Vitamin A and retinoids

The term ‘vitamin A’ was defined (IUNS Committee on Nomenclature, 1978) as the generic descriptor for all C_{20}-β-ionone derivatives that exhibit qualitatively the biological activity of all-trans retinol. The term ‘provitamin A’ for the carotenoids giving rise to vitamin A is retained.

Chemically, vitamin A belongs to the ‘retinoids’, defined (IUPAC–IUB Joint Commission on Biochemical Nomenclature, 1982) as a class of compounds consisting of four isoprenoid units joined in a head-to-tail manner. These recommendations also contain the statement: all retinoids may be formally derived from a monocyclic parent compound containing five carbon–carbon double bonds and a functional group at the end of the acyclic portion (Fig. 1).

The two definitions do not contradict each other. There are, however, certain implications in the words ‘vitamin A’ and ‘retinoids’ that should be considered when using the terms. ‘Vitamin A’ means a group of substances (retinol, retinyl esters, and retinol) with defined biological activities. Further, there are certain metabolites of vitamin A, such as all-trans- and cis-isomeric retinoic acids, that can perform some, but not all, of the biological functions of vitamin A; they are incapable of being metabolically converted into retinol, retinal, etc. (Chytil, 1984).

Retinoic acid and some of its isomers and derivatives, together with a number of structurally modified retinoids, have been shown to control cell differentiation in many epithelial tissues and to prevent metaplasia (Sporn et al. 1976; Bollag & Matter, 1981). Some of these substances are used in the treatment of various types of keratinization disorders. Such compounds cannot substitute for vitamin A; indeed some of them even act as vitamin A antagonists (Law & Rando, 1989; Hanck et al. 1991).

The term ‘retinoids’ is widely employed for this class of compounds. This practice arose from an earlier proposal (Sporn et al. 1976) to use the name ‘retinoids’ collectively for both natural forms and synthetic analogues of vitamin A that are capable of preventing the development of cancer. General usage of this term is, however, misleading for two reasons. First, the customary practice gives the name ‘retinoids’, which has an agreed definition based on chemical structure (IUPAC–IUB Joint Commission on Biochemical Nomenclature, 1982), to a class of compounds defined by their biological activity. Second, many synthetic members of this class of compounds, the so-called ‘arotinoids’ (Loeliger et al. 1980) or ‘retinoidal benzoic acid derivatives’ (Frickel, 1984) as well as others, are not chemically retinoids. The contain, e.g., aromatic rings replacing either the basic β-ionone type ring structure or unsaturated bonds of the tetraene side chain of the retinoid skeleton (Fig. 2).

We now suggest that the compounds that control epithelial differentiation and prevent metaplasia, without possessing the full range of activities of vitamin A, should be termed ‘retinoate analogues’. Although they are usually called ‘retinoids’, we discourage their designation by a term that has a defined, but different, meaning.

A new term for the group of substances with such antimetaplastic activities may be

![Fig. 1. Structure of the parent compound of retinoids.](image-url)
desirable, especially if it is based on their biological activity. It should not imply a chemical structure because of heterogeneity among the compounds. Proposals for such a term are welcome.

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REFERENCES


