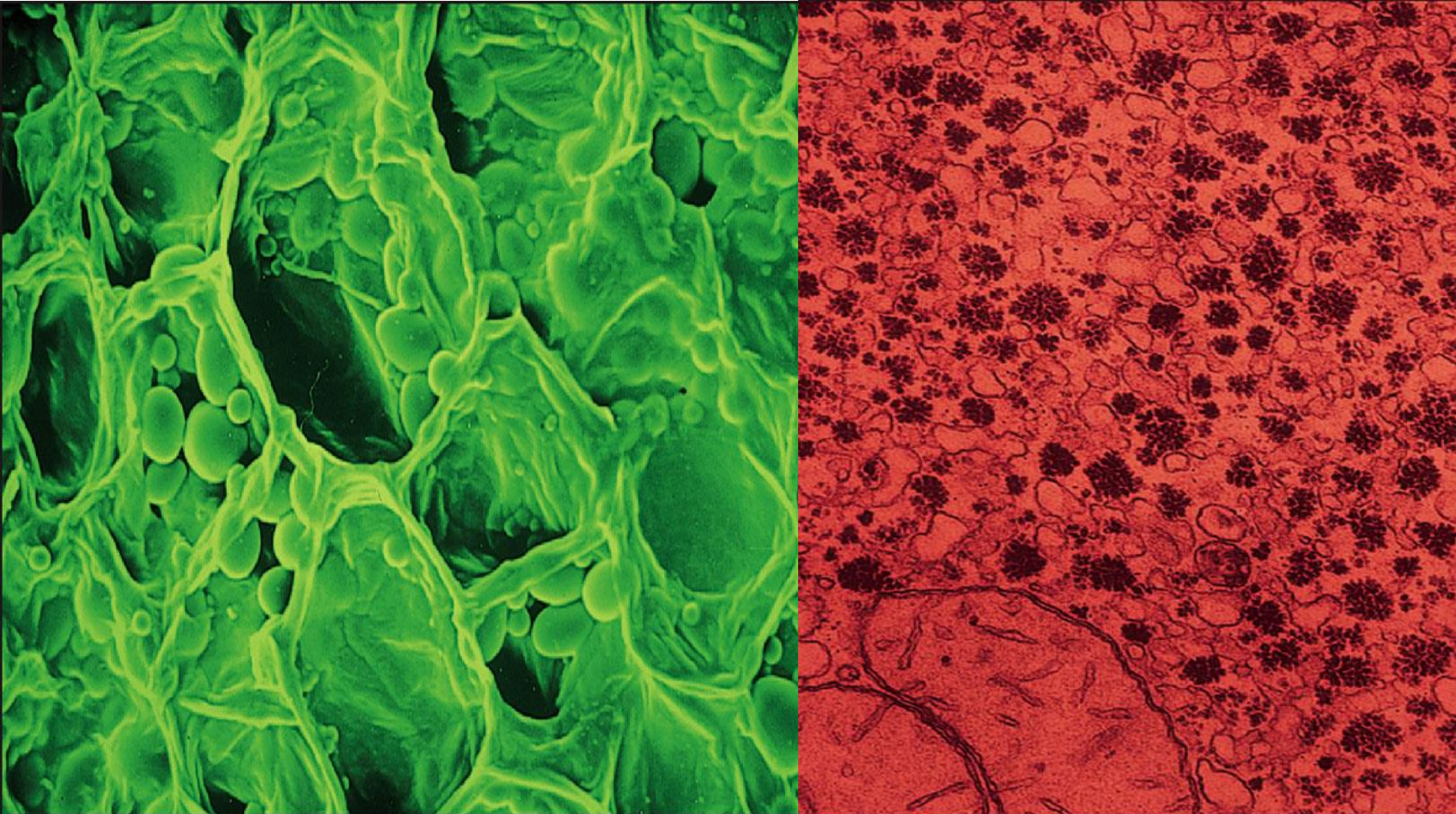


Amylopectin

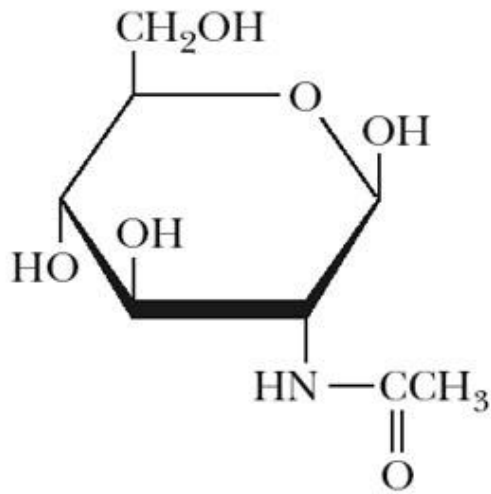


Glycogen

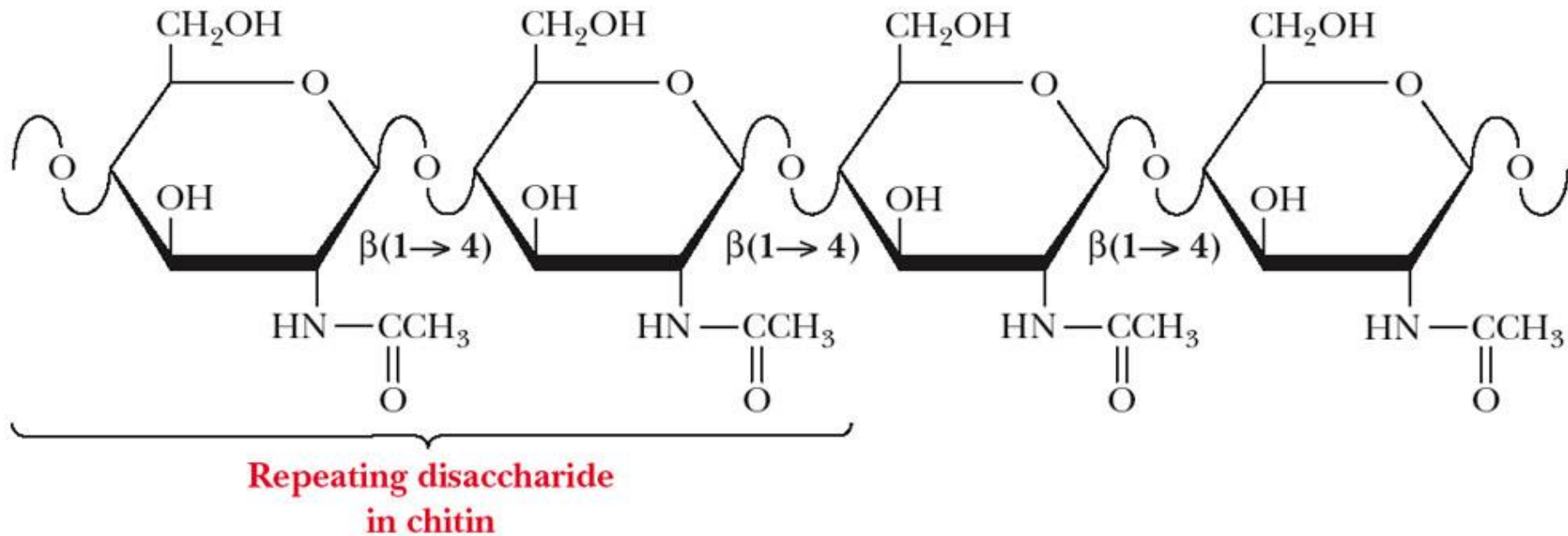
녹말과 글리코겐의 차이점



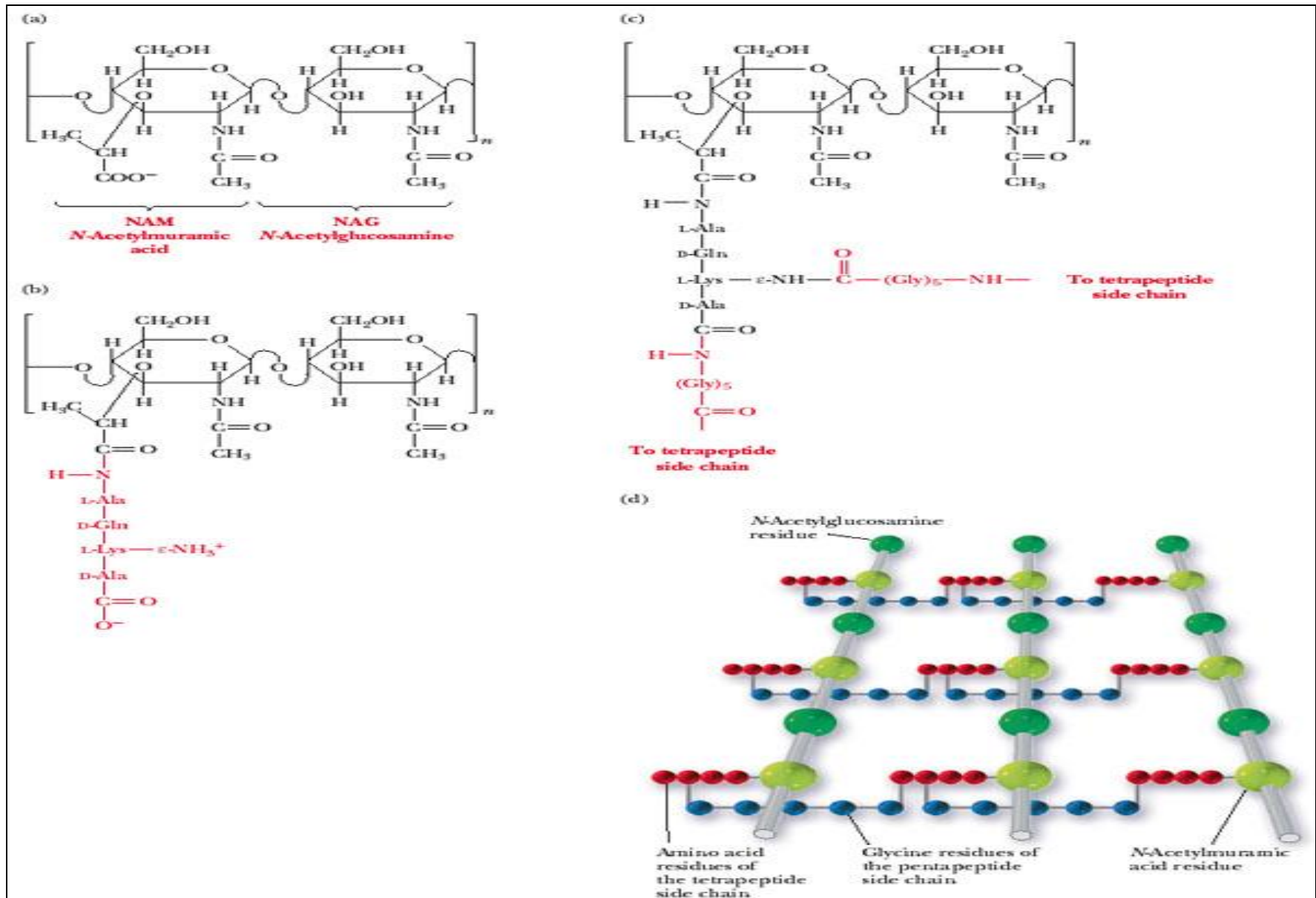
키틴



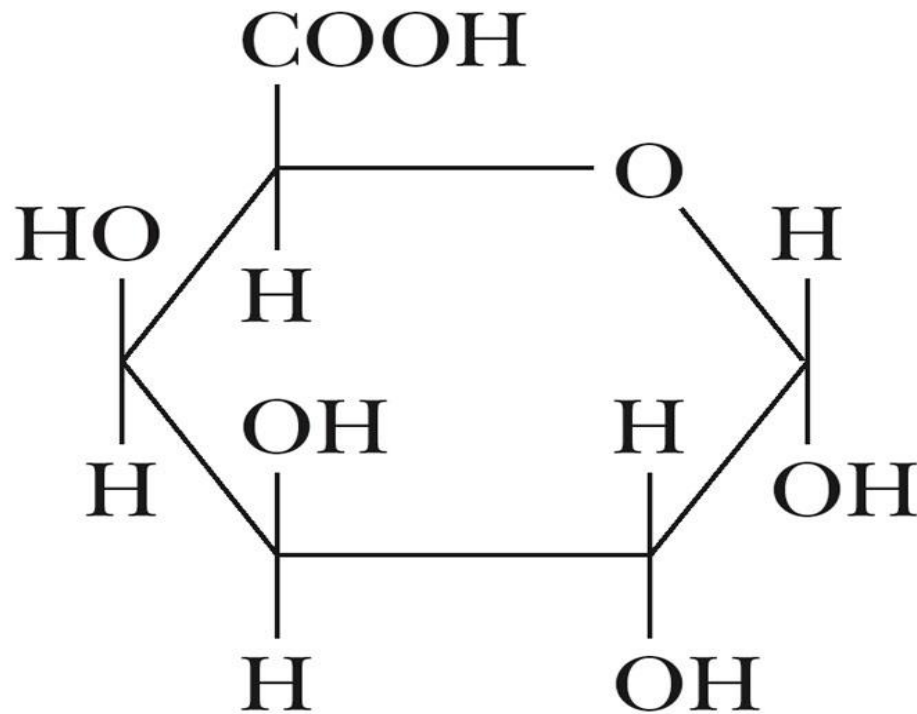
N-Acetyl-β-D-glucosamine



Peptidoglycan: 박테리아의 세포벽성분

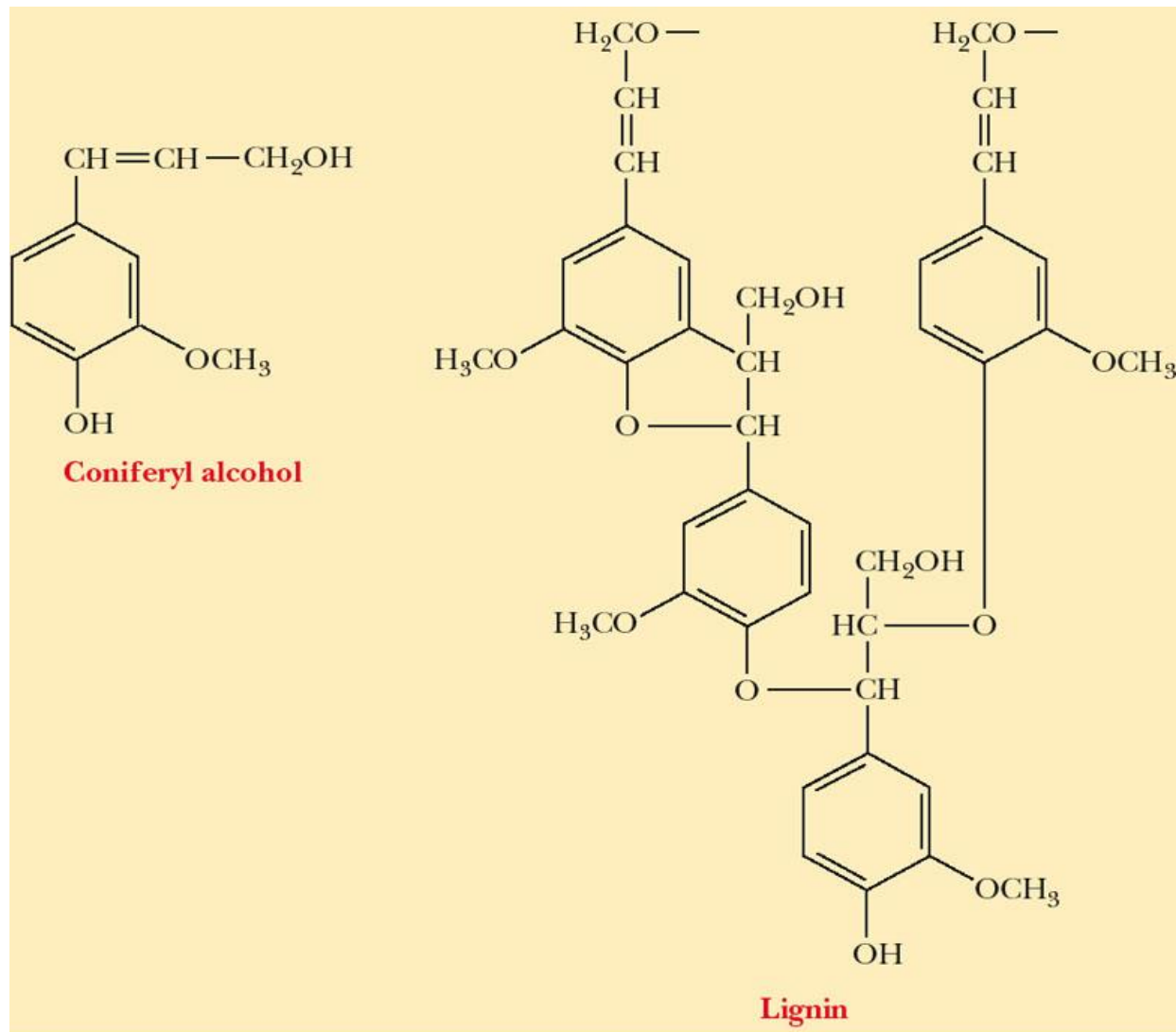


Pectin (D-galacturonic acid의 복합체)



D-Galacturonic acid

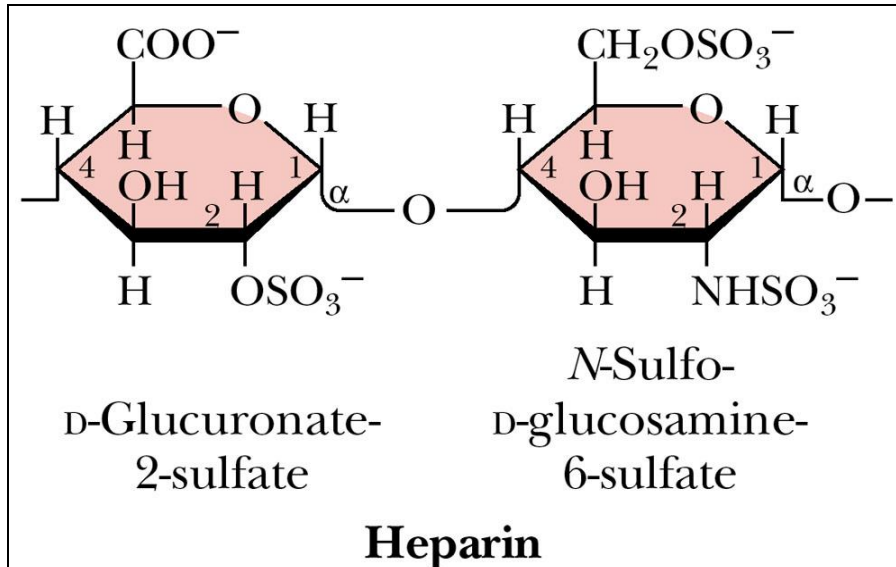
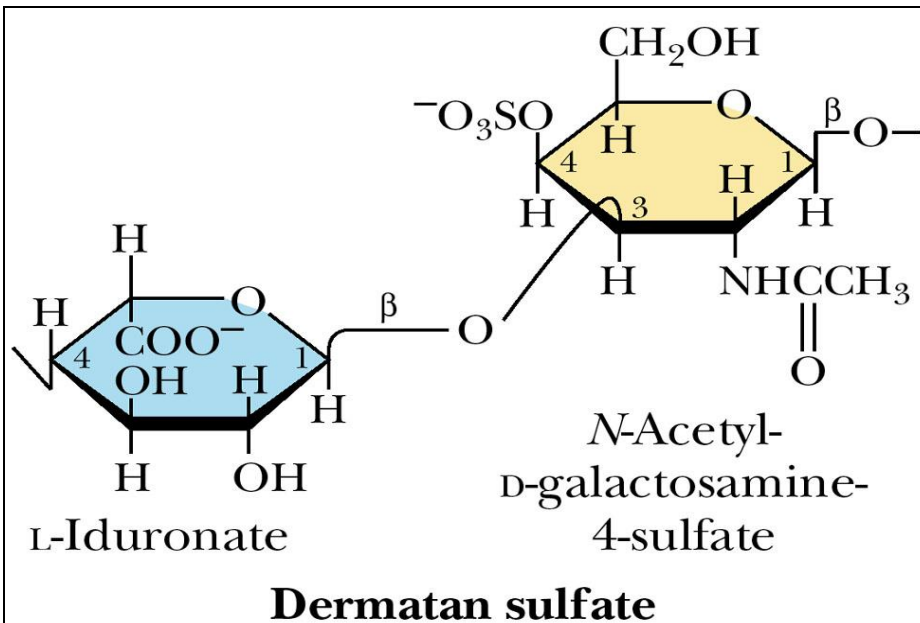
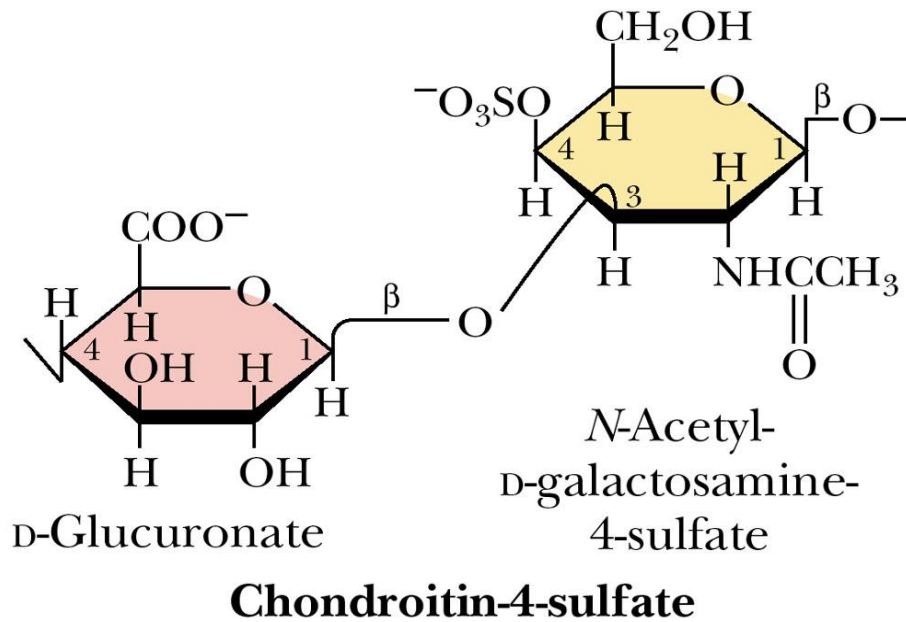
Lignin



Glycosaminoglycans

- 아미노당 + 음전하를 가진 당
(sulfate, carboxyl group)
- 콘드로이딘 설페이트 - 결합조직 성분
- Keratan sulfate
- Dermatan sulfate
- 헤파린 - 항응고제

Glycosaminoglycans



혈액형

- 적혈구의 세포막에 있는 항원인 여러 종류의 당단백질의 유무에 따라 분류되는 혈액의 종류를 일컫는다.
- ABO type
 - A형- A형 항원을 가진다.
 - B형- B형 항원을 가진다
 - AB형- A와 B형 항원인자를 가진다.
 - O형 - 항원인자가 없다
- Rh type
 - Rh+ : Rh항원을 가지고 있다.
 - Rh- : 아무것도 가지고 있지 않다

β -N-Acetylgalactosamine (1 $\rightarrow$ 3) β -Galactose (1 $\rightarrow$ 3) β -N-Acetylgalactosamine



α -L-Fucose

Nonreducing end

Type-A blood-group antigen

α -Galactose (1 $\rightarrow$ 3) β -Galactose (1 $\rightarrow$ 3) β -N-Acetylgalactosamine



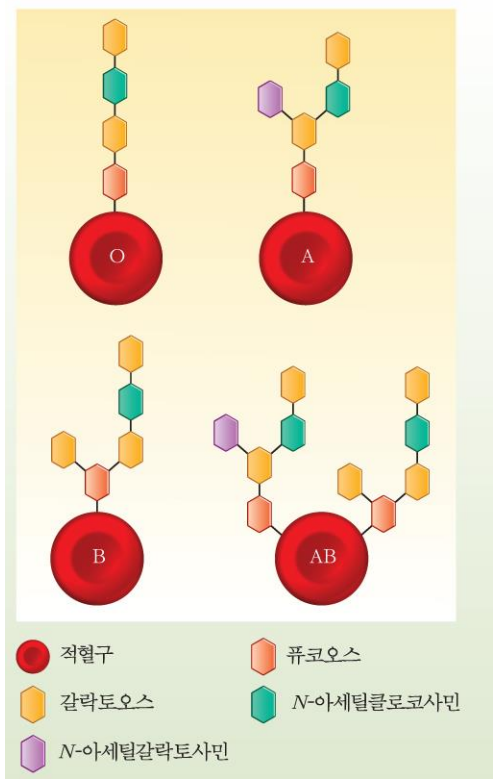
α -L-Fucose

Nonreducing end

Type-B blood-group antigen

16.5 생화학과의 접목 | 건강과 관련된 이야기

당단백질과 수혈



수혈 상관관계			
혈액형	항체를 형성하는 대상 혈액형	수혈 받을 수 있는 혈액형	수혈해 줄 수 있는 혈액형
O	A, B	O	O, A, B, AB
A	B	O, A	A, AB
B	A	O, B	B, AB
AB	없음	O, A, B, AB	AB

16.1 생화학과의 접목 | 영양과 건강

저-탄수화물 식이요법



시판되는 일부 식품들은 그 식품의 글리세믹 지표가 낮다는 것을 주장하고 있다.



저-탄수화물 식이요법으로 체중이 감소하면 혈압을 현저하게 떨어뜨릴 수 있다.

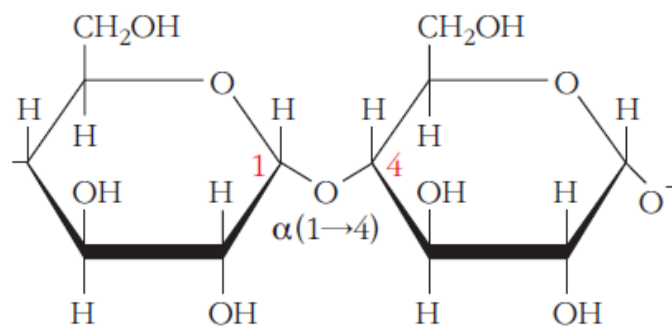
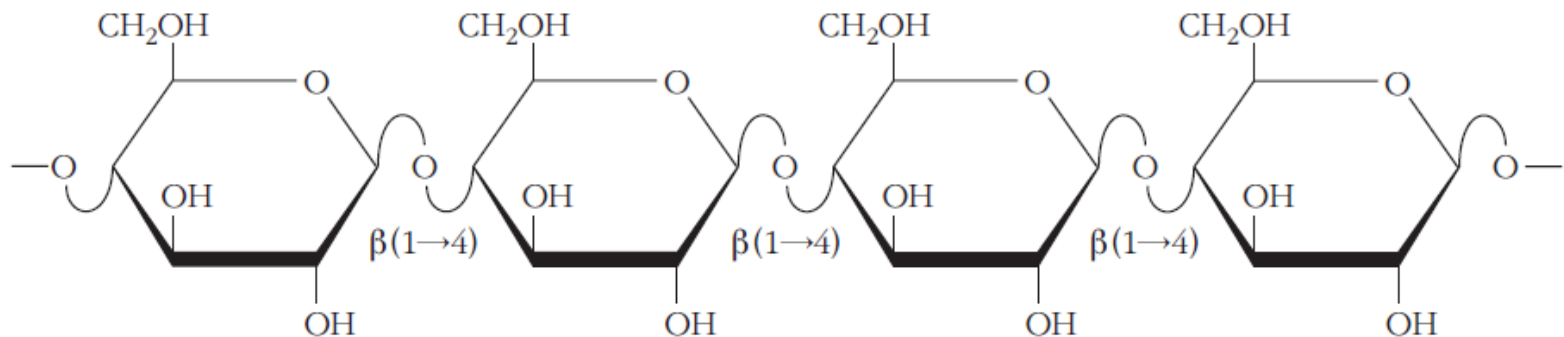
저 탄수화물식이요법

- 체중조절에 효과적인가?
 - Atkin diet (황제 diet)
- 저당질식이는 운동에 효과적인가?



16.4 생화학과의 접목 | 건강과 관련된 이야기

식이섬유가 몸에 아주 좋은 이유는 무엇일까?



수많은 아침식사용 곡류식품(시리얼)은 섬유질 함량이 높다는 광고를 하고 있다.
이러한 아침식사에는 과일도 들어 있어서 섬유질 함량이 올라간다.