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B to Calcium

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ABBREVIATIONS AND SYMBOLS

Various entries in this list differ from the corresponding entries in Vols. 1 and 2. These changes, and a few additions, are largely based on the report of the SUN Commission of the IUPAP (Commission on Symbols, Units and Nomenclature of the International Union of Pure and Applied Physics), which was approved in 1960, at Ottawa, by the General Assembly of the IUPAP. Many of these symbols have also been accepted by the IUPAC (International Union of Pure and Applied Chemistry) (see *J. Am. Chem. Soc.* **82**, 5517 (1960)).

A	ampere(s)
A	anion (eg, H*A*)
Å	angstrom unit(s)
AATCC	American Association of Textile Chemists and Colorists
abs	absolute
ac	alternating current
ac-	alicylic (eg, *ac*-derivatives of tetrahydronaphthalene)
accel(d)	accelerate(d)
acceln	acceleration
ACS	American Chemical Society
addn	addition
AGA	American Gas Association
Ah	ampere-hour(s)
AIChE	American Institute of Chemical Engineers
AIME	American Institute of Mining and Metallurgical Engineers
AIP	American Institute of Physics
alc	alcohol(ic)
alk	alkaline (not alkali)
Alk	alkyl
A-min	ampere-minute(s)
amt	amount (noun)
anhyd	anhydrous
API	American Petroleum Institute
app	apparatus
approx	approximate(ly)
aq	aqueous
ar-	aromatic (eg, *ar*-derivatives of tetrahydronaphthalene)
Ar	aryl
as-	asymmetric(al)
ASA	American Standards Association
ASHRAE	American Society of Heating, Refrigeration and Air-Conditioning Engineers
ASM	American Society for Metals
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
atm	atmosphere(s), atmospheric
at. no.	atomic number
at. wt	atomic weight
av	average
b	barn(s)
b (as in b_{11})	boiling (at 11 mm)
bbl	barrel(s)

BC	body-centered
Bé	Baumé
Bhn	Brinell hardness number
bp	boiling point
Btu	British thermal unit(s)
bu	bushel(s)
C	centigrade; coulomb(s)
C-	denoting attachment to carbon (eg, *C*-alkyl derivatives of aniline)
ca	circa, approximately
cal	calorie(s)
calcd	calculated
cfm, ft^3/min	cubic foot (feet) per minute
cg	centigram(s)
cgs	centimeter-gram-second
chem	chemical
Ci	curie(s)
CI	Colour Index (number); the CI numbers given in *ECT*, 2nd ed., are from the new *Colour Index* (1956) and Suppl. (1963), *Soc. Dyers Colourists*, Bradford, England, and *AATCC*, U.S.A.
cif	cost, insurance, freight
cl	car lots
cm	centimeter(s)
coeff	coefficient
compd, cpd	compound (noun)
compn	composition
concd	concentrated
concn	concentration
cond	conductivity
const	constant
cont	continued
cor	corrected
cp	chemically pure
cP	centipoise(s)
cpd, compd	compound (noun)
cps	cycles per second
crit	critical
cryst	crystalline
crystd	crystallized
crystn	crystallization
cSt	centistokes
cu	cubic
d	density (conveniently, specific gravity)
d	differential operator
d-	*dextro*-, dextrorotatory
D-	denoting configurational relationship (as to *dextro*-glyceraldehyde
db	dry-bulb
dB	decibel(s)
dc	direct current
dec, decomp	decompose(s)
decompd	decomposed
decompn	decomposition
den	denier
den/fil	denier per filament
deriv	derivative
detd	determined
detn	determination
diam	diameter
dielec	dielectric (adj.)
dil	dilute
distd	distilled
distn	distillation
dl	deciliter
dl-, DL	racemic
dm	decimeter
dp	dewpoint
dyn	dyne(s)
e	electron
ed.	edited, edition, editor
elec	electric(al)
emf	electromotive force
en	entropy unit(s)

eng	engineering
equil	equilibrium(s)
equiv	equivalent
esp	especially
est(d)	estimate(d)
estn	estimation
esu	electrostatic unit(s)
eV	electron volt(s)
expt(l)	experiment(al)
ext(d)	extract(ed)
extn	extraction
F	Fahrenheit; farad(s)
F	faraday constant
FC	face-centered
Fed, fedl	federal (eg, Fed Spec)
fl oz	fluid ounce(s)
fob	free on board
fp	freezing point
frz	freezing
ft	foot (feet)
ft^3/min, cfm	cubic foot (feet) per minute
ft-lb	foot-pound(s)
g	gram(s)
g	gravitational acceleration
G	gauss
G	Gibbs free energy
gal	gallon(s)
g/den	gram(s) per denier
gem-	geminal (attached to the same atom)
g-mol	gram-molecular (as in g-mol wt)
g-mole	gram-mole
G-Oe	gauss-oersted(s)
h, hr	hour(s)
hl	hectoliter
hp	horsepower
hr, h	hour(s)
hyd	hydrated, hydrous
hyg	hygroscopic
i, insol	insoluble
^{i} (eg, Pr^{i})	iso (eg, isopropyl)
i-	inactive (eg, *i*-methionine)
IACS	International Annealed Copper Standard
ibp	initial boiling point
ICC	Interstate Commerce Commission
ICT	International Critical Tables
ID	inner diameter
in.	inch(es)
insol, i	insoluble
IPT	Institute of Petroleum Technologists
IU	International Unit(s)
IUPAC	International Union of Pure and Applied Chemistry
J	joule(s)
K	Kelvin
K	dissociation constant
kbar	kilobar(s)
kc	kilocycle(s)
kcal	kilogram-calorie(s)
keV	kilo electron volt(s)
kg	kilogram(s)
kG	kilogauss
kJ	kilojoule(s)
kV	kilovolt(s)
kVA	kilovolt-ampere(s)
kW	kilowatt(s)
kWh	kilowatt-hour(s)
l	liter(s)
l-	*levo-*, levorotatory
L-	denoting configurational relationship (as to *levo*-glyceraldehyde)
lb	pound(s)
LC_{50}	concentration lethal to 50% of the animals tested
lcl	less than car lots
LD_{50}	dose lethal to 50% of the animals tested

liq	liquid
ln	logarithm (natural)
log	logarithm (common)
m	meter(s)
m-	meta (eg, *m*-xylene)
M	metal
M	molar (as applied to concentration; not molal)
mA	milliampere(s)
mAh	milliampere-hour(s)
manuf	manufacture
manufd, mfd	manufactured
manufg, mfg	manufacturing
max	maximum
Mc	megacycle
MCA	Manufacturing Chemists' Association
mcal	millicalorie(s)
mech	mechanical
meq	milliequivalent(s)
MeV	million electron volt(s)
mfd, manufd	manufactured
mfg, manufg	manufacturing
mg	milligram(s)
min	minimum; minute(s)
misc	miscellaneous
mixt	mixture
ml	milliliter(s)
MLD	minimum lethal dose
mm	millimeter(s)
mM	millimole(s)
mo(s)	month(s)
mol	molecule, molecular
mol wt	molecular weight
mp	melting point
mph	miles per hour
MR	molar refraction
mV	millivolt(s)
mμ	millimicron(s)

^{n} (as, Bu^{n}), *n*-	normal (as, normal butyl)
n (as, n_D^{20})	index of refraction (for 20°C and sodium light)
n-, ^{n}	normal (eg, *n*-butyl)
N	normal (as applied to concentration)
N-	denoting attachment to nitrogen (eg, *N*-methylaniline)
neg	negative (adj.)
NF	*National Formulary* (American Pharmaceutical Association, Washington, D.C.)
NMR	nuclear magnetic resonance
NND	*New and Nonofficial Drugs* (Am. Med. Assoc.)
no.	number
NOIBN	not otherwise indexed by name (ICC specification for shipping containers)
o-	ortho (eg, *o*-xylene)
O-	denoting attachment to oxygen (eg, *O*-acetylhydroxylamine)
Ω	ohm(s)
Ω-cm	ohm-centimeter(s)
OD	outer diameter
Oe	oersted(s)
owf	on weight of fiber
oz	ounce(s)
p-	para (eg, *p*-xylene)
P	poise(s)
pdr	powder
PhI	*Pharmacopoeia Internationalis*, 2 vols. and Suppl., World Health Organization, Geneva, 1951, 1955, and 1959
pos	positive (adj.)
powd	powdered

ppm	parts per million
ppt(d)	precipitate(d)
pptn	precipitation
Pr. (no.)	Foreign prototype (number); dyestuff designation used in *AATCC Year Books* for dyes not listed in the old *Colour Index* (1924 ed.; 1928 Suppl.); obsolete since new *Colour Index* was published (1956 ed.; 1963 Suppl.)
prepd	prepared
prepn	preparation
psi	pound(s) per square inch
psia	pound(s) per square inch absolute
psig	pound(s) per square inch gage
pt	point
pts	parts
qual	qualitative
quant	quantitative
qv	which see (quod vide)
r	roentgen
R	univalent hydrocarbon radical (or hydrogen); Rankine
rep	roentgen(s) equivalent physical
resp	respectively
rh	relative humidity
RI	Ring Index (number); from *The Ring Index*, Reinhold Publishing Corp., N.Y., 1940
rms	root mean square
rpm	revolutions per minute
rps	revolutions per second
RRI	Revised Ring Index (number); from *The Ring Index*, 2nd ed., American Chemical Society, Washington, D.C., 1960
RT	room temperature
s, sol	soluble
^{s} (eg, Bu^{s}), *sec-*	secondary (eg, secondary butyl)
s-, *sym-*	symmetrical (eg, *s-m*-xylidene)
S-	denoting attachment to sulfur (eg, *S*-methylcysteine)
SAE	Society of Automotive Engineers
satd	saturated
satn	saturation
SCF	standard cubic foot (feet) (760 mm Hg, 60°F)
Sch	Schultz number (designation for dyes from *Farbstofftabellen*, 4 vols., Akademie Verlag, Leipzig, 1931–1939)
sec	second(s)
sec-, ^{s}	secondary (eg, *sec*-butyl)
SFs	Saybolt Furol second(s)
sl s, sl sol	slightly soluble
sol, s	soluble
soln	solution
soly	solubility
sp	specific
sp, spp	species (sing. and pl.)
spec	specification
sp gr	specific gravity
sq	square
St	stokes
STP	standard temperature and pressure (760 mm Hg, 0°C)
subl	sublime(s), subliming
SUs	Saybolt Universal second(s)
sym, *s-*	symmetrical (eg, *sym-m*-xylidene)
t, temp	temperature
^{t} (as, Bu^{t}), *t-*, *tert-*	tertiary (eg, tertiary butyl)

t-, *tert-*, ^{t}	tertiary (eg, *t*-butyl)	*v-*, *vic-*	vicinal (attached to adjacent atoms)
TAPPI	Technical Association of the Pulp and Paper Industry	var	variety
		vic-, *v-*	vicinal (attached to adjacent atoms)
tech	technical		
temp, t	temperature	vol	volume(s) (not volatile)
tert-, *t-*, ^{t}	tertiary (eg, *tert*-butyl)	v s, v sol	very soluble
theoret	theoretical	vs	versus
Twad	Twaddell	W	watt(s)
USP	(*The*) *United States Pharmacopeia* (Mack Publishing Co., Easton, Pa.)	Wh	watt-hour(s)
		xu (ca 10^{-11} cm)	x unit(s)
uv	ultraviolet	yd	yards(s)
V	volt(s)	yr	year(s)

Quantities

Some standard abbreviations (prefixes) for very small and very large quantities are as follows:

deci (10^{-1})	d	deka (10^{1})	dk
centi (10^{-2})	c	hecto (10^{2})	h
milli (10^{-3})	m	kilo (10^{3})	k
micro (10^{-6})	μ	mega (10^{6})	M
nano (10^{-9})	n	giga (10^{9})	G (or B)
pico (10^{-12})	p	tera (10^{12})	T
femto (10^{-15})	f		
atto (10^{-18})	a		

CONTENTS

B

BABBITT METALS. See Bearing materials.

BACTERIAL, RICKETTSIAL, AND MYCOTIC INFECTIONS, CHEMOTHERAPY

This article deals with the chemotherapy of bacterial (including treponemal), fungal (mycotic), and rickettsial disease. This grouping is used because it defines the discussion with regard to the application of chemotherapeutic agents. For example, chloramphenicol is used for the treatment of typhoid fever which is of bacterial origin, and typhus fever which is caused by a rickettsial organism. Penicillin is used in the treatment of syphilis which is of treponemal origin. The fungal infections are now found to be susceptible to antibiotics produced by the streptomyces, the same organisms which produce many of the important antibacterial antibiotics. See also Parasitic infections, chemotherapy; Protozoal infections, chemotherapy; Viral infections, chemotherapy.

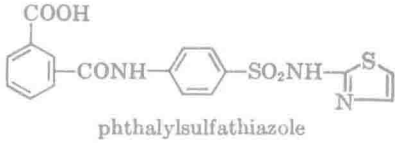
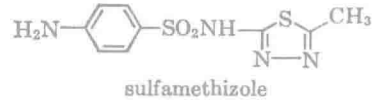
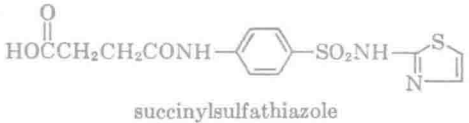
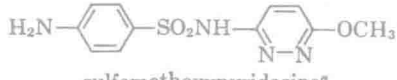
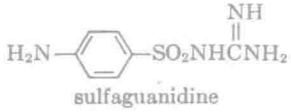
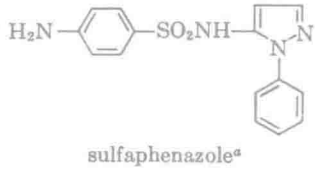
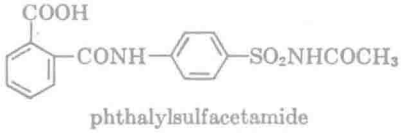
The history of scientific chemotherapy is intimately interwoven in principle and in time with the development of bacteriology and the study of infectious diseases. In establishing bacteriology as an experimental science, Pasteur indicated the association of specific organisms with specific diseases. Following Pasteur, Koch developed the disciplines for the study of infectious diseases; this soon permitted recognition of the agents of the important bacterial diseases of man. Ehrlich was one of this early German group associated with Koch in studying the nature of infectious disease, and as an important phase of these studies, he developed the science of chemotherapy.

Ehrlich's early experiments revealed a selective affinity between specific tissues and specific dyes in vitro. Extending this principle to the living animal he showed that certain dyes exhibited selective tissue affinities. Thus, methylene blue and other basic dyes were bound by nervous tissue. He found that methylene blue was also useful as a microbial stain. On this basis he discovered that when the dye was injected into animals infected with malaria, it combined with the parasites to kill them while leaving the body tissues unaffected. These studies stimulated interest in the treatment of infectious diseases with specific chemotherapeutic agents, a procedure for which he originated the term chemotherapy

By this time Ehrlich had already published the side-chain theory of antibody formation, and had completed considerable work in the area of immunity. Because of this, he was made director of the Institute for Experimental Therapy at Frankfurt in 1899. He had also completed exploratory experiments in the specificity of dyes, and demonstrated the chemotherapeutic activity of trypan red.

At Frankfurt, Ehrlich devoted his creative effort to chemotherapy and in 1906 the Georg-Speyer Haus was built for him. There he had facilities designed and equipped for the study of chemotherapy. Four years earlier, Ehrlich and Shiga had investigated the activity of Atoxyl (sodium arsanilate) against trypanosomiasis. Unfortunately, they chose to employ, by chance, an arsenic-resistant strain of trypanosomes in these experiments and concluded that Atoxyl was inactive against these infections. In 1905 Thomas and Breinl found that with a different strain of trypanosome, Atoxyl was active against the infection. This discovery renewed Ehrlich's interest in the aromatic arsenical compounds. The experiments which followed in the Speyer Haus established a methodology of testing chemotherapeutics and represented the first large-scale attempt at screening. The discovery in 1910 of Salvarsan (3,3′-diamino-4,4′-dihydroxyarsenobenzene dihydrochloride), an aromatic arsenical active against *Treponema pallidum*, resulted directly from methodical screening of many compounds.

Table 1. Sulfonamides

Not absorbed from the gastrointestinal tract; concentrated in the gastrointestinal tracts.	Absorbed from the gastrointestinal tract; soluble in urine; blood and tissue level not favored.
 phthalylsulfathiazole	 sulfamethizole
 succinylsulfathiazole	 sulfamethoxypyridazine[a]
 sulfaguanidine	 sulfaphenazole[a]
 phthalylsulfacetamide	

[a] Long-acting.

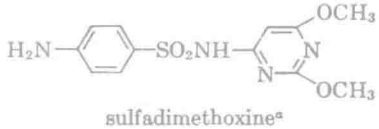
The disciplines established by Ehrlich were carried on in Germany and elsewhere after his death. There followed an intensive period of work which was concerned with the development of organometallic compounds active against various protozoal and spirochetal infections. The toxicity associated with these compounds limited their usefulness, however, and the search for a less toxic material continued. In 1920 the Bayer group introduced Germanin, known as Bayer 205, which was the first departure from organometallic complexes. It had a remarkably high therapeutic index in trypanosome infections and a therapeutic index of 300 for mice. This was more than 30 times the highest index which Ehrlich had envisioned.

During Ehrlich's lifetime, only limited work was conducted on the chemotherapy of bacterial infections. Ehrlich and Bechold, in 1906, had published investigations into the activity of substituted phenols against bacterial infections. While these compounds had a marked effect in vitro, their in vivo effect was inhibited as a result of the combination of the phenols with serum proteins. In 1911 Morgenroth and Levy reported the effective treatment of pneumococcal infections in mice with optochin, a derivative of quinine. The material failed to have a similar effect in humans and was therefore of no practical value. Morgenroth's investigations led to extensive work on quinine derivatives but was of limited usefulness. Other workers continued the

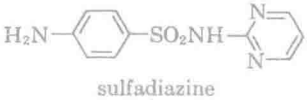
Table 1 (*continued*)

Absorbed from the gastrointestinal tract; blood and tissue level favored; greater or lesser tendency to crystallize in urine.

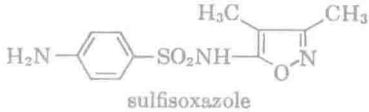
sulfanilamide



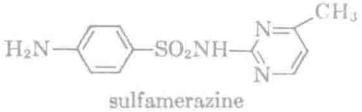
sulfadimethoxine[a]



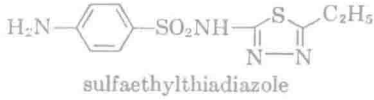
sulfadiazine



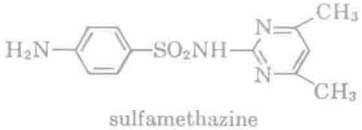
sulfisoxazole



sulfamerazine



sulfaethylthiadiazole



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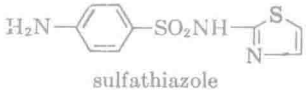
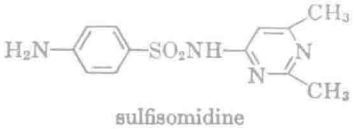


sulfathiazole

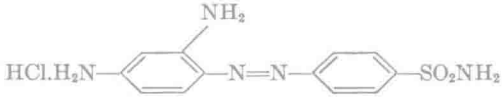


sulfisomidine

study of the effects of dyes on bacterial infections. By 1920 Morgenroth, working with Schnitzer and Rosenberg, had found that only the basic dyes possessed specific antibacterial activity. They had prepared a derivative of acridine called rivanol, a compound which had a high but local effect on streptococcal infections of low toxicity. The first really significant development in the chemotherapy of bacterial infections did not come until the introduction of sulfonamides.

Sulfonamides

The first reported use of sulfonamides (qv) was in 1933 when Foerster dramatically cured an infant of staphylococcal septicemia with the drug streptozon. This was the sulfonamide, Prontosil, developed by Domagk at I. G. Farbenindustrie. Domagk reported that streptococcal and staphylococcal infections were susceptible to Prontosil. Trefouel and co-workers suggested that Prontosil was metabolized in the host to give *p*-aminobenzenesulfonamide as an active principle.



Prontosil

At this point, extensive work on the sulfonamides was begun. Sulfapyridine was prepared by May and Baker in England and shown to be highly active and less toxic than other forms. At present a group of at least twelve different sulfonamides are available as chemotherapeutic agents with specific indications for their use; this represents only a small number of the different sulfonamides which have been synthesized. The structures and use of commercially marketed sulfonamides are shown in Table 1.

The sulfa compounds and the nitrofurans are active against a variety of bacteria. Independently, a variety of synthetic compounds have been discovered that are specifically active against the tubercle bacillus. These compounds include isonicotinic acid hydrazide, *p*-aminosalicylic acid, and pyrazinamide, which are in clinical use. A number of other types of compounds have been described that are not in clinical use at present. The antituberculosis agents are discussed in greater detail on pp. 29–31.

The sulfonamides taken as a group are active against a wide spectrum of Gram-positive, Gram-negative, and acid-fast bacteria, but there are considerable differences in the sensitivity of different strains in any one species. Therapeutic effectiveness is dependent upon achieving adequate levels of drug concentration in the areas of disease process. Derivatives are therefore selected on the basis of pharmacological properties that promote selective concentration in different body areas. All derivatives have the same mode of antibacterial action. As many as three derivatives are sometimes combined to achieve the desired pharmacological characteristics. Three types of sulfonamides may be recognized: (*1*) those which are not absorbed from the gastrointestinal tract, leading to high concentrations in that area, and therefore are useful for the treatment of enteric diseases such as bacillary dysentery and cholera; (*2*) those which are absorbed from the gastrointestinal tract, soluble in urine, not giving high blood and tissue levels, and therefore are useful in treating genitourinary infections; (*3*) those which are absorbed from the gastrointestinal tract, give higher blood