A symmetry operation that is not compatible with the periodicity of a crystal pattern (in two or three dimensions) is called a **noncrystallographic symmetry**. Rotations other than 1, 2, 3, 4, and 6 (in $E^2$ and $E^3$) belong to this type of symmetry. Rotations 5, 8, 10 and 12 are compatible with a translation in higher-dimensional spaces, but they are commonly considered noncrystallographic. For example, in quasicrystals fivefold or tenfold rotational axes are incapable of tiling space through the application of three-dimensional lattice translations, but they act as normal symmetry axes in a higher-dimensional space. Continuous rotations, which give rise to the Curie groups contained in the cylindrical system and in the spherical system, are noncrystallographic in any dimension.

**Discussion**

In biological crystallography, the term 'noncrystallographic symmetry' is often, but improperly, used to indicate a symmetry relationship between similar subunits within the crystallographic asymmetric unit. This use comes from the fact that the operation required to superimpose one subunit on another is similar to a space group operation, but it operates only over a local volume, and the superposition may be inexact because the subunits are in different environments. The 'subunit' can be a molecular aggregate, a single molecule, a monomer unit of an oligomeric molecule, or a fragment of a molecule. The superposition is inexact because protein subunits in different environments are never identical. At the very least, surface side chains are differently ordered, and solvation is different because of different interactions with adjacent subunits. This use of the term 'noncrystallographic symmetry' is improper for two reasons:

1. a symmetry operation acting on a subspace of the crystal space is called a local symmetry operation; it is a space groupoid operation;
2. an operation that superposes two objects only approximately is called a pseudo symmetry operation.

**See also**

Section 10.1.4 of *International Tables for Crystallography, Volume A*

Section 2.3.5 of *International Tables for Crystallography, Volume B*

**Contributors**

- [Online Dictionary of Crystallography](#)