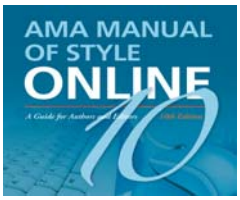

Human Gene Nomenclature Quiz
by Laura King, MA, ELS

Directions: Edit the following sentences based on section 15.6.2 of the *AMA Manual of Style*, keeping in mind that some examples may be correct as is. Below is a brief list of how to edit gene symbols, gene names, alleles, genotypes, and phenotypes. All this information can be found in section 15.6.2.

Gene Symbols: A gene symbol is a short term, typically 3 to 7 characters long, that conveys in abbreviated form the name or other attribute of a gene. Human gene symbols usually consist of uppercase letters and may also contain (but never begin with) numerals. Approved gene symbols do not contain Greek letters, roman numerals, superscripts, or subscripts and usually contain no punctuation. In *JAMA* and the *Archives* Journals, gene symbols are italicized, per official recommendations, for example, *AFB* for the α-fetoprotein gene.

Gene Names: Genes are usually named for the molecular product of the gene, the function of the gene, or the condition associated with the gene, if known. Gene names are not italicized, for example, the β_2-microglobulin gene.

Alleles: Alleles denote alternative forms of a gene. Alleles are often characterized by particular variant sequences (mutations). Because alleles are alternative forms of a particular gene, they are expressed by means of both the gene name or symbol and an appendage that indicates the specific allele. Classically, allele symbols consist of the gene symbol plus an asterisk plus the italicized allele designation, for example, *HBB*S* for the *S* allele of the *HBB* gene.

Genotypes: Genotype comprises the set of alleles in an individual. Genotypes are italicized, for example, *CYP2D6*4A/*5.* When a genotype is being expressed in terms of nucleotides (eg, a polymorphism), italics and other punctuation are not needed, for example, *MTHFR*677 TT genotype. When the individual is being described in terms of the 2 possible amino acids at 1 position in the protein owing to a single-nucleotide polymorphism (nonsynonymous mutation), the corresponding amino acids are separated by a virgule, for example, Met/Val (heterozygous). Such terms should be explained at first mention with the amino acid terms expanded, for example, the common methionine/valine (Met/Val) polymorphism at codon 129.

Phenotypes: Phenotype is the collection of traits in an individual resulting from his or her genotype. When phenotypes are expressed in terms of the specific alleles, the phenotype term derives from the genotype term, but no italics are used, and, instead of asterisks, spaces are used. For example, for genotype *ABO*A1/ABO*O*, the phenotype is ABO A1.

1. Women who have inherited mutations in the breast cancer genes BRCA1 or BRCA2 have substantially elevated risks of breast cancer and ovarian cancer, with a lifetime risk of breast cancer of 56% to 84%.

ANSWER:

Women who have inherited mutations in the breast cancer genes *BRCA1* or *BRCA2* have substantially elevated risks of breast cancer and ovarian cancer, with a lifetime risk of breast cancer of 56% to 84%.

Editor's Note: Gene symbols should be italicized (§**15.6.2**, Human Gene Nomenclature, *Gene Symbols*, pp 609-610 in print).

2. We measured ERBB2 protein expression and ERBB2 gene amplification by means of immunohistochemical assessment and fluorescence in situ hybridization, respectively.

ANSWER:
We measured ERBB2 (formerly HER2/neu) protein expression and *ERBB2* gene amplification by means of immunohistochemical assessment and fluorescence in situ hybridization, respectively.

> **Editor's Note:** Gene symbols should be italicized but protein symbols set in roman (§**15.6.2**, Human Gene Nomenclature, Writing About Genes and Italicizing Gene Symbols, pp 613-628 in print). The symbol for the oncogene known as *HER2/neu* is actually *ERBB2*. Because the term *HER2/neu* is widely used and recognized, it may be included in parentheses after the first mention of *ERBB2* (§**15.6.3**, Oncogenes and Tumor Suppressor Genes, pp 632-637 in print).

3. We examined measures that may be associated with disease in individuals carrying the gene expansion for Huntington disease (HD). Our study included 505 at-risk individuals who had previously undergone elective DNA analyses for the CAG expansion in the HD gene (predictive testing) and did not currently have a clinical diagnosis of HD.

ANSWER:
We examined measures that may be associated with disease in individuals carrying the gene expansion for Huntington disease (HD). Our study included 505 at-risk individuals who had previously undergone elective DNA analyses for the CAG expansion in the *HD* gene (predictive testing) and did not currently have a clinical diagnosis of HD.

> **Editor's Note:** Some gene symbols may be the same as abbreviations for diseases. The gene symbol but not the abbreviation for the disease should be italicized (§**15.6.2**, *Writing About Genes and Italicizing Gene Symbols*, pp 613-628 in print).

4. The cause of the faulty enzyme was found to be a defect in the glucose-6-phosphate dehydrogenase (G6PD) gene.

ANSWER:
The cause of the faulty enzyme was found to be a defect in the glucose-6-phosphate dehydrogenase gene (*G6PD*).

> **Editor's Note:** Gene symbols do not immediately follow the term in the gene name that they might seem to abbreviate but rather should relate to the word *gene* that usually follows it (§**15.6.2**, Human Gene Nomenclature, *Writing About Genes and Italicizing Gene Symbols*, pp 613-628 in print).

5. On the basis of our biochemical results and in agreement with previously published criteria, the m.5728A>G mutation qualifies as being pathogenic.

ANSWER:
On the basis of our biochemical results and in agreement with previously published criteria, the m.5728A>G mutation qualifies as being pathogenic.

> **Editor's Note:** Unlike gene symbols, mutations are not italicized (§**15.6.2**, Human Gene Nomenclature, *Writing About Genes and Italicizing Gene Symbols*, pp 613-628 in print).

6. Discordant phenotypes resulted from the same mutation in exon ORF15 of the retinitis pigmentosa GTPase regulator gene (RPGR) in 2 presumed dizygotic twin brothers with X-linked retinal disease. An identical mutation in RPGR-ORF15 manifested distinct clinical phenotypes in individuals of the same family.

ANSWER:

Discordant phenotypes resulted from the same mutation in exon ORF15 of the retinitis pigmentosa GTPase regulator gene (*RPGR*) in 2 presumed dizygotic twin brothers with X-linked retinal disease. An identical mutation in *RPGR*-ORF15 manifested distinct clinical phenotypes in individuals of the same family.

> **Editor's Note:** In discussions of mutations, the gene symbols remain italicized; specific mutations, however, are *not* italicized (§**15.6.2**, Human Gene Nomenclature, *Writing About Genes and Italicizing Gene Symbols*, pp 613-628 in print).

7. The apolipoprotein E ε4 allele (*APOE*ε4*) is associated with an increased risk of developing Alzheimer disease.

ANSWER:

The apolipoprotein E ε4 allele (*APOE*E4*) is associated with an increased risk of developing Alzheimer disease.

> **Editor's Note:** As with gene symbols, alleles are italicized and Greek letters are changed to Latin letters, for example, *APOE*E4* not *APOE*ε4.* However, the following expressions are all used for *APOE*E4*: *ε4* allele, epsilon 4 allele, E4 allele, *APOE*4,* apoe e4, and *APOEE4*; follow author preference (§**15.6.2**, Human Gene Nomenclature, *Alleles*, pp 628-629 in print).

8. The HLA-DQB1*0503 allele is significantly associated with susceptibility to tuberculosis in Cambodian patients.

ANSWER:
The HLA-DQB1*05:03 allele is significantly associated with susceptibility to tuberculosis in Cambodian patients.

> **Editor's Note:** Although alleles are traditionally italicized, alleles of the major histocompatibility locus are set in roman (§**15.6.2**, Human Gene Nomenclature, *Alleles*, pp 628-629 in print). **Update to the Manual:** In April 2010, the WHO Nomenclature Committee for Factors of the HLA System introduced a modification of the nomenclature outlined in the manual; the new nomenclature introduces delimiters in the form of colons, which removes the restriction of only allowing 99 alleles in 1 group. Hence the former HLA-DQB1*0503 is now expressed as HLA-DQB1*05:03 (Tait BD. The ever-expanding list of HLA alleles: changing HLA nomenclature and its relevance to clinical transplantation. *Transplant Rev [Orlando].* 2011;25[1]:1-8.).

9. We investigated the characterization of mutations of the ATP7B gene and the correlation between the ATP7B genotype and the ATP7B phenotype in the Chinese population.

ANSWER:
We investigated the characterization of mutations of the *ATP7B* gene and the correlation between the *ATP7B* genotype and the ATP7B phenotype in the Chinese population.

> **Editor's Note:** Genes and genotypes are italicized and phenotypes are set in roman (§**15.6.2**, Human Gene Nomenclature, *Genotype and Phenotype Terminology*, pp 629-631 in print).

10. Our study found that valine/valine (val/val) individuals were susceptible to Alzheimer disease in late life and methionine/valine (met/val) allele carriers were susceptible to Alzheimer disease in early adult life.

ANSWER:
Our study found that valine/valine (Val/Val) individuals were susceptible to Alzheimer disease in late life and methionine/valine (Met/Val) allele carriers were susceptible to Alzheimer disease in early adult life.

> **Editor's Note:** The terms Val/Val (homozygous), Met/Val (heterozygous), and Met/Met (homozygous) should be set in roman. Although the full terms are not capitalized, the abbreviations use initial capital letters (§**15.6.2**, Human Gene Nomenclature, *Genotype and Phenotype Terminology*, pp 629-631 in print).

11. The ADRB2 gene Gln27Glu (79 CG) G allele carriers with heart failure were significantly more likely to demonstrate an improved ejection fraction with carvedilol therapy than were patients homozygous for the C allele.

ANSWER:
The *ADRB2* gene Gln27Glu (79 CG) G allele carriers with heart failure were significantly more likely to demonstrate an improved ejection fraction with carvedilol therapy than were patients homozygous for the C allele.

> **Editor's Note:** Within larger terms, only the gene symbol (eg, *ADRB2*) should be italicized (§**15.6.2**, Human Gene Nomenclature, *Gene Symbols*, pp 609-610 in print).

12. The distribution of the ADH3 genotypes AA, GA, and GG was similar in the groups with and without cancer.

ANSWER:

The distribution of the *ADH3* genotypes AA, GA, and GG was similar in the groups with and without cancer.

> **Editor's Note:** Although the genotype symbol should be italicized, when the genotype is being expressed in terms of nucleotides, italics and other punctuation are not needed (eg, AA, GA, and GG) (§**15.6.2**, Human Gene Nomenclature, *Genotype and Phenotype Terminology*, pp 629-631 in print).