NOTES

Abbreviations of Names of Genera Suggested for Coding Microbiological Data

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A list of abbreviations of generic names appearing in the eighth edition of *Bergey's Manual* is presented. The list includes names of accepted genera and other genera cited as synonymous or of uncertain status. Since names of the latter still appear in the literature or are used in subspecialties of microbiology, abbreviations for these genera are also given. The abbreviations have been found useful when coding data for computer storage and analysis. Because of the saving in space, a larger number of strain characteristics can be stored in a computerized data bank. In addition, the abbreviations are often mnemonic, a helpful characteristic.

The advantages of using computer technology in microbial systematics are being reported with increasing frequency (5). To employ computers most effectively, it is essential to find ways of coding data unambiguously and with maximum efficiency at a minimum cost. The microbiological data center set up by the World Federation of Culture Collections at the University of Queensland, St. Lucia, Queensland, Australia, and the American Type Culture Collection, Rockville, Md., employ the same standardized format (4) for coding data.

At the American Type Culture Collection, attention has been directed towards system design and coding individual strain data in a binary format (2). Information concerning the source of the strain, identification, location in a given culture collection, etc., is also being stored.

One of the constraints in using the computer to handle data is the available storage capacity. This problem can be acute when there are more items of data on individual strains to be stored than the available storage space can accommodate. The names of bacterial genera published in the eighth edition of *Bergey's Manual* (1) range in length from 4 letters, viz., *Mima*, an illegitimate name (3), to 19 letters in the case of *Streptovorticillium*. It is obvious that many unabbreviated names will require considerable storage space, without considering the strain data also to be entered. In the case of *Streptovorticillium roseovorticillium* subsp. *roseovorticillium*, two-thirds of the available 80 columns on a single Hollerith card are immediately used up by the name alone. One solution, therefore, was to derive standard abbreviations for each genus listed in *Bergey's Manual* (1). Upon ex-

amination of the genus names, it was apparent that parts of names are repeated in the names

TABLE 1. Code for the abbreviations of names of bacterial genera appearing in the eighth edition of *Bergey's manual*

AC	= ACETO
AR	= AERO, AR
AT	= ACTINO
AZ	= AZOTO, AZO
BC	= BACILLUS
BI	= BIFID
BT	= BACTER, BACTERIUM, BACT, BACTERIO
CE	= CELLULO
CO	= COCCUS
CS	= CYSTIS, CYSTO
DP	= DIPLO
EN	= ENTERO
HL	= HALO
HM	= HAEMO
LC	= LACTO
LE	= LEUCO
LP	= LEPTO
ME	= METHANO
MI	= MICRO
ML	= METHYLO
MN	= MONAS, MONAD
MY	= MYCO, MYCES
NI	= NITRO
NM	= NEMA
NO	= NITROSO
PD	= PEDIO, PEDIA
PL	= PLASMA
PR	= PARA
PS	= PSEUDO
RO	= RHODO
SF	= SPHAERA, SPHAERO
SO	= SPORO, SPORA, SPORIA, SPORANGIUM
SP	= SPIRO, SPIRA, SPIRILLUM
ST	= STREPTO
SU	= SULPHUR, SULFO
TH	= THIO
TM	= THERMO, THERMUS
TX	= THRIX
VB	= VIBRIO

TABLE 2. Abbreviations for names of bacterial genera

Generic name	Abbreviation	Generic name	Abbreviation
<i>Acetobacter</i>	ACBT	<i>Coxiella</i>	COXL
<i>Acholeplasma</i>	ACPL	<i>Crenothrix</i>	CRTX
<i>Achromatium</i>	ACMT	<i>Cristispira</i>	CRSP
<i>Achroonema</i>	ACNM	<i>Cystobacter</i>	CSBT
<i>Acidaminococcus</i>	AACO	<i>Cytophaga</i>	CTFG
<i>Acinetobacter</i>	ANBT	<i>Dactylosporangium</i>	DTSO
<i>Actinobacillus</i>	ATBC	<i>Dermatophilus</i>	DMFL
<i>Actinobifida</i>	ATBI	<i>Deroxia</i>	DRXA
<i>Actinomyces</i>	ATMY	<i>Desmanthos</i>	DMTS
<i>Actinoplanes</i>	ATPN	<i>Desulfotomaculum</i>	DSMC
<i>Aegyptianella</i>	AGTL	<i>Desulfovibrio</i>	DSVB
<i>Aerococcus</i>	ARCO	<i>Ectothiorhodospira</i>	ETSP
<i>Aeromonas</i>	ARMN	<i>Edwardsiella</i>	EDWL
<i>Agrobacterium</i>	AGBT	<i>Ehrlichia</i>	EHRL
<i>Alcaligenes</i>	ALC	<i>Enterobacter</i>	ENBT
<i>Alysiella</i>	ALSL	<i>Eperythrozoon</i>	EPRZ
<i>Amoebobacter</i>	AMBT	<i>Erwinia</i>	ERWN
<i>Amorphosporangium</i>	AMSP	<i>Erysipelothrix</i>	ESTX
<i>Ampullariella</i>	APRL	<i>Escherichia</i>	ESCH
<i>Anaplasma</i>	ANPL	<i>Eubacterium</i>	EUBT
<i>Ancalomicrobium</i>	ANMI	<i>Flavobacterium</i>	FVBT
<i>Arachnia</i>	ARAC	<i>Flexibacter</i>	FXBT
<i>Archangium</i>	ACNG	<i>Flexithrix</i>	FXTX
<i>Arthrobacter</i>	ARBT	<i>Francisella</i>	FRCL
<i>Asticcacaulis</i>	ASCL	<i>Frankia</i>	FRNK
<i>Azomonas</i>	AZMN	<i>Fusobacterium</i>	FSBT
<i>Azotobacter</i>	AZBT	<i>Gallionella</i>	GLNL
<i>Bacillus</i>	BC	<i>Gemella</i>	GMLL
<i>Bacterionema</i>	BTNM	<i>Geodermatophilus</i>	GDMF
<i>Bacteroides</i>	BTRD	<i>Gluconobacter</i>	GNBT
<i>Bartonella</i>	BRTL	<i>Grahamella</i>	GRML
<i>Bdellovibrio</i>	BDVB	<i>Haemobartonella</i>	HMBL
<i>Beggiatoa</i>	BGGT	<i>Haemophilus</i>	HMFL
<i>Beijerinckia</i>	BEIJ	<i>Hafnia</i>	HAFN
<i>Bifidobacterium</i>	BIBT	<i>Halobacterium</i>	HLBT
<i>Blastobacter</i>	BSBT	<i>Halococcus</i>	HLCO
<i>Blattabacterium</i>	BLBT	<i>Herpetosiphon</i>	HPSN
<i>Bordetella</i>	BDTL	<i>Hyphomicrobium</i>	HFMI
<i>Borrelia</i>	BRRL	<i>Hyphomonas</i>	HFMN
<i>Brachyarcus</i>	BRAC	<i>Kitasatoa</i>	KTST
<i>Branhamella</i>	BNHL	<i>Klebsiella</i>	KLEB
<i>Brucella</i>	BRCL	<i>Kurthia</i>	KURT
<i>Butyrivibrio</i>	BUVB	<i>Kusnezovia</i>	KNZO
<i>Calymmatobacterium</i>	CMBT	<i>Lachnospira</i>	LCSP
<i>Campylobacter</i>	CPBT	<i>Lactobacillus</i>	LCBC
<i>Cardiobacterium</i>	CDBT	<i>Lamprocystis</i>	LMCS
<i>Caryophanon</i>	CARY	<i>Lampropedia</i>	LMPD
<i>Caulobacter</i>	CLBT	<i>Leptospira</i>	LPSP
<i>Caulococcus</i>	CLCO	<i>Leptothrix</i>	LPTX
<i>Cellulomonas</i>	CEMN	<i>Leptotrichia</i>	LPTC
<i>Chlamydia</i>	CLMD	<i>Leuconostoc</i>	LEUC
<i>Chlorobium</i>	CLOR	<i>Leucothrix</i>	LETX
<i>Chloropseudomonas</i>	CSMN	<i>Lieskeella</i>	LSKL
<i>Chondromyces</i>	CNMY	<i>Listeria</i>	LIST
<i>Chromatium</i>	CMTM	<i>Lucibacterium</i>	LUBT
<i>Chromobacterium</i>	CRBT	<i>Macromonas</i>	MAMN
<i>Citrobacter</i>	CTBT	<i>Megasphaera</i>	MGSF
<i>Clathrochloris</i>	CLCH	<i>Melittangium</i>	MLNG
<i>Clonothrix</i>	CNTX	<i>Metallogenium</i>	MLOG
<i>Clostridium</i>	CLOS	<i>Methanobacterium</i>	MEBT
<i>Corynebacterium</i>	CNBT	<i>Methanococcus</i>	MECO
<i>Cowdria</i>	CWDR	<i>Methanosarcina</i>	MESR

TABLE 2—Continued

Generic name	Abbreviation	Generic name	Abbreviation
<i>Methylococcus</i>	MLCO	<i>Rothia</i>	ROTH
<i>Methylomonas</i>	MLMN	<i>Ruminococcus</i>	RMCO
<i>Microbispora</i>	MBSO	<i>Salmonella</i>	SAML
<i>Micrococcus</i>	MICO	<i>Saprospira</i>	SASP
<i>Microcylus</i>	MICY	<i>Sarcina</i>	SR
<i>Microellobosporia</i>	MLSO	<i>Selenomonas</i>	SEMN
<i>Micromonospora</i>	MOSO	<i>Seliberia</i>	SEBR
<i>Micropolyspora</i>	MPSO	<i>Serratia</i>	SER
<i>Moraxella</i>	MRXL	<i>Shigella</i>	SHGL
<i>Mycobacterium</i>	MYBT	<i>Siderocapsa</i>	SDCP
<i>Mycoplasma</i>	MYPL	<i>Siderococcus</i>	SDCO
<i>Myxococcus</i>	MXCO	<i>Simonsiella</i>	SMSL
<i>Nannocystis</i>	NACS	<i>Sphaerotilus</i>	SFTL
<i>Naumannella</i>	NMNL	<i>Spirillospora</i>	SPSO
<i>Neisseria</i>	NEIS	<i>Spirillum</i>	SP
<i>Neorickettsia</i>	NERK	<i>Spirochaeta</i>	SPCT
<i>Nevskia</i>	NVSK	<i>Spiroplasma</i>	SPPL
<i>Nitrobacter</i>	NIBT	<i>Sporichthya</i>	SOCH
<i>Nitrococcus</i>	NICO	<i>Sporocytophaga</i>	SOCY
<i>Nitrosococcus</i>	NOCO	<i>Sporolactobacillus</i>	SOLC
<i>Nitrosolobus</i>	NOLB	<i>Sporosarcina</i>	SOSR
<i>Nitrosomonas</i>	NOMN	<i>Staphylococcus</i>	SFCO
<i>Nitrospira</i>	NOSP	<i>Stigmatella</i>	SGML
<i>Nitrospina</i>	NISN	<i>Streptobacillus</i>	STBC
<i>Nocardia</i>	NOC	<i>Streptococcus</i>	STCO
<i>Ochrobium</i>	OCRB	<i>Streptomyces</i>	STMY
<i>Oscillospira</i>	OSSP	<i>Streptosporangium</i>	STSO
<i>Paracoccus</i>	PRCO	<i>Streptothrix</i>	STTX
<i>Paranaplasma</i>	PRPL	<i>Streptovercillum</i>	STVC
<i>Pasteurella</i>	PSTL	<i>Succinimonas</i>	SCMN
<i>Pasteuria</i>	PSIA	<i>Succinivibrio</i>	SCVB
<i>Pediococcus</i>	PDCO	<i>Sulfolobus</i>	SULB
<i>Pedomicrobium</i>	PDMI	<i>Symbiotes</i>	SMBI
<i>Pelodictyon</i>	PEDT	<i>Thermoactinomyces</i>	TMAT
<i>Pelonema</i>	PENM	<i>Thermomonospora</i>	TMMO
<i>Peloploca</i>	PEPC	<i>Thermoplasma</i>	TMPL
<i>Pelosigma</i>	PESM	<i>Thermus</i>	TM
<i>Peptococcus</i>	PTCO	<i>Thiobacillus</i>	THBC
<i>Peptostreptococcus</i>	PSCO	<i>Thiobacterium</i>	THBT
<i>Photobacterium</i>	PHBT	<i>Thiocapsa</i>	THCP
<i>Phragmidiothrix</i>	PHTX	<i>Thiocystis</i>	THCS
<i>Pilemelia</i>	PIML	<i>Thiodendron</i>	THDD
<i>Planctomyces</i>	PTMY	<i>Thiodictyon</i>	THDT
<i>Planobispora</i>	PBSO	<i>Thiopedia</i>	THPD
<i>Planococcus</i>	PNCO	<i>Thioploca</i>	THPC
<i>Planomonospora</i>	PMO	<i>Thiosarcina</i>	THSR
<i>Plesiomonas</i>	PLMN	<i>Thiospira</i>	THSP
<i>Polyangium</i>	PONG	<i>Thiospirillum</i>	THSL
<i>Propionibacterium</i>	PRBT	<i>Thiothrix</i>	THTX
<i>Prosthecochloris</i>	PCCL	<i>Thiovulum</i>	THVL
<i>Prosthecomicrobium</i>	PCMI	<i>Toxothrix</i>	TOTX
<i>Proteus</i>	PROT	<i>Treponema</i>	TREP
<i>Pseudomonas</i>	PSMN	<i>Veillonella</i>	VEIL
<i>Pseudonocardia</i>	PSNC	<i>Vibrio</i>	VB
<i>Rhizobium</i>	RHIZ	<i>Vitreoscilla</i>	VITR
<i>Rhodomicrobium</i>	ROMI	<i>Wolbachia</i>	WLBC
<i>Rhodopseudomonas</i>	ROPS	<i>Xanthomonas</i>	XNMN
<i>Rhodospirillum</i>	ROSP	<i>Yersinia</i>	YERS
<i>Rickettsia</i>	RKTS	<i>Zoogloea</i>	ZOGL
<i>Rickettsiella</i>	RKSL	<i>Zymomonas</i>	ZYMN
<i>Rochalimaea</i>	RKLM		

of many different genera, for example, "*Micro-*" in *Micrococcus*, *Microbacterium*, and *Micromonospora*, "-bacter" in *Acetobacter*, *Acinetobacter*, and *Flexibacter*, etc. Taking this into account, each of these parts of names was coded, and the code was applied to each genus name. A list of the codes is given in Table 1, and complete lists of the coded generic names are given in Tables 2 and 3. An upper limit of four characters was arbitrarily set for any one name. Interestingly, the majority of the names were four characters. Some were just two letters, viz., "SP" for *Spirillum*, whereas others were three letters in length. For the sake of consistency, only letters occurring in the full generic name were used. The letters "ph" did, however, present a problem solved only by substituting "F" for "ph," viz., "SFCO" for *Staphylococcus*.

The list, admittedly, contains some apparent inconsistencies, although it offers what is considered to be the most practical solution. Comments and suggestions for improving the abbreviations are requested.

An alternative approach that was considered was to use numbers instead of letters, realizing an even greater saving in computer storage. However, numbers are difficult to remember and have no mnemonic value. Furthermore, a list of over 300 bacterial genera would require a translation code to return the numbers into names. The abbreviations used are those that best suggest the full generic name, a feature that is impossible if numbers were used for coding.

It is hoped that the code offered here will form a basis for establishing a standardized set of abbreviations of generic names for use with computers. In addition, a proposal will be submitted to the International Committee on Systematic Bacteriology, with a request that it be considered for official approval by that body as a means of reference to genera in scientific journals. Confusion will thereby be minimized, especially when titles and abstracts are collected in publications other than the original journal.

Similar logic can be applied to the derivation

TABLE 3. Abbreviations for names of bacterial genera of uncertain standing

Generic name	Abbreviation	Generic name	Abbreviation
<i>Achromobacter</i>	ACHR	<i>Myxobacter</i>	MXBT
<i>Actinomonospora</i>	ATMO	<i>Oceanomonas</i>	OCMN
<i>Actinopycnidium</i>	ATPN	<i>Oceanospirillum</i>	OCSP
<i>Actinosclerotium</i>	ATSC	<i>Odontomyces</i>	ODMY
<i>Actinosporangium</i>	ATSO	<i>Oscillaria</i>	OSLR
<i>Ampullaria</i>	APUL	<i>Oscillatoria</i>	OSLT
<i>Aquaspirillum</i>	AQSP	<i>Pectobacterium</i>	PCBT
<i>Beneckea</i>	BNKA	<i>Providencia</i>	PRVD
<i>Betabacterium</i>	BEBT	<i>Pseudobacterium</i>	PSBT
<i>Betacoccus</i>	BECO	<i>Ramibacterium</i>	RMBT
<i>Blastocaulis</i>	BSCL	<i>Rhodotheca</i>	ROTC
<i>Brevibacterium</i>	BVBT	<i>Ristella</i>	RSTL
<i>Catenabacterium</i>	CABT	<i>Saccharomonas</i>	SAMN
<i>Cellvibrio</i>	CEVB	<i>Siderobacter</i>	SDBT
<i>Chlorochromatium</i>	CLMT	<i>Sideromonas</i>	SDMN
<i>Cillobacterium</i>	CIBT	<i>Sideronema</i>	SDNM
<i>Cladothrix</i>	CLTX	<i>Siderophacus</i>	SDFC
<i>Diplococcus</i>	DPCO	<i>Siderosphaera</i>	SDSF
<i>Eikenella</i>	EKNL	<i>Sorangium</i>	SRNG
<i>Elytrosporangium</i>	ELSO	<i>Sphaerophorus</i>	SFFR
<i>Ferribacterium</i>	FRBT	<i>Spironema</i>	SPNM
<i>Fusiformis</i>	FSFM	<i>Spiroschaudinna</i>	SPSD
<i>Fusocillus</i>	FSCL	<i>Stelangium</i>	SLNG
<i>Gaffkya</i>	GFKY	<i>Streptobacterium</i>	STBT
<i>Herellea</i>	HERL	<i>Streptopycnidium</i>	STPN
<i>Hydrogenomonas</i>	HYMN	<i>Sulfomonas</i>	SUMN
<i>Intrasporangium</i>	ITSO	<i>Sulfospirillum</i>	SUSP
<i>Levinea</i>	LEVN	<i>Thermobacterium</i>	TMBT
<i>Lingelsheimia</i>	LNGM	<i>Thermopolyspora</i>	TMPO
<i>Methanospirillum</i>	MESP	<i>Thermostreptomyces</i>	TMSM
<i>Methylovibrio</i>	MLVB	<i>Vertillomyces</i>	VTMY
<i>Microbacterium</i>	MIBT	<i>Waksmania</i>	WKMA
<i>Microtetraspora</i>	MTSO	<i>Zymobacterium</i>	ZYBT
<i>Mima</i>	MIMA	<i>Zymosarcina</i>	ZYSR

of abbreviations of genus names for other microorganisms, such as fungi, protozoa, and viruses. Computerization of data collected for these groups will, in many ways, present problems similar to those encountered with the bacteria.

ADDENDUM

After submission of this manuscript for publication, we were informed that T. Cross and F. L. Davies of the Postgraduate School of Studies in Biological Sciences, University of Bradford, Bradford, England, had studied the use of abbreviations for 33 generic names in the *Actinomycetales*. Thirty of these names we had abbreviated in this manuscript. We might also suggest abbreviations for three genera also included by Cross and Davies in their unpublished remarks: *Actinomadura*, *Agromyces*, and *Oerskovia* with the respective abbreviations of ATMD, AGMY, and OESK or OSKV. ATMD and OESK are listed as *incertae sedis*, and AGMY is not

listed anywhere in the eighth edition of *Bergey's Manual*.

REPRINT REQUESTS

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