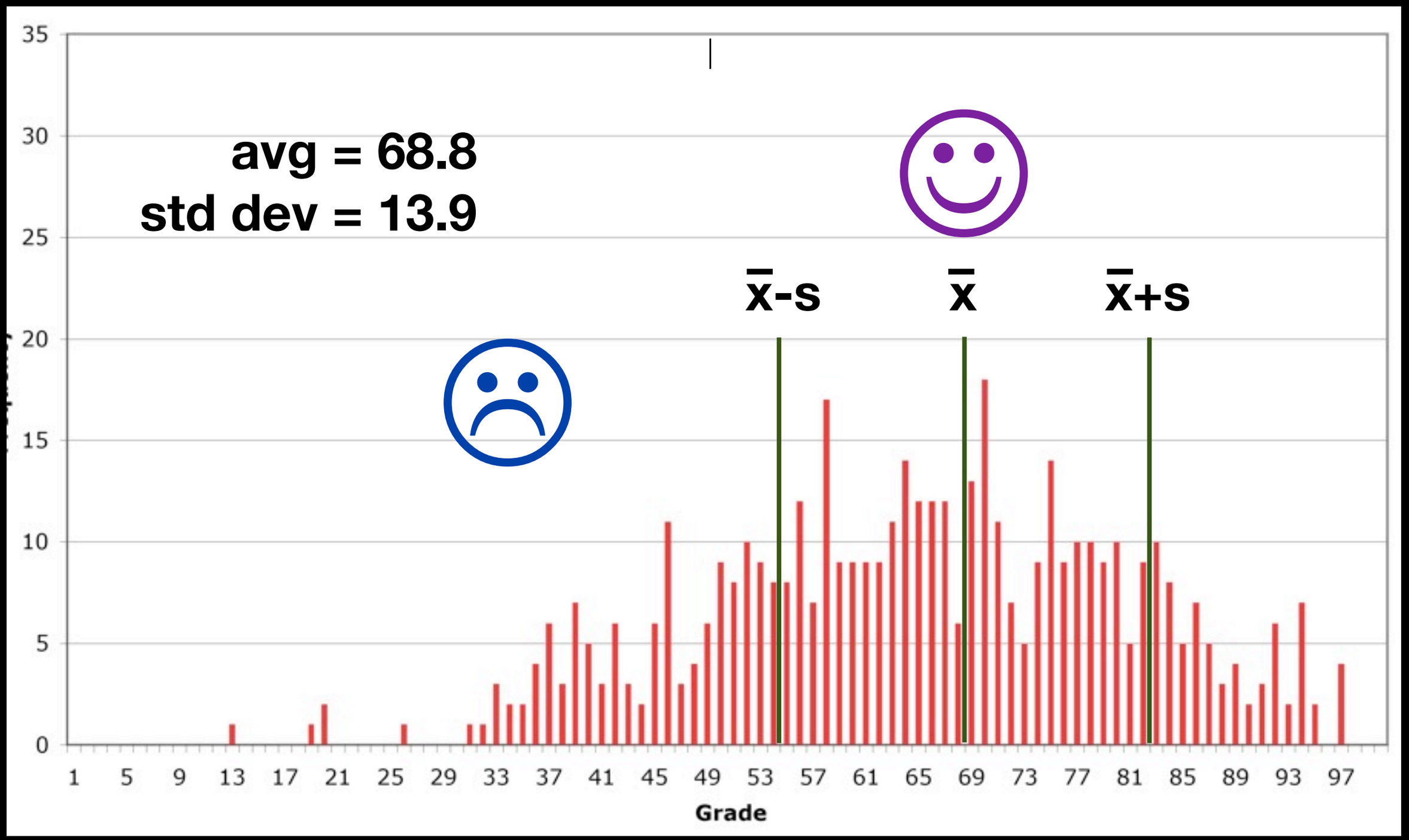
Welcome to 3.091

Lecture 30

November 25, 2009

Biochemistry: Amino Acids

Test 3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x̄-s
x̄
x̄+s
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30
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20
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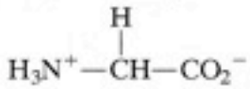
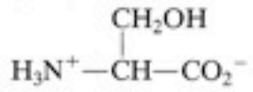
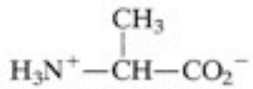
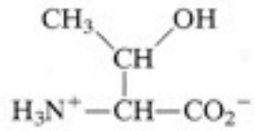
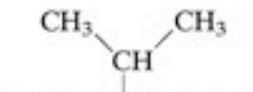
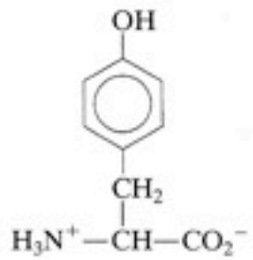
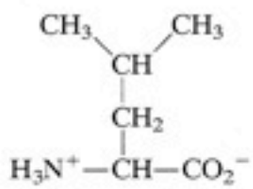
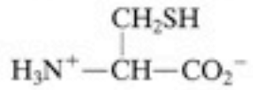
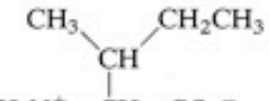
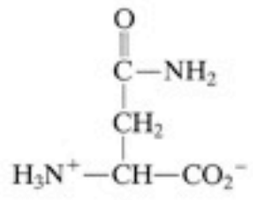
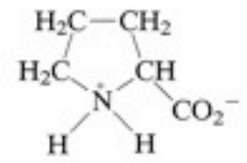
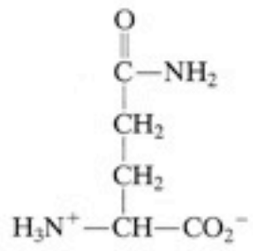
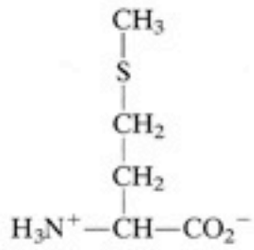
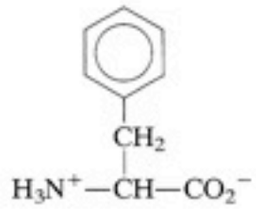
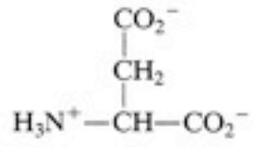
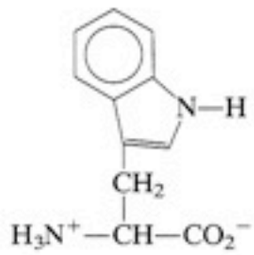
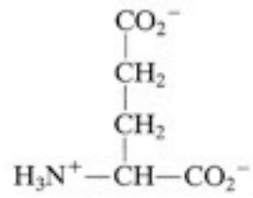
10
5
0
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57 61 65 69 73 77 81 85 89 93 97
Grade

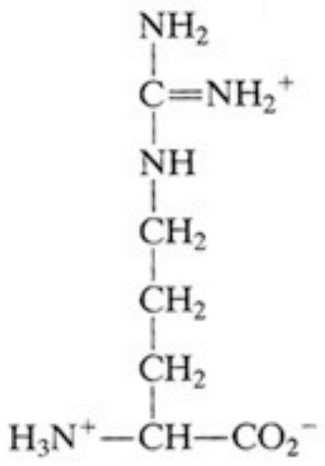
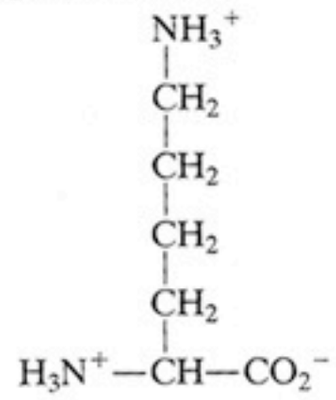
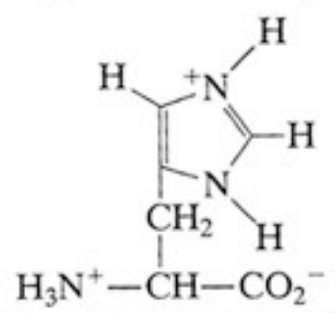
All things are made of atoms – little particles that move around in perpetual motion, attracting each other when they are a little distance apart, but repelling upon being squeezed into one another.

R. Feynmann, R. Leighton, M. Sands
The Feynmann Lectures on Physics

TABLE BIO.1 The 20 Standard Amino Acids

Name	*Structure (at neutral pH)*	*Name*	*Structure (at neutral pH)*
Nonpolar (Hydrophobic) R Groups		**Polar (Hydrophilic) R Groups**	
Glycine (Gly)		Serine (Ser)	
Alanine (Ala)		Threonine (Thr)	
Valine (Val)		Tyrosine (Tyr)	
Leucine (Leu)		Cysteine (Cys)	
Isoleucine (Ile)		Asparagine (Asn)	
Proline (Pro)		Glutamine (Gln)	
Methionine (Met)		**Negatively Charged R Groups**	
Phenylalanine (Phe)		Aspartic acid (Asp)	
Tryptophan (Trp)		Glutamic acid (Glu)	

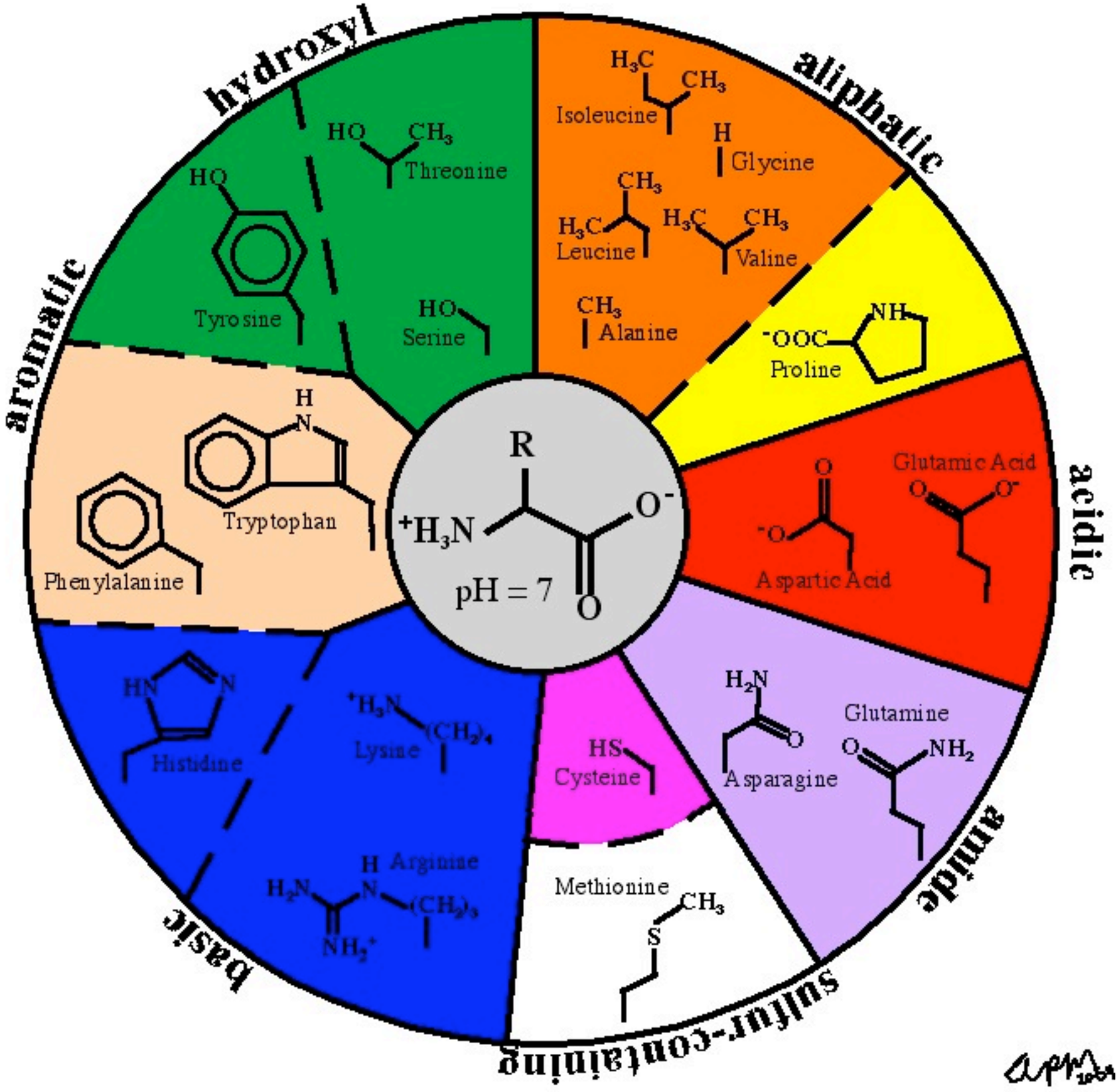
(continued)

Name	*Structure (at neutral pH)*	*Name*	*Structure (at neutral pH)*
Positively Charged R Groups		**Positively Charged R Groups**	
Arginine (Arg)		Lysine (Lys)	
		Histidine (His)	

Courtesy of John Wiley & Sons. Used with permission. Source: Spencer, J. N., G. M. Bodner, and L. H. Rickard. *Chemistry: Structure and Dynamics*. 2nd edition, supplement. New York, NY: John Wiley & Sons, 2003.

Amino Acid		Side-Chain pKA	
Alanine	Ala	A	-
Cysteine	Cys	C	8.33
Aspartic Acid	Asp	D	3.90
Glutamic Acid	Glu	E	4.07
Phenylalanine	Phe	F	-
Glycine	Gly	G	-
Histidine	His	H	6.04
Isoleucine	Ile	I	-
Lysine	Lys	K	10.79
Leucine	Leu	L	-
Methionine	Met	M	-
Asparagine	Asn	N	-
Proline	Pro	P	-
Glutamine	Gln	Q	-
Arginine	Arg	R	12.48
Serine	Ser	S	-
Threonine	Thr	T	-
Valine	Val	V	-
Tryptophan	Trp	W	-
Tyrosine	Tyr	Y	10.13

compiled by Andrew Magyar



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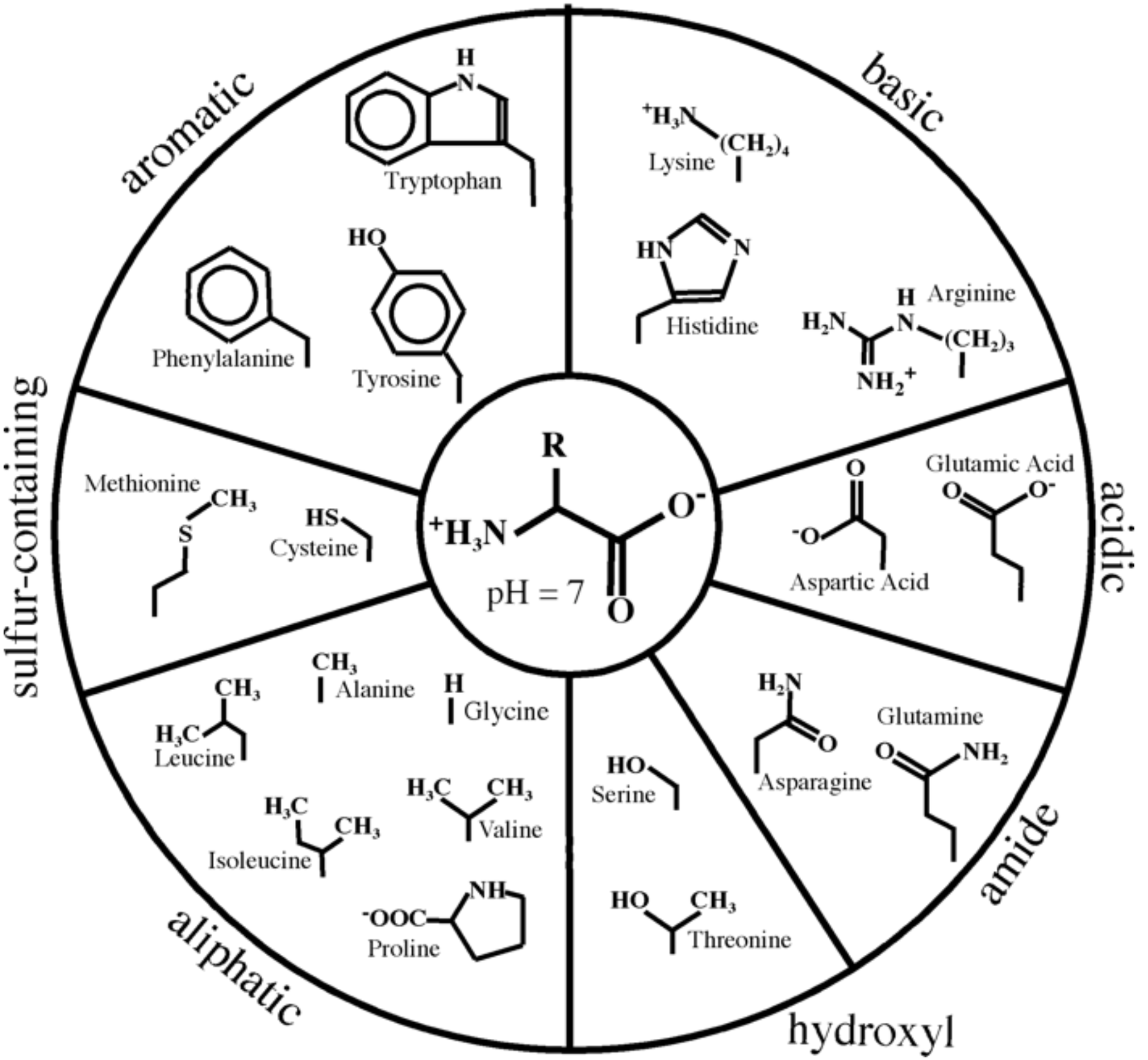

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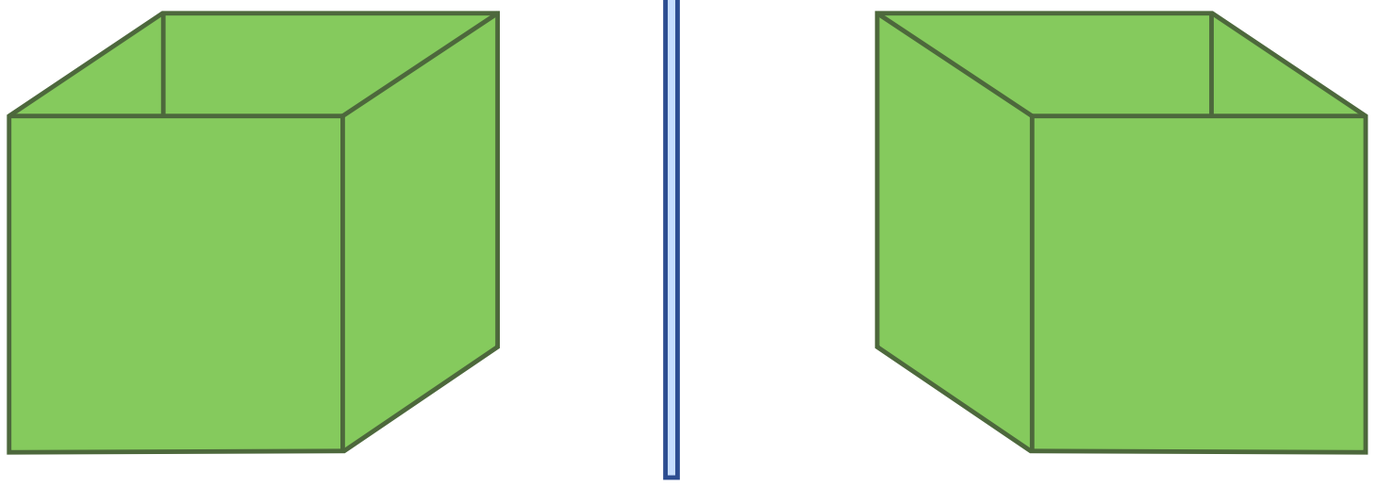
MIRROR



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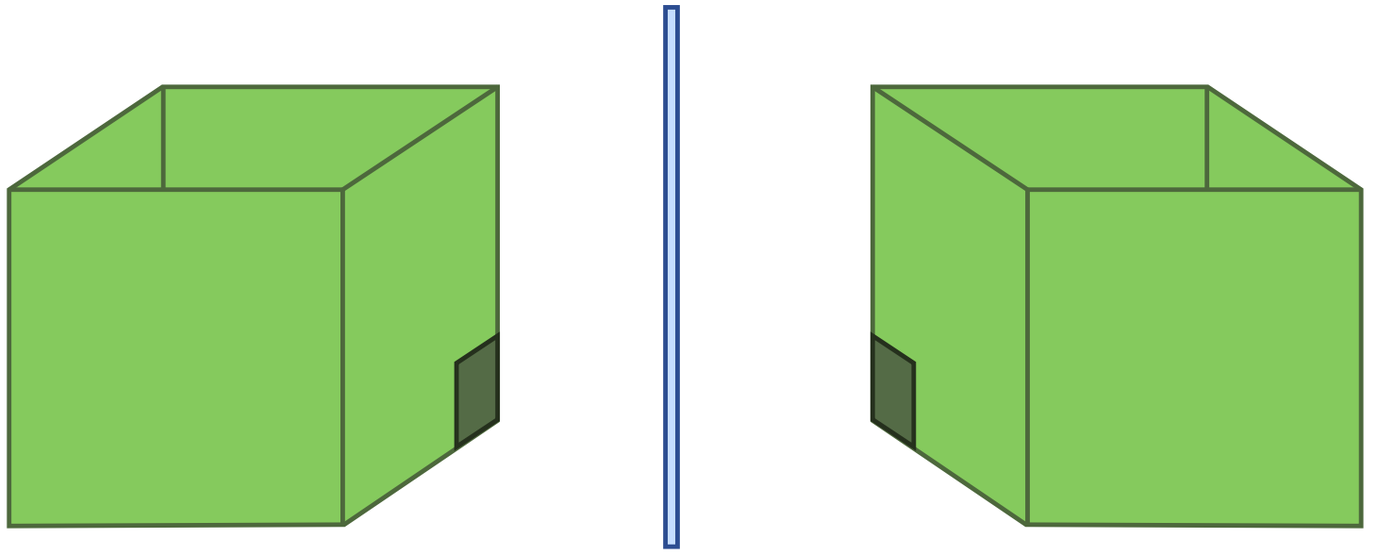


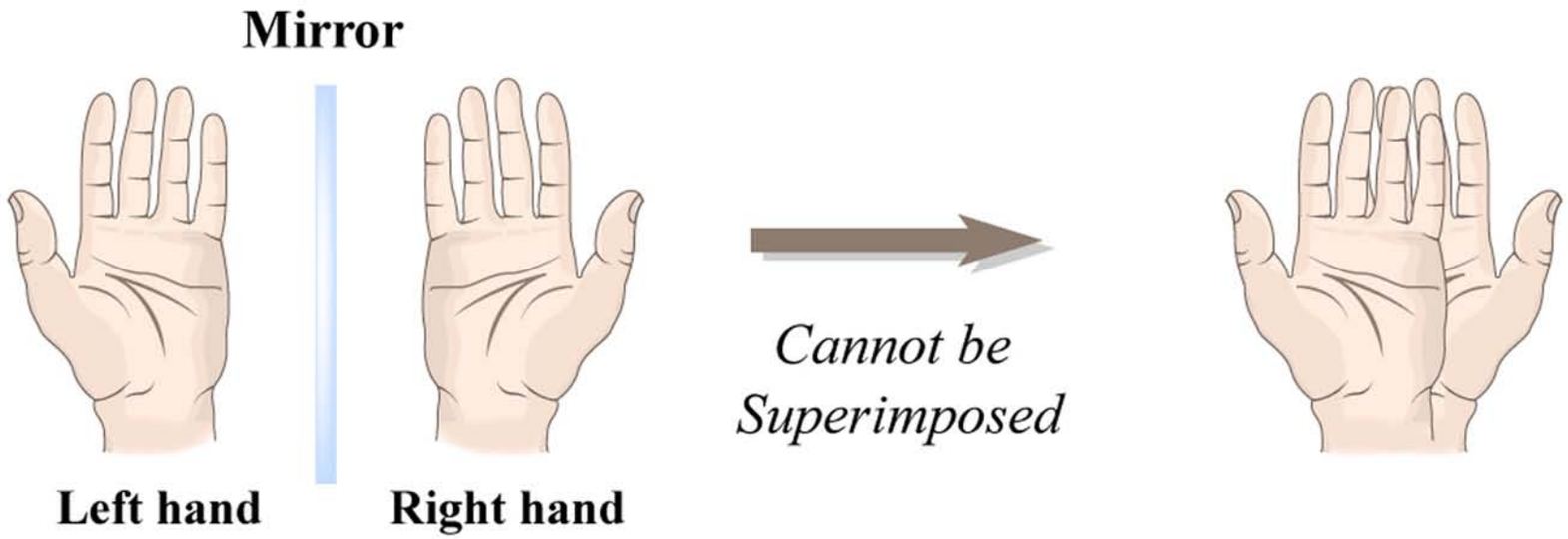
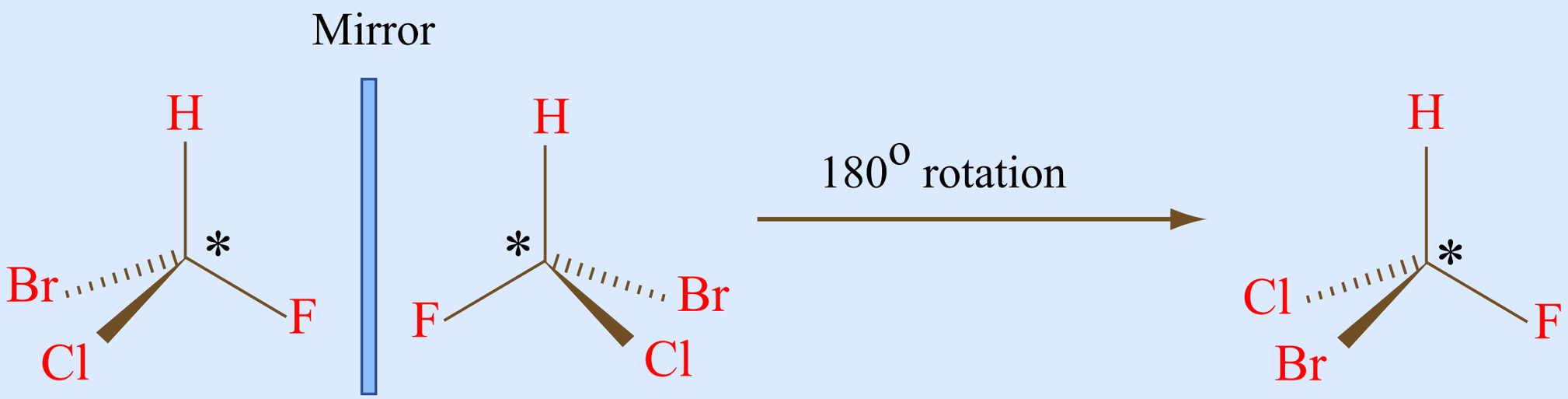
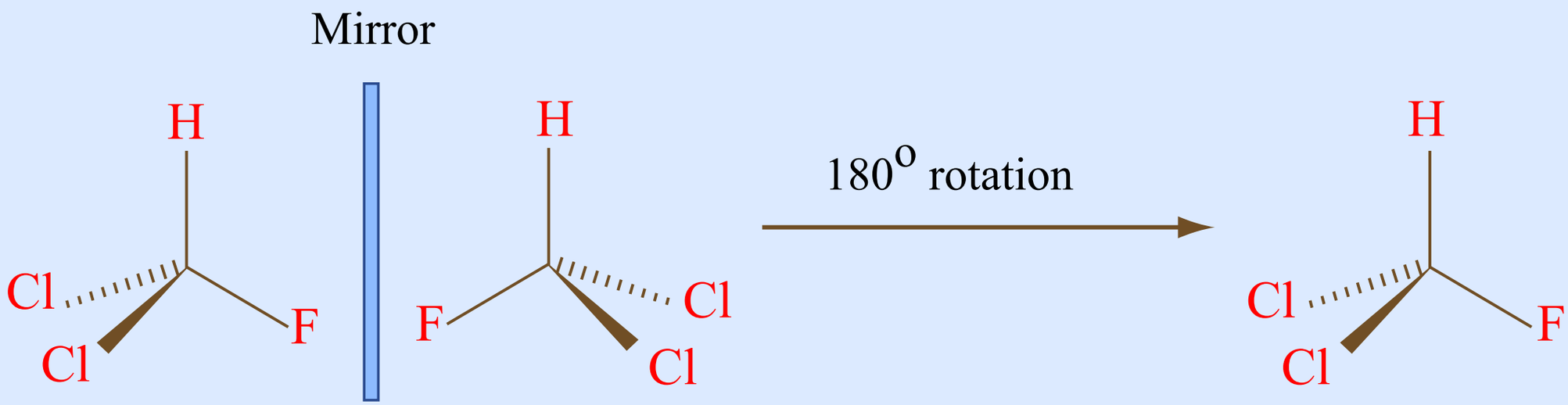


Image by MIT OpenCourseWare.

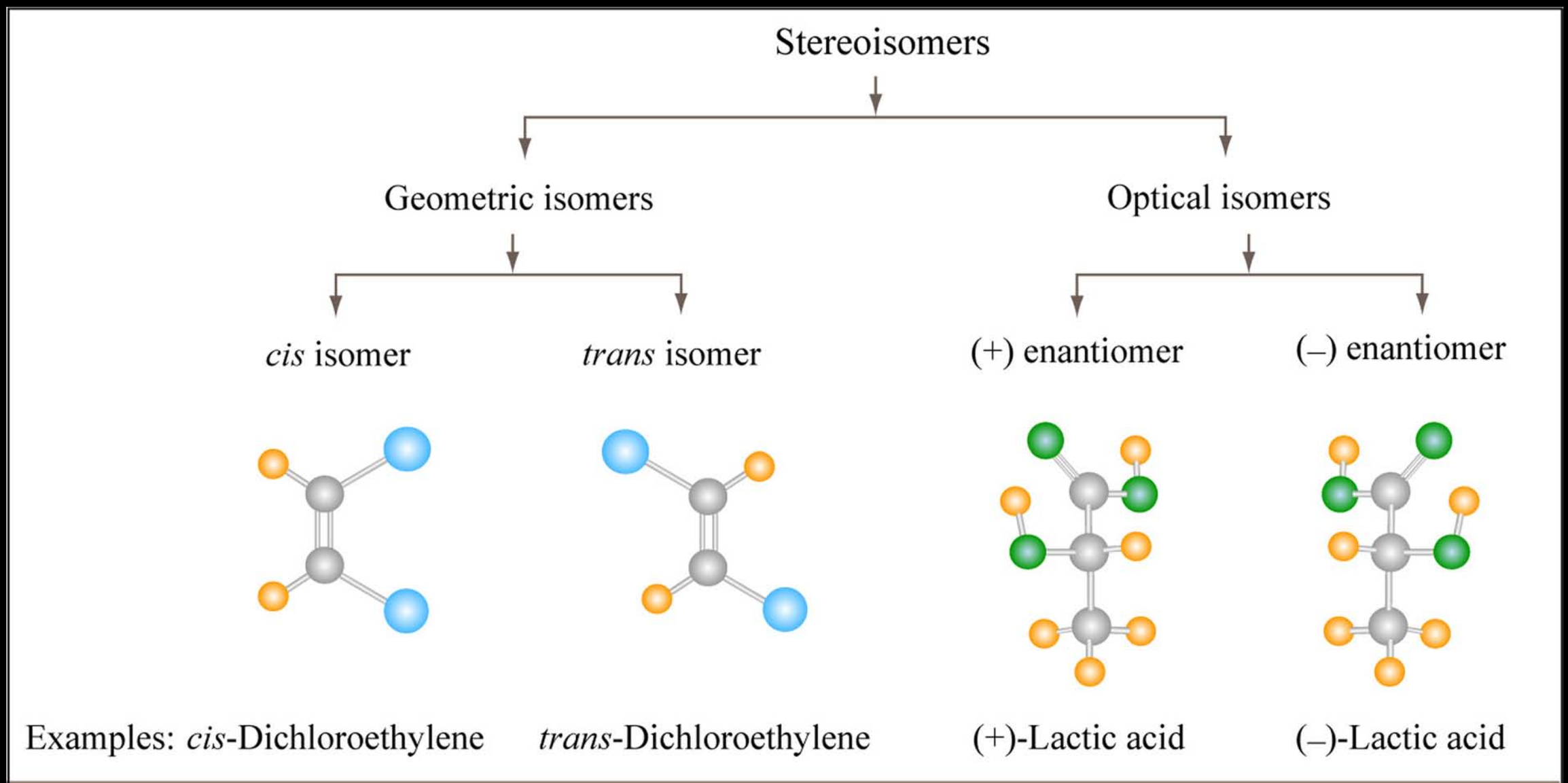
Chiral and Achiral Molecules



Bromochlorofluoromethane: Cannot be Superimposed



Dichlorofluoromethane: Can be Superimposed



Four Categories of Stereoisomers

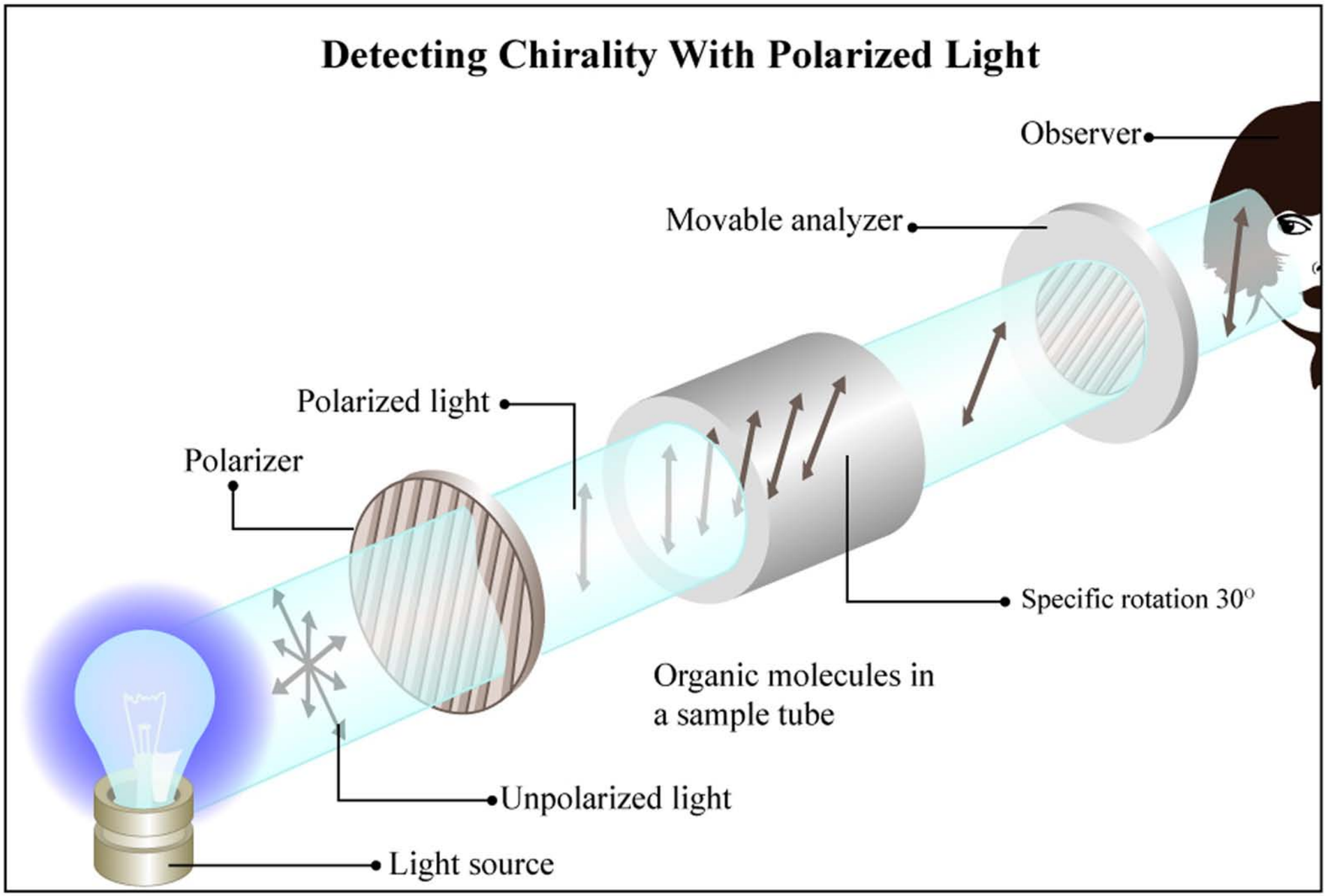
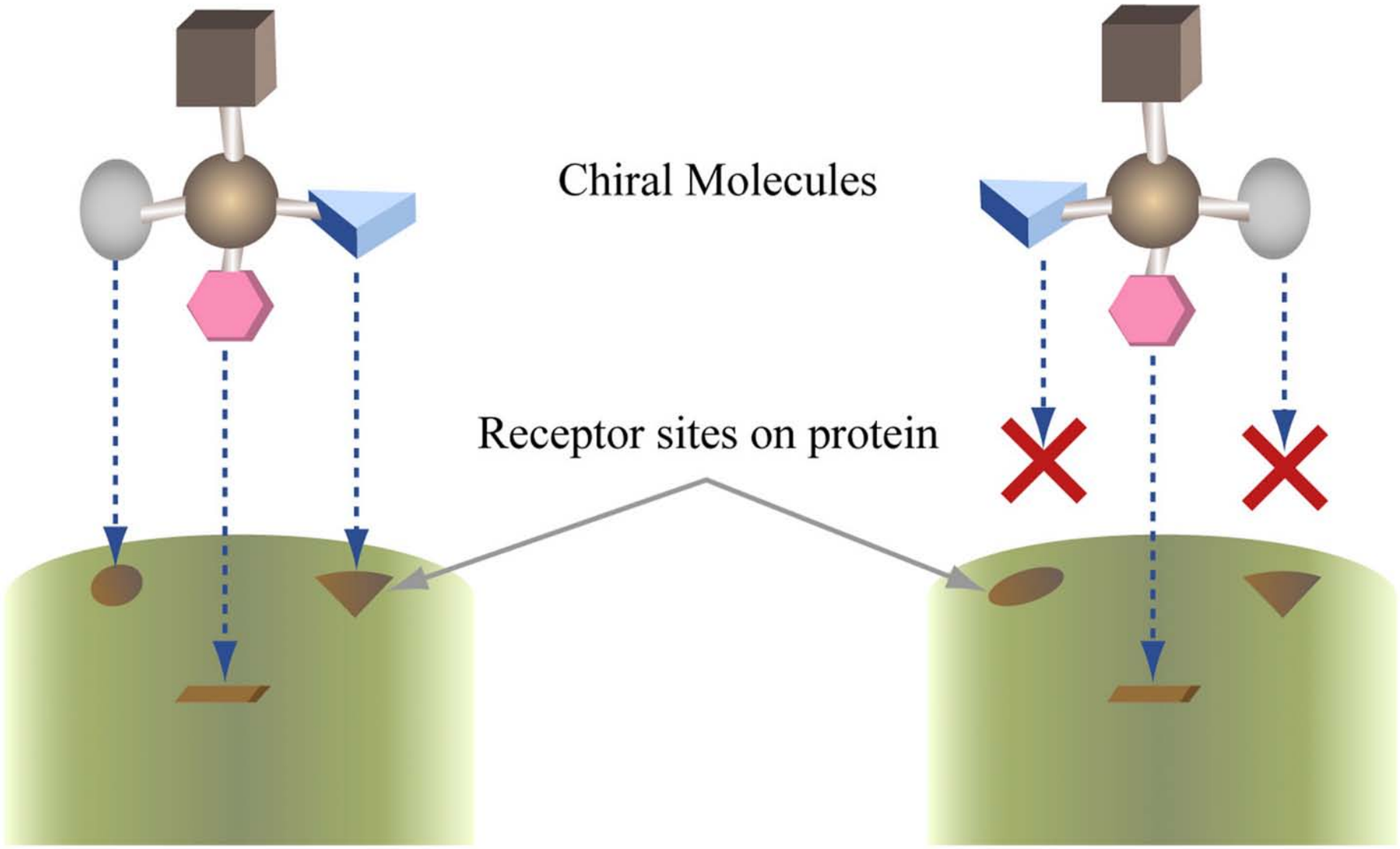


Image by MIT OpenCourseWare.

$\alpha \propto$ ① conc. of chiral species
② path length through same



Interaction of chiral molecules with biological receptors

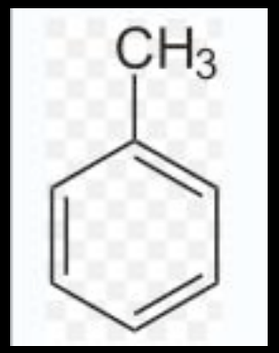
extreme kinetics:
the Halifax Explosion

* Thursday, December 6, 1917

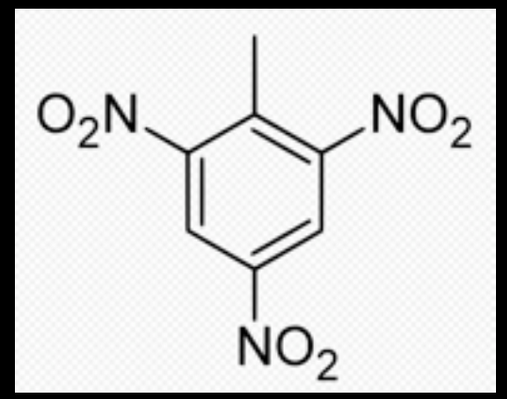
* *Imo*, Belgian, relief ship

* *Mont Blanc*, French, supply ship:
  35 tons benzol
  300 rounds ammunition
  10 tons gun cotton
  2,300 tons picric acid (used in explosives)
  20,000 tons TNT 💣💣💣💣💣💣

* at 8:45 a.m. *Imo* hits *Mont Blanc*, missing TNT, striking picric acid stored directly beneath drums of benzol on deck, sparks



toluene = methyl benzene



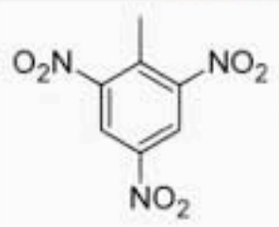
trinitrotoluene = TNT

Trinitrotoluene

From Wikipedia, the free encyclopedia

Trinitrotoluene (pronounced /traɪˌnaɪtreɪˈtɒljuːiːn/; abbreviated **TNT**), or more specifically, **2,4,6-trinitrotoluene**, is a chemical compound with the formula $C_6H_2(NO_2)_3CH_3$. This yellow-coloured solid is sometimes used as a reagent in chemical synthesis, but it is best known as a useful explosive material with convenient handling properties. The explosive yield of TNT is considered to be the standard measure of strength of bombs and other explosives. (Dynamite, though, has a more than 60% higher energy density than TNT, with roughly 7.5 MJ/kg compared to 4.6 MJ/kg for TNT.) In chemistry, TNT is used to generate charge transfer salts.

Preparation [edit]

Trinitrotoluene	
	
IUPAC name	[show]
Other names	2,4,6-Trinitrotoluene, TNT, Trilite, Tolite, Trinol, Trotyl, Tritolo, Tritolol, Triton, Tritone, Trotol, Trinitrotoluol, 2,4,6-Trinitromethylbenzene
Identifiers	
Abbreviations	TNT
CAS number	118-96-7 ✓

Related Links

Halifax Explosion
(off-site)

Tips and Information About Natural Christmas Trees

Christmas Festival of Trees

Choose and Cut Operators
(off site)

Christmas Tree Council of Nova Scotia
(off-site)

About Balsam Fir

The Boston Christmas Tree

For more than 30 years, Nova Scotia has donated a giant evergreen each year to the people of Boston as a thank you for their assistance following the 1917 Halifax Explosion.

This year's tree is a 40 foot white spruce located in New Ross, Lunenburg County. It is being provided by Mr. & Mrs. Alan Broome. The white spruce will serve as the focal point for the annual tree-lighting ceremony on Thursday Nov 30, 6:30 p.m. to 8 p.m. at the Boston Common.

Ross Pentz, Department of Natural Resource's Christmas tree extension specialist for Western Nova Scotia, is co-ordinating activities on behalf of the province. Department of Transportation and Public Works staff are transporting the tree to Boston. Officials expect the tree will arrive in Boston on Friday, Nov. 17, at which time the tree will be set up on the Boston Common.

About the Boston Christmas Tree

The tree usually comes from a private land owner and is selected by the Nova Scotia Department of Natural Resources based upon the following specifications:

- Balsam fir, white spruce or red spruce
- Forty-five to fifty feet (45'-50') in height
- healthy with good color
- Medium to heavy density
- Uniform and symmetrical
- Easy to access.

The Boston Christmas Tree, version 2007

Courtesy of the Province of Nova Scotia. Used with permission.

14 m white spruce from the Annapolis Valley, Nova Scotia

3.091SC Introduction to Solid State Chemistry

Fall 2009