

# Mind your binomials: a guide to microbial nomenclature and spelling in *Sexually Transmitted Infections*

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Here is a quick quiz:

Question 1: In which published articles is/are the name of the organism or condition spelled correctly?

- A. *N. gonorrhoeae*<sup>1</sup>
- B. Trichomoniasis<sup>2</sup>
- C. *Chlamydiae trachomatis*<sup>3</sup>
- D. *Neisseria gonorrhoea*<sup>4</sup>
- E. *Neisseria gonorrhoea*<sup>5</sup>

Answer: At the end of this piece.

Question 2: Do you like it when someone misspells your name?

Answer: We don't like it and you probably don't either.

There are several reasons for expecting authors to spell scientific terms correctly. First, the conventions for scientific names are meant to allow scientists to communicate precisely and accurately with each other. Incorrect spelling or terminology of the names of microorganisms can cause confusion and perpetuate mistakes. Second, an incorrectly spelled name in the title<sup>3,4</sup> of an article means that scientists searching for your article might not find it. Third, and maybe unfairly, poor spelling gives editors and reviewers the impression that you do not know or do not care about the subject of your research.

A quick look at the mistakes made when spelling *Neisseria gonorrhoeae* and *Chlamydia trachomatis* suggests that people are confused about when to use the Latin name for the pathogen or its common descriptive name and about differences between UK and US English spelling. It didn't take long to put together the errors listed above, so we conclude that there is a real problem. Now is a good time to remind ourselves of the conventions for using and writing scientific names and to let authors know of our new guidance for

nomenclature and abbreviations for bacteria, protozoa and viruses and the infections they cause.

## WHAT IS BINOMIAL NOMENCLATURE?

All living organisms have two names (binomial) to describe them: a genus (generic name for a group of closely related organisms) and a species (specific name that distinguishes individual types within the group). Knapp *et al*<sup>6</sup> nicely summarised the origins of the system, which were invented by Carl Linnæus, a Swedish botanist in the 18th century. Linnæus suggested two-word 'nomina trivialia' to make it easier to remember the names of organisms, which were originally descriptive phrases ('nomina specifica') that changed as knowledge accrued. The rules for nomenclature have changed over time and differences between zoology, botany and microbiology have emerged.<sup>6</sup>

## BACTERIA

Bacteria have names in Latin. All bacteria are named in five taxonomic categories: class, order, family, genus and species. The genus and species form the binomial that we use to identify the organism (table 1). The name of the genus can come from the person who discovered it, for example, *Neisseria*, from Albert Neisser, or a characteristic of the organism, for example, *Chlamydia*, which is Greek for a cloak and describes its intracellular nature. The genus might have more than one distinct species. For example, many species of *Neisseria*

colonise humans and animals, but only two are human pathogens (*N. gonorrhoeae* and *N. meningitidis*).<sup>7</sup> Sometimes, the species can be divided into subspecies. For example, we use the binomial *Treponema pallidum* to refer to the sexually transmitted infection syphilis, but there are three subspecies: *T. pallidum* subspecies *pallidum* causes syphilis; *T. pallidum* subsp. *pertenue* causes yaws; and *T. pallidum* subsp. *endemicum* causes bejel.<sup>8</sup> *Chlamydia* is a bacterium with a contentious taxonomic history, having been called *Miyaganauwella*, *Bedsonia* and *Rakeia* in the past,<sup>9</sup> and having initially been thought to be a virus<sup>10</sup> or a protozoan.<sup>11</sup>

## VIROSES

Virologists have adopted different criteria for nomenclature, partly because viruses are not living organisms.<sup>12</sup> Viruses often have names in English, for example hepatitis B virus, but they can also have Latin names, for example herpes simplex virus (herpes comes from the Greek herpein, to creep). The generic names of viruses such as HIV are not written in italics; italics are only used for the virus species name or its family. They are not capitalised unless the name is a proper noun, for example Ebola virus.

## WHOSE RESPONSIBILITY IS IT TO GET THE NAME RIGHT?

Authors probably expect copy editors to correct their spelling and editors expect authors to proofread carefully. As our published examples show, failures at both stages result in errors in the printed version. But getting to print is the end of a long process and editors and reviewers will read a manuscript before it is accepted. Authors are responsible for checking their spelling and terminology before submitting a manuscript. First impressions are important so it makes sense to get the spelling and formatting right before submission.

**Table 1** Nomenclature for bacteria and general principles for formatting

	Formatting	Example
Genus	Italicised, uppercase first letter	<i>Neisseria</i>
Species	Italicised, lowercase	<i>gonorrhoeae</i>
Condition	Not italicised, lowercase except when used at start of a sentence	gonorrhoea (UK), gonorrhea (US)
Abbreviation of genus	May be used when several species from the same genus are being named or the same species is mentioned repeatedly. Write the genus in full the first time, then abbreviate with a full stop after the initial	"The sample contained <i>Neisseria gonorrhoeae</i> , <i>N. meningitidis</i> and <i>N. lactamica</i> "
Unknown species	If the precise species is not known, use sp. If there is more than one species, use spp.	"The condition was caused by a <i>Neisseria</i> sp." "They identified several <i>Neisseria</i> spp. in the sample"

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**Table 2** Organism names and abbreviations for bacteria and protozoa

Binomial name	Genus	Abbreviation of organism name	Condition*	Abbreviation of infection name†
<i>Chlamydia trachomatis</i>	<i>Chlamydia</i>	<i>C. trachomatis</i>	Chlamydia	CT
<i>Mycoplasma genitalium</i>	<i>Mycoplasma</i>	<i>M. genitalium</i>	<i>M. genitalium</i> infection‡	MG
<i>Neisseria gonorrhoeae</i> §	<i>Neisseria</i>	<i>N. gonorrhoeae</i>	Gonorrhoea§	NG¶
<i>Treponema pallidum</i>	<i>Treponema</i>	<i>T. pallidum</i>	Syphilis	TP
<i>Trichomonas vaginalis</i>	<i>Trichomonas</i>	<i>T. vaginalis</i>	Trichomoniasis	TV

\*Only capitalise first letter if used at the start of a sentence, otherwise lowercase.

†In general, we discourage the use of abbreviated names for conditions. These abbreviations can be used in tables and figures where space is limited. They still need to be spelled out at the first use.

‡There is no agreed name at present.

§Please note the 'e' at the end of the Latin species name. There is no 'e' at the end of the name of the condition. We use UK English spelling, which has an extra 'o' in the name of the condition.

¶GC cannot be used to abbreviate *Neisseria gonorrhoeae*. GC is used mainly in the UK as an abbreviation of gonococcus, the shape of the bacterium (see table 3).

**Table 3** Adjectives for describing shapes of bacteria

Shape singular/plural	Description	Example	Plural	Adjective
Coccus/cocci	Spherical bacteria; can be in pairs (diplococci) or chains (streptococci)	Gonococcus Pneumococcus	Gonococci Pneumococci	Gonococcal Pneumococcal
Bacillus/bacilli*	Rod-shaped bacteria			Bacillary
Spiral	Spiral-shaped bacteria	Spirochaet†	Spirochaetes	Spirochaetal

\*Not to be confused with *Bacillus* the genus.

†Most common example for sexually transmitted pathogens, that is, *Treponema pallidum*. Alternative forms are vibrio and spirillum.

## ADVICE FOR AUTHORS

Editors and production staff at *Sexually Transmitted Infections* have come up with some guidance for authors (tables 1, 2 and 3). This combines published conventions for scientific nomenclature, summarised by the journal *Emerging Infectious Diseases*,<sup>13</sup> and the opinions of the editors. We try to cover spelling and abbreviations of both organisms and conditions for the most common sexually transmitted infections (table 2).

We have posted the guidance in our Instructions for Authors on the submission website (<http://sti.bmj.com/site/about/guidelines.xhtml>) and we hope you find it useful. Please follow our guidance for all your future submissions.

Answer: all are incorrect (see table 2 for the correct spelling).

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