PTO Form 1930 (Rev 9/2007)
OMB No. 0651-0050 (Exp. 05/31/2014)

Request for Reconsideration after Final Action

The table below presents the data as entered.

Input Field	Entered
SERIAL NUMBER	85943027
LAW OFFICE ASSIGNED	LAW OFFICE 104
MARK SECTION (no change)	
ARGUMENT(S)	

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Nikos Alexakis AG

Serial No.: 85943027

Trademark: OMEGA SOUL

Classes: 05 and 28

Filed: 05/27/2013

To: Commissioner for Trademarks

P.O. Box 1451

Alexandria, Virginia 22313-1451

Attn: Donald O. Johnson, Esquire

Trademark Examining Attorney

Law Office 104

REQUEST FOR RECONSIDERATION AFTER PARTIAL FINAL OFFICE ACTION

In an Office Action dated July, 17 2013, the Examining Attorney refuses registration on the ground that there is a prior pending trademark which is confusingly similar and also on the ground that the mark is deceptive in regard to the goods covered in Class 5. The Examining Attorney has also requested the applicant to disclaim the wording “OMEGA”, to clarify the identification of goods and to provide further information regarding the trademark’s goods.

On February, 2 2014 the Examining Attorney made the refusal of the registration on the ground that the mark is deceptive (section 2 (a) Trademark Act) partially final in regard to Class 5.

1. The U.S. Court of Appeals for the Federal Circuit[1], has articulated the following test to determine whether a mark is deceptive (as also found in the Trademark Manual of Examining Procedure at § 1203.02 (b) and the Examination Guide 1-11):

   (1) Is the term misdescriptive of the character, quality, function, composition or use of the goods?

   (2) If so, are prospective purchasers likely to believe that the misdescription actually describes the goods?

   (3) If so, is the misdescription likely to affect a significant portion of the relevant consumers’ decision to purchase? [2]

   2. The applicant respectfully submits that the examining attorney has failed to prove that the term OMEGA by itself is understood by a substantial part of consumers to mean OMEGA FATTY-ACIDS.

   3. It is essential to the first prong of the Budge test for section 2(a) deceptiveness, that the term is misdescriptive. The term is not a generic term for omega fatty acids, as is for example CAFTERIA for services of a restaurant (*In re Alp of South Beach, Inc*. 79 USPQ 2d 1009 (TTAB 2006)) or TITANIUM as material for recreational vehicles (*Glendale International Corp. v. U.S. Patent & Trademark*

Office, 75 USPQ2d 1139 (DC EVa 2005)) or silk for clothing articles (*In re Phillips-Van Heusen Corp.*, 63 USPQ2d 1047 (TTAB 2002)).

4. The evidence submitted by the applicant with its first response to the July Office Action shows that the majority of products which contain omega fatty acids contain the numbers 3, 6, 7 or 9. This is done to reference the group of fats.

A consumer thus might come to understand that a product called OMEGA 3, would contain omega three fatty acids. Or that a product named OMEGA 6, would contain Omega 6 fatty acids.

5. The evidence, however, does not suggest that the competitors on the market simply use OMEGA to reference the ingredient "omega three fatty acid" as the Examining Attorney suggests. Nor does the evidence suggest that OMEGA is generally used to reference omega fatty acids in general. Attached we forward **evidence** from Wikipedia.org concerning the term *fatty acids*.

6. The evidence submitted by the Examining Attorney with the July Office Action concerning products containing the name OMEGA usually references the numbers 3, 6, 7, or 9. Only rarely this has not been the case.

7. Moreover, the evidence suggests that the term OMEGA is freely used to name products that contain a variety of ingredients but omega fatty acids. The applicant has submitted a screenshot omeganutrition.com as an example.

8. The applicant relies on the Trademark Trial and Appeal Board decision *In re Omega Alpha Pharmaceuticals Inc.* that the trademark applications OMEGA ALPHA with application numbers 77486429 and 77486441 is NOT deceptive when used in connection with the identified goods of Class 5.

9. A substantial part of the consumers will understand the term OEMGA as a Greek letter and in combination with SOUL as a trademark, namely OMEGA SOUL. Enclosed we attach **evidence** from Wikipedia.org concerning the term *OMEGA* and *OMEGA disambiguation*.

10. As part of the three prongs Budge test the misdescription must be likely to affect a significant portion of the relevant consumers' decision to purchase the product.

The Examining Attorney indicated in the July Office Action that "[I] n this case, applicant's mark includes the wording "OMEGA", which indicates the goods

contain **omega fatty acids**, a group of fats that are thought by a substantial number of consumers to have health benefits".

It is submitted that not all omega fatty acids are known to have health benefits. There is evidence that suggest that Omega-6 fatty acids have negative health effects. Enclosed we attach **evidence** from Wikipedia.org for a detailed discussion of the negative health effects of omega-6 fatty acids.

For the forgoing reasons, it is respectfully submitted that the present application is in condition for publication and registration, and such action is requested.

Respectfully submitted on behalf of

Nikos Alexakis AG

Marijan Stephan Hucke

Attorney for Applicant

Attorney of record New York Bar Member

HUCKE HUCKE Law Office

An der Fuchskaul 14

50259 Pulheim

Germany

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[1] *In re Budge Mfg. Co. Inc*., 857 F.2d 773, 775, 8 USPQ2d 1259, 1260 (Fed. Cir. 1988), *aff'g* 8 USPQ2d 1790 (TTAB 1987).

[2] In re Spirits Int'l, N.V., 563 F.3d 1347, 90 USPQ2d 1589 (Fed. Cir. 2009); In re Budge Mfg. Co. Inc., 857 F.2d 773, 775, 8 USPQ2d 1259, 1260 (Fed. Cir. 1988), aff'g 8 USPQ2d 1790 (TTAB 1987).

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DESCRIPTION OF EVIDENCE FILE	The evidence consists of Wikipedia printouts for the terms, OMEGA, fatty acids, omega-6 fatty acid and OMEGA (disambiguation).
SIGNATURE SECTION	
RESPONSE SIGNATURE	/MHUCKE/
SIGNATORY'S NAME	Marijan Hucke
SIGNATORY'S POSITION	Attorney of record [NY] bar member
SIGNATORY'S PHONE NUMBER	646-396-0410
DATE SIGNED	08/05/2014
AUTHORIZED SIGNATORY	YES
CONCURRENT APPEAL NOTICE FILED	NO
FILING INFORMATION SECTION	
SUBMIT DATE	Tue Aug 05 10:32:38 EDT 2014
TEAS STAMP	USPTO/RFR-82.232.180.231-20140805103238275989-85943027-5009ae9cec975bec281e6856b7f793717613369d05323e536f738a5fa5df7252-N/A-N/A-20140805101811222481

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Request for Reconsideration after Final Action
To the Commissioner for Trademarks:

Application serial no. **85943027** has been amended as follows:

ARGUMENT(S)
In response to the substantive refusal(s), please note the following:

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Serial No.: 85943027

Trademark: OMEGA SOUL

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EVIDENCE

Evidence in the nature of The evidence consists of Wikipedia printouts for the terms, OMEGA, fatty acids, omega-6 fatty acid and OMEGA (disambiguation). has been attached.

Original PDF file:

evi_801287248-101811222_._Fatty_acid.pdf

Converted PDF file(s) (9 pages)

Evidence-1
Evidence-2
Evidence-3
Evidence-4
Evidence-5
Evidence-6
Evidence-7
Evidence-8
Evidence-9

Original PDF file:

evi_801287248-101811222_._Omega__disambiguation_.pdf

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Original PDF file:

evi_801287248-101811222_._Omega-6_fatty_acid.pdf

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Evidence-1

Evidence-2
Evidence-3
Evidence-4
Evidence-5

SIGNATURE(S)
Request for Reconsideration Signature
Signature: /MHUCKE/ Date: 08/05/2014
Signatory's Name: Marijan Hucke
Signatory's Position: Attorney of record [NY] bar member

Signatory's Phone Number: 646-396-0410

The signatory has confirmed that he/she is an attorney who is a member in good standing of the bar of the highest court of a U.S. state, which includes the District of Columbia, Puerto Rico, and other federal territories and possessions; and he/she is currently the applicant's attorney or an associate thereof; and to the best of his/her knowledge, if prior to his/her appointment another U.S. attorney or a Canadian attorney/agent not currently associated with his/her company/firm previously represented the applicant in this matter: (1) the applicant has filed or is concurrently filing a signed revocation of or substitute power of attorney with the USPTO; (2) the USPTO has granted the request of the prior representative to withdraw; (3) the applicant has filed a power of attorney appointing him/her in this matter; or (4) the applicant's appointed U.S. attorney or Canadian attorney/agent has filed a power of attorney appointing him/her as an associate attorney in this matter.

The applicant is not filing a Notice of Appeal in conjunction with this Request for Reconsideration.

Serial Number: 85943027
Internet Transmission Date: Tue Aug 05 10:32:38 EDT 2014
TEAS Stamp: USPTO/RFR-82.232.180.231-201408051032382
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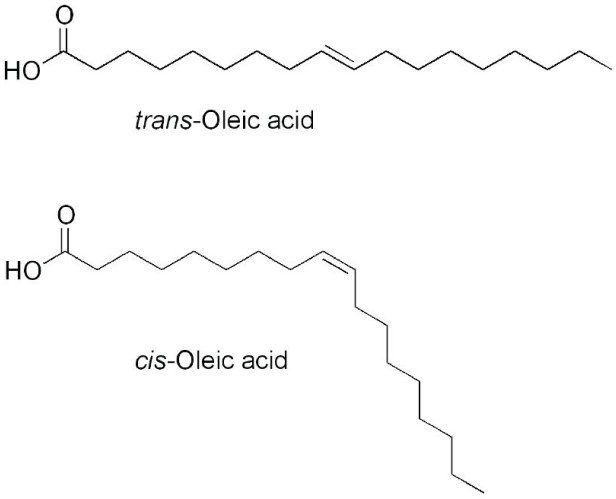
Fatty acid

Not to be confused with fat.

Types of fats in food

• Unsaturated fat
  • Monounsaturated fat
  • Polyunsaturated fat
  • Trans fat
  • Omega numbering:
  • ω−3
  • ω−6
  • ω−7
  • ω−9
• Saturated fat
  • Interesterified fat

See also
• Fatty acid • Essential fatty acid
• v • t • e [1]

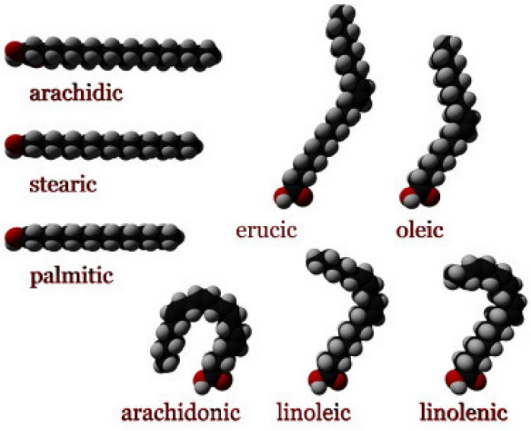


Comparison of the *trans* isomer (top) Elaidic acid and the *cis*-isomer oleic acid.

In chemistry, particularly in biochemistry, a **fatty acid** is a carboxylic acid with a long aliphatic tail (chain), which is either saturated or unsaturated. Most naturally occurring fatty acids have a chain of an even number of carbon atoms, from 4 to 28. Fatty acids are usually derived from triglycerides or phospholipids. When they are not attached to other molecules, they are known as "free" fatty acids. Fatty acids are important sources of fuel because, when metabolized, they yield large quantities of ATP. Many cell types can use either glucose or fatty acids for this purpose. In particular, heart and skeletal muscle prefer fatty acids. Despite long-standing assertions to the contrary, fatty acids can be used as a source of fuel for brain cells, at least in some rodents, in addition to glucose and ketone bodies.

Types of fatty acids

Fatty acids that have carbon–carbon double bonds are known as unsaturated. Fatty acids without double bonds are known as saturated. They differ in length as well.



Three-dimensional representations of several fatty acids

Length of free fatty acid chains

Fatty acid chains differ by length, often categorized as short to very long.

- Short-chain fatty acids (SCFA) are fatty acids with aliphatic tails of fewer than six carbons (i.e. butyric acid).
- Medium-chain fatty acids (MCFA) are fatty acids with aliphatic tails of 6–12[2] carbons, which can form medium-chain triglycerides.
- Long-chain fatty acids (LCFA) are fatty acids with aliphatic tails 13 to 21 carbons.
- Very long chain fatty acids (VLCFA) are fatty acids with aliphatic tails longer than 22 carbons

Unsaturated fatty acids

Unsaturated fatty acids have one or more double bonds between carbon atoms. (Pairs of carbon atoms connected by double bonds can be saturated by adding hydrogen atoms to them, converting the double bonds to single bonds. Therefore, the double bonds are called unsaturated.)

The two carbon atoms in the chain that are bound next to either side of the double bond can occur in a *cis* or *trans* configuration.

cis

> A *cis* configuration means that adjacent hydrogen atoms are on the same side of the double bond. The rigidity of the double bond freezes its conformation and, in the case of the *cis* isomer, causes the chain to bend and restricts the conformational freedom of the fatty acid. The more double bonds the chain has in the *cis* configuration, the less flexibility it has. When a chain has many *cis* bonds, it becomes quite curved in its most accessible conformations. For example, oleic acid, with one double bond, has a "kink" in it, whereas linoleic acid, with two double bonds, has a more pronounced bend. Alpha-linolenic acid, with three double bonds, favors a hooked shape. The effect of this is that, in restricted environments, such as when fatty acids are part of a phospholipid in a lipid bilayer, or triglycerides in lipid droplets, cis bonds limit the ability of fatty acids to be closely packed, and therefore could affect the melting temperature of the membrane or of the fat.

trans

> A *trans* configuration, by contrast, means that the next two hydrogen atoms are bound to *opposite* sides of the double bond. As a result, they do not cause the chain to bend much, and their shape is similar to straight saturated fatty acids.

In most naturally occurring unsaturated fatty acids, each double bond has three *n* carbon atoms after it, for some n, and all are cis bonds. Most fatty acids in the *trans* configuration (trans fats) are not found in nature and are the result of human processing (e.g., hydrogenation).

The differences in geometry between the various types of unsaturated fatty acids, as well as between saturated and unsaturated fatty acids, play an important role in biological processes, and in the construction of biological structures

(such as cell membranes).

Examples of Unsaturated Fatty Acids

Common name	Chemical structure	Δ^x	C:D	n–x
Myristoleic acid	$CH_3(CH_2)_3\mathbf{CH=CH}(CH_2)_7COOH$	*cis*-Δ^9	14:1	*n*–5
Palmitoleic acid	$CH_3(CH_2)_5\mathbf{CH=CH}(CH_2)_7COOH$	*cis*-Δ^9	16:1	*n*–7
Sapienic acid	$CH_3(CH_2)_8\mathbf{CH=CH}(CH_2)_4COOH$	*cis*-Δ^6	16:1	*n*–10
Oleic acid	$CH_3(CH_2)_7\mathbf{CH=CH}(CH_2)_7COOH$	*cis*-Δ^9	18:1	*n*–9
Elaidic acid	$CH_3(CH_2)_7\mathbf{CH=CH}(CH_2)_7COOH$	*trans*-Δ^9	18:1	*n*–9
Vaccenic acid	$CH_3(CH_2)_5\mathbf{CH=CH}(CH_2)_9COOH$	*trans*-Δ^{11}	18:1	*n*–7
Linoleic acid	$CH_3(CH_2)_4\mathbf{CH=CH}CH_2\mathbf{CH=CH}(CH_2)_7COOH$	*cis*,*cis*-Δ^9,Δ^{12}	18:2	*n*–6
Linoelaidic acid	$CH_3(CH_2)_4\mathbf{CH=CH}CH_2\mathbf{CH=CH}(CH_2)_7COOH$	*trans*,*trans*-Δ^9,Δ^{12}	18:2	*n*–6
α-Linolenic acid	$CH_3CH_2\mathbf{CH=CH}CH_2\mathbf{CH=CH}CH_2\mathbf{CH=CH}(CH_2)_7COOH$	*cis*,*cis*,*cis*-Δ^9,Δ^{12},Δ^{15}	18:3	*n*–3
Arachidonic acid	$CH_3(CH_2)_4\mathbf{CH=CH}CH_2\mathbf{CH=CH}CH_2\mathbf{CH=CH}CH_2\mathbf{CH=CH}(CH_2)_3COOH$ [NIST] [3]	*cis*,*cis*,*cis*,*cis*-$\Delta^5\Delta^8$,Δ^{11},Δ^{14}	20:4	*n*–6
Eicosapentaenoic acid	$CH_3CH_2\mathbf{CH=CH}CH_2\mathbf{CH=CH}CH_2\mathbf{CH=CH}CH_2\mathbf{CH=CH}CH_2\mathbf{CH=CH}(CH_2)_3COOH$	*cis*,*cis*,*cis*,*cis*,*cis*-Δ^5,Δ^8,Δ^{11},Δ^{14},Δ^{17}	20:5	*n*–3
Erucic acid	$CH_3(CH_2)_7\mathbf{CH=CH}(CH_2)_{11}COOH$	*cis*-Δ^{13}	22:1	*n*–9
Docosahexaenoic acid	$CH_3CH_2\mathbf{CH=CH}CH_2\mathbf{CH=CH}CH_2\mathbf{CH=CH}CH_2\mathbf{CH=CH}CH_2\mathbf{CH=CH}CH_2\mathbf{CH=CH}(CH_2)_2COOH$	*cis*,*cis*,*cis*,*cis*,*cis*,*cis*-Δ^4,Δ^7,Δ^{10},Δ^{13},Δ^{16},Δ^{19}	22:6	*n*–3

Essential fatty acids

Main article: Essential fatty acid

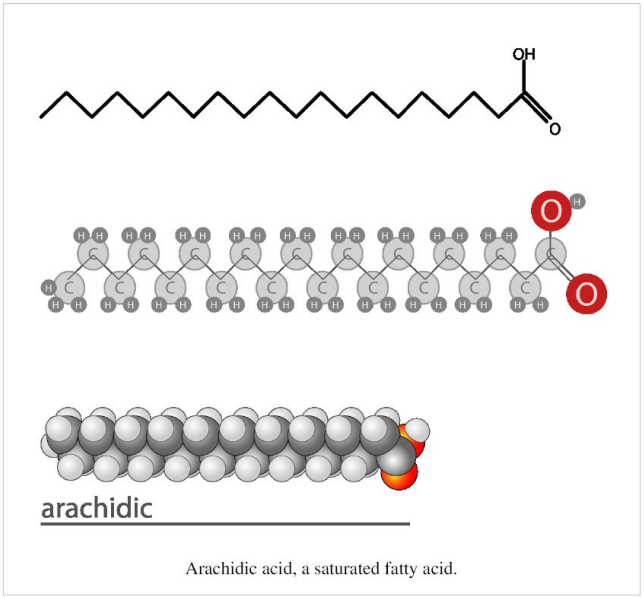
Fatty acids that are required by the human body but cannot be made in sufficient quantity from other substrates, and therefore must be obtained from food, are called essential fatty acids. There are two series of essential fatty acids: one has a double bond three carbon atoms removed from the methyl end; the other has a double bond six carbon atoms removed from the methyl end. Humans lack the ability to introduce double bonds in fatty acids beyond carbons 9 and 10, as counted from the carboxylic acid side. Two essential fatty acids are linoleic acid (LA) and alpha-linolenic acid (ALA). They are widely distributed in plant oils. The human body has a limited ability to convert ALA into the longer-chain *n*-3 fatty acids eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), which can also be obtained from fish.

Saturated fatty acids

Main article: Saturated fat

For a more comprehensive list, see List of saturated fatty acids.

Saturated fatty acids are long-chain carboxylic acids that usually have between 12 and 24 carbon atoms and have no double bonds. Thus, saturated fatty acids are saturated with hydrogen (since double bonds reduce the number of hydrogens on each carbon). Because saturated fatty acids have only single bonds, each carbon atom within the chain has 2 hydrogen atoms (except for the omega carbon at the end that has 3 hydrogens).



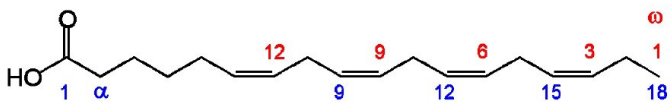
Arachidic acid, a saturated fatty acid.

Examples of Saturated Fatty Acids

Common name	Chemical structure	*C*:*D*
Caprylic acid	$CH_3(CH_2)_6COOH$	8:0
Capric acid	$CH_3(CH_2)_8COOH$	10:0
Lauric acid	$CH_3(CH_2)_{10}COOH$	12:0
Myristic acid	$CH_3(CH_2)_{12}COOH$	14:0
Palmitic acid	$CH_3(CH_2)_{14}COOH$	16:0
Stearic acid	$CH_3(CH_2)_{16}COOH$	18:0
Arachidic acid	$CH_3(CH_2)_{18}COOH$	20:0
Behenic acid	$CH_3(CH_2)_{20}COOH$	22:0
Lignoceric acid	$CH_3(CH_2)_{22}COOH$	24:0
Cerotic acid	$CH_3(CH_2)_{24}COOH$	26:0

Nomenclature

Several different systems of nomenclature are used for fatty acids. The following table describes the most common systems.



Numbering of carbon atoms

System	Example	Explanation
Trivial nomenclature	Palmitoleic acid	**Trivial names** (or **common names**) are non-systematic historical names, which are the most frequent naming system used in literature. Most common fatty acids have trivial names in addition to their *systematic names* (see below). These names frequently do not follow any pattern, but they are concise and often unambiguous.
Systematic nomenclature	(9Z)-octadecenoic acid	**Systematic names** (or **IUPAC names**) derive from the standard *IUPAC Rules for the Nomenclature of Organic Chemistry*, published in 1979, along with a recommendation published specifically for lipids in 1977. Counting begins from the carboxylic acid end. Double bonds are labelled with *cis-/trans-* notation or *E-/Z-* notation, where appropriate. This notation is generally more verbose than common nomenclature, but has the advantage of being more technically clear and descriptive.
Δ^x nomenclature	*cis*,*cis*-Δ^9,Δ^{12} octadecadienoic acid	In **Δ^x** (or **delta-*x***) **nomenclature**, each double bond is indicated by Δ^x, where the double bond is located on the *x*th carbon–carbon bond, counting from the carboxylic acid end. Each double bond is preceded by a *cis-* or *trans-* prefix, indicating the conformation of the molecule around the bond. For example, linoleic acid is designated "cis-Δ^9, cis-Δ^{12} octadecadienoic acid". This nomenclature has the advantage of being less verbose than systematic nomenclature, but is no more technically clear or descriptive.
***n*–*x* nomenclature**	*n*–3	***n*–*x*** (***n* minus *x***; also **ω–*x*** or **omega-*x***) **nomenclature** both provides names for individual compounds and classifies them by their likely biosynthetic properties in animals. A double bond is located on the x^{th} carbon–carbon bond, counting from the terminal methyl carbon (designated as *n* or ω) toward the carbonyl carbon. For example, α-Linolenic acid is classified as a *n*–3 or omega-3 fatty acid, and so it is likely to share a biosynthetic pathway with other compounds of this type. The ω–*x*, omega-*x*, or "omega" notation is common in popular nutritional literature, but IUPAC has deprecated it in favor of *n*–*x* notation in technical documents. The most commonly researched fatty acid biosynthetic pathways are *n*–3 and *n*–6.
Lipid numbers	18:3 18:3ω6 18:3, cis,cis,cis-Δ^9,Δ^{12},Δ^{15}	**Lipid numbers** take the form *C*:*D*, where *C* is the number of carbon atoms in the fatty acid and *D* is the number of double bonds in the fatty acid (if more than one, the double bonds are assumed to be interrupted by CH 2 units, *i.e.*, at intervals of 3 carbon atoms along the chain). This notation can be ambiguous, as some different fatty acids can have the same numbers. Consequently, when ambiguity exists this notation is usually paired with either a Δ^x or *n*–*x* term.

Production

Fatty acids are usually produced industrially by the hydrolysis of triglycerides, with the removal of glycerol (see oleochemicals). Phospholipids represent another source. Some fatty acids are produced synthetically by hydrocarboxylation of alkenes.

Free fatty acids

Main article: fatty acid synthesis

The biosynthesis of fatty acids involves the condensation of acetyl-CoA. Since this coenzyme carries a two-carbon-atom group, almost all natural fatty acids have even numbers of carbon atoms.

The "uncombined fatty acids" or "free fatty acids" found in organisms come from the breakdown of a triglyceride.Wikipedia:Citation needed Because they are insoluble in water, these fatty acids are transported (solubilized, circulated) while bound to plasma protein albumin. The levels of "free fatty acid" in the blood are limited by the availability of albumin binding sites.

Fatty acids in dietary fats

The following table gives the fatty acid, vitamin E and cholesterol composition of some common dietary fats.

	Saturated	**Monounsaturated**	**Polyunsaturated**	**Cholesterol**	**Vitamin E**
	g/100g	g/100g	g/100g	mg/100g	mg/100g
Animal fats					
Lard	40.8	43.8	9.6	93	0.00
Duck fat	33.2	49.3	12.9	100	2.70
Butter	54.0	19.8	2.6	230	2.00
Vegetable fats					
Coconut oil	85.2	6.6	1.7	0	.66
Palm kernel oil	81.5	11.4	1.6	0	3.80
Palm oil	45.3	41.6	8.3	0	33.12
Cottonseed oil	25.5	21.3	48.1	0	42.77
Wheat germ oil	18.8	15.9	60.7	0	136.65
Soybean oil	14.5	23.2	56.5	0	16.29
Olive oil	14.0	69.7	11.2	0	5.10
Corn oil	12.7	24.7	57.8	0	17.24
Sunflower oil	11.9	20.2	63.0	0	49.00
Safflower oil	10.2	12.6	72.1	0	40.68
Hemp oil	10	15	75	0	12.34
Canola/Rapeseed oil	5.3	64.3	24.8	0	22.21

Reactions of fatty acids

Fatty acids exhibit reactions like other carboxylic acids, i.e. they undergo esterification and acid-base reactions.

Acidity

Fatty acids do not show a great variation in their acidities, as indicated by their respective pK_a. Nonanoic acid, for example, has a pK_a of 4.96, being only slightly weaker than acetic acid (4.76). As the chain length increases, the solubility of the fatty acids in water decreases very rapidly, so that the longer-chain fatty acids have minimal effect on the pH of an aqueous solution. Even those fatty acids that are insoluble in water will dissolve in warm ethanol, and can be titrated with sodium hydroxide solution using phenolphthalein as an indicator to a pale-pink endpoint. This analysis is used to determine the free fatty acid content of fats; i.e., the proportion of the triglycerides that have been hydrolyzed.

Hydrogenation and hardening

Hydrogenation of unsaturated fatty acids is widely practiced to give saturated fatty acids, which are less prone toward rancidification. Since the saturated fatty acids are higher melting than the unsaturated relatives, the process is called hardening. This technology is used to convert vegetable oils into margarine. During partial hydrogenation, unsaturated fatty acids can be isomerized from *cis* to *trans* configuration.[4]

More forcing hydrogenation, i.e. using higher pressures of H_2 and higher temperatures, converts fatty acids into fatty alcohols. Fatty alcohols are, however, more easily produced from fatty acid esters.

In the Varrentrapp reaction certain unsaturated fatty acids are cleaved in molten alkali, a reaction at one time of relevance to structure elucidation.

Auto-oxidation and rancidity

Main article: Rancidification

Unsaturated fatty acids undergo a chemical change known as auto-oxidation. The process requires oxygen (air) and is accelerated by the presence of trace metals. Vegetable oils resist this process because they contain antioxidants, such as tocopherol. Fats and oils often are treated with chelating agents such as citric acid to remove the metal catalysts.

Ozonolysis

Unsaturated fatty acids are susceptible to degradation by ozone. This reaction is practiced in the production of azelaic acid ($(CH_2)_7(CO_2H)_2$) from oleic acid.

Analysis

In chemical analysis, fatty acids are separated by gas chromatography of methyl esters; additionally, a separation of unsaturated isomers is possible by argentation thin-layer chromatography.

Circulation

Digestion and intake

Main article: Digestion § Fat digestion

Short- and medium-chain fatty acids are absorbed directly into the blood via intestine capillaries and travel through the portal vein just as other absorbed nutrients do. However, long-chain fatty acids are not directly released into the intestinal capillaries. Instead they are absorbed into the fatty walls of the intestine villi and reassembled again into

triglycerides. The triglycerides are coated with cholesterol and protein (protein coat) into a compound called a chylomicron.

Within the villi, the chylomicron enters a lymphatic capillary called a lacteal, which merges into larger lymphatic vessels. It is transported via the lymphatic system and the thoracic duct up to a location near the heart (where the arteries and veins are larger). The thoracic duct empties the chylomicrons into the bloodstream via the left subclavian vein. At this point the chylomicrons can transport the triglycerides to tissues where they are stored or metabolized for energy.

Metabolism

Main article: Fatty acid metabolism

Fatty acids (provided either by ingestion or by drawing on triglycerides stored in fatty tissues) are distributed to cells to serve as a fuel for muscular contraction and general metabolism. They are consumed by mitochondria to produce ATP through beta oxidation.

Distribution

Main article: Blood fatty acids

Blood fatty acids are in different forms in different stages in the blood circulation. They are taken in through the intestine in chylomicrons, but also exist in very low density lipoproteins (VLDL) and low density lipoproteins (LDL) after processing in the liver. In addition, when released from adipocytes, fatty acids exist in the blood as free fatty acids.

It is proposed that the blend of fatty acids exuded by mammalian skin, together with lactic acid and pyruvic acid, is distinctive and enables animals with a keen sense of smell to differentiate individuals.

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[4] Anneken, David J. *et al.* (2006) "Fatty Acids" in *Ullmann's Encyclopedia of Industrial Chemistry*, Wiley-VCH, Weinheim.

External links

- Lipid Library (http://www.lipidlibrary.co.uk/)
- *Prostaglandins, Leukotrienes & Essential Fatty Acids* Journal (http://intl.elsevierhealth.com/journals/plef/)
- Fatty Blood Acids (http://www.dmfpolska.eu/Diagnostics.html)

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Omega (disambiguation)

a multilingual free encyclopedia **Wiktionary** ['wɪk(ə)ərɪ] n. a wiki-based Open Content dictionary Willkommen Bienvenue Welcome	Look up ***omega*** in Wiktionary, the free dictionary.

Omega is the last letter in the Greek alphabet. See that article for more uses of the upper case (Ω) or lower case (ω) letter as a symbol.

Omega may also refer to:

Alphabet

- Omega (Cyrillic) (Ѡ, ѡ), the Cyrillic counterpart of the Greek omega

Astronomy

- Omega Nebula, a star cluster, Messier catalogue number 17.
- Multiple stars have the Bayer designation of Omega
- Omega Centauri, a globular cluster in the constellation of Centaurus.
- Ω is one name for the density parameter; see Ultimate fate of the universe

Orbital elements

- Longitude of the ascending node, abbreviated **Ω**
- Argument of periapsis, abbreviated **ω**

Mathematics

- Lambert W function, also known as the omega function
- Wright Omega function, another function defined in terms of the Lambert W function
- Omega constant, a specific value derived from the Lambert W function
- Omega language, a set of infinite-length sequences of symbols
- Chaitin's constant, or Halting Probability, written as Ω
- ω, the smallest infinite ordinal number, also understood as the set of all natural numbers
- ω_1 or Ω, the smallest uncountable ordinal number, also understood as the set of all countable ordinal numbers
- $\omega(g(n))$ and $\Omega(g(n))$, asymptotic notations used to characterize function growth
- The omega and agemo subgroups of a p-group, $\Omega(G)$ and $\mho(G)$

Automobiles

- Chevrolet Omega, a car model by General Motors do Brasil
- Opel Omega, a car model by Opel/Vauxhall
- Oldsmobile Omega, a car model by General Motors

Organisations

- Omega Institute for Holistic Studies, established 1977 at Rhinebeck, New York
- Omega SA, a Swiss luxury watchmaker
- Omega AS, a Norwegian company which supplies project personnel and project information management systems (Pims) to the oil and energy industry globally.

Special Forces

- OMEGA, a Latvian special operations unit
- Omega Special Task Force, Georgian counter terrorism unit
- Joint Task Force OMEGA, a special operations task force of the Colombian Military

Philosophy

- Omega Point, an idea in eschatology advanced by Pierre Teilhard de Chardin and physicist and mathematician Frank J. Tipler

Politics

- Omega 7, a Cuban anti-communist paramilitary group based in the United States

Places in the United States

- Omega, California, now uninhabited
  - Omega Hydraulic Diggings, historical gold mining site
- Omega, Georgia
- Omega, Indiana
- Omega, Oklahoma

Science

- OMEGA laser, laser at the Laboratory for Laser Energetics, University of Rochester, NY
- Omega loop, a protein motif
- Omega-3 fatty acid
- Omega-6 fatty acid
- Omega-9 fatty acid
- Omega particle, a sub-atomic particle
- Omega block, a typical block pattern in meteorology
- Omega, "ω", in physics, may refer to an object's angular frequency or angular velocity
- Omega, in sociobiology, the lowest rank in a dominance hierarchy
- Omega equation, in meteorology, the vertical velocity
- Omega West Reactor (OWR) an experimental physics reactor located at Los Alamos National Laboratory.
- Omega (unit), global mean saturation state of aragonite in surface seawater

Technology

- Omega (camera), a brand of cameras and enlargers
- OMEGA Navigation System, the first worldwide radio navigation system
- Omega (T_eX), a Unicode extension of the T_eX typesetting system
- Omega drivers, third-party drivers for ATI and nVidia graphics cards
- Ωmega interpreter, a strict pure functional programming language
- Iomega, a brand of storage media
- Omega SA, a luxury watch company currently owned by the Swatch Group

Fiction

Books

- *Omega* (novel), a 2003 science fiction novel by Jack McDevitt
- *Omega* (Harris novel), a 2000 novel by Christine Harris
- *Omega: The Last Days of the World*, an 1894 science fiction novel by Camille Flammarion

Fictional characters from books

- Omega, a character in the Maximum Ride book series

Film

- *Omega* (film), a Greek film
- Omega 13, a time-machine in the 1999 science fiction/comedy film *Galaxy Quest* that can send the user back in time thirteen seconds
- Omega, the fictional government agency in the film *True Lies*

Fictional characters from films

- The Omegas, a group of mutant outcasts in the 2006 film *X-Men: The Last Stand*

Television

- *Omega* (Doctor Who audio), a Big Finish Productions audio drama based on *Doctor Who*
- "Omega class destroyer", a fictional Earth starship from the *Babylon 5* science-fiction series

Fictional characters from television

- Omega (Doctor Who), a fictional character from the television series
- Omega Ranger, a character from *Power Rangers: S.P.D.*
- Omega, an alias of O'Malley, a character in *Red vs. Blue*
- Kamen Rider Orga, a fictional character motif as (Ω)

Comics characters

- Omega (comics), a comic book villain from the Legion of Super-Heroes
- Omega the Unknown, a character in the Marvel Comics universe

Video games

- *Omega* (1989 computer game), by Origin Systems

Video game characters

- Genra, also known as Omega, the final boss of *Dead or Alive 3*
- Omega, a recurring boss in the *Final Fantasy* series
- Omega, a character in the Mega Man Zero series
- E-123 Omega, a fictional character from the Sonic the Hedgehog series
- Omega Metroids, the final evolution of the normal Metroid cycle from the game *Metroid II: Return of Samus,* also seen in *Metroid Fusion*
- Omega Rugal, an enhanced, powered version of Rugal Bernstein, one of the final bosses of the *The King of Fighters* game series

Music

- Omega (band), a Hungarian rock band
- "Omega" (song), a song by Rebecca St. James
- Omega Recording Studios, a recording school and studio located outside of Washington D.C.
- Omega (singer), a Dominican merengue singer
- Queen Omega (singer), a Trinidadian reggae singer
- *Omega*, an album by the Finnish black metal band Azaghal
- *Omega* (Asia album),
- *Omega* (Alyson Avenue album)
- "Omega", a song by Bruce Dickinson from his *Accident of Birth* album
- Omega and the Mechanical Animals, a moniker adopted by Marilyn Manson during his late 90's glam era

Other uses

- Omega (barque), the world's last cargo-carrying square-rigger sailing ship, sunk in 1958 off Peru
- Omega (grape), another name for the Catawba grape
- Omega Development Site, planned to be one of Europe's largest business parks, in Warrington, Cheshire
- Omega Pharma, a Belgian pharmaceutical company
- OMEGA Memorandum, a 1956 State Dept memorandum designed to marginalize Gamal Abdel Nasser
- Organization of Modern Extreme Grappling Arts (OMEGA), a wrestling promotion owned by Matt and Jeff Hardy
- Omega Training Group, company which provides support for defense-oriented programs

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Ωω

Greek alphabet

Αα	Alpha	Νν	Nu
Ββ	Beta	Ξξ	Xi
Γγ	Gamma	Οο	Omicron
Δδ	Delta	Ππ	Pi
Εε	Epsilon	Ρρ	Rho
Ζζ	Zeta	Σσς	Sigma
Ηη	Eta	Ττ	Tau
Θθ	Theta	Υυ	Upsilon
Ιι	Iota	Φφ	Phi
Κκ	Kappa	Χχ	Chi
Λλ	Lambda	Ψψ	Psi
Μμ	Mu	Ωω	Omega

History

Archaic local variants

- Ϝ
- Ͱ
- Ϻ
- Ϙ
- Ϟ
- Ϡ

- Diacritics
- Ligatures

Numerals

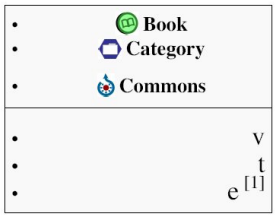
- ϛ (6)
- ϟ (90)
- ϡ (900)

Use in other languages

- Bactrian
- Coptic
- Albanian

Related topics

- Use as scientific symbols



Omega (capital: **Ω**, lowercase: **ω**; Greek Ωμέγα) is the 24th and last letter of the Greek alphabet. In the Greek numeric system, it has a value of 800. The word literally means "great O" (*ō mega*, mega meaning 'great'), as opposed to omicron, which means "little O" (*o mikron*, micron meaning "little").[2] This name is Byzantine; in Classical Greek, the letter was called *ō* (ὦ), whereas the omicron was called *ou* (οὖ).[3] The form of the uppercase letter derives from that of an omicron (O) broken up at the side (Ↄ), with the edges subsequently turned outward (Ω , Ω , Ω).[4] The modern lowercase shape goes back to the uncial form ω , a form that developed during the 3rd century BC in ancient handwriting on papyrus, from a flattened-out form of the letter (∽) that had its edges curved even further upward.[5]

In phonetic terms, the Ancient Greek Ω is a long open-mid *o* [ɔː], comparable to the vowel of British English *raw*. In Modern Greek, Ω represents the same sound as omicron. The letter omega is transcribed *ō* or simply *o*.

Omega (the last letter of the Greek alphabet) is often used to denote the last, the end, or the ultimate limit of a set, in contrast to alpha, the first letter of the Greek alphabet.

Omega was also adopted into the early Cyrillic alphabet. See Cyrillic omega (Ѡ, ѡ). A Raetic variant is conjectured to be at the origin or parallel evolution of the Elder Futhark ᛟ.

Omega was also adopted into the Latin alphabet, as a letter of the 1982 revision to the African reference alphabet. It has had little use. See Latin omega.

Omega is also used in Christianity, as a part of the Alpha and Omega metaphor.

The symbol Ω (uppercase letter)

The uppercase letter Ω is used as a symbol:

- In physics:
  - For ohm – SI unit of electrical resistance; formerly also used upside down (℧) to represent mho, the old name for the inverse of an ohm (now siemens with symbol S) used for electrical conductance. Unicode has a separate code point for the ohm sign (U+2126, Ω), but it is included only for backward compatibility, and the Greek uppercase omega character (U+03A9, Ω) is preferred.[6]
  - In statistical mechanics, Ω refers to the multiplicity (number of microstates) in a system.
  - The solid angle or the rate of precession in a gyroscope.
  - In particle physics to represent the Omega baryons.
  - In astronomy (cosmology), Ω refers to the density of the universe, also called the density parameter.
  - In astronomy (orbital mechanics), Ω refers to the longitude of the ascending node of an orbit
- In mathematics and computer science:
  - In complex analysis, the Omega constant, a solution of Lambert's W function
  - A variable for a 2-dimensional region in calculus, usually corresponding to the domain of a double integral.
  - In topos theory, the (codomain of the) subobject classifier of an elementary topos.
  - In combinatory logic, the looping combinator, *(λ x. x x) (λ x. x x)*
  - In group theory, the omega and agemo subgroups of a *p*-group, $\Omega(G)$ and $\mho(G)$
  - In statistics, it is used as the symbol for the sample space, or total set of possible outcomes.
  - In number theory, $\Omega(n)$ is the number of prime divisors of n.

  - in notation related to Big O notation to describe the asymptotic behavior of functions.
  - Chaitin's constant.
- As part of logo or trademark:
  - The logo of Omega Watches SA.
  - Part of the Badge of the Supreme Court of the United Kingdom.
  - Part of the mission patch for STS-135, as it was the last mission of the Space Shuttle program.
  - The logo of the God of War video game series based around Greek mythology.
  - The logo of E-123 Omega, a *Sonic the Hedgehog* character.
  - The logo of the Heroes of Olympus series, based on Greek mythology.
  - the logo of the Ultramarines in Warhammer 40,000
- Other
  - The symbol of the resistance movement against the Vietnam-era draft
  - Year or date of death
  - Used to refer to the lowest-ranked wolf in a pack
  - In eschatology, the symbol for the end of everything
  - In molecular biology, the symbol is used as shorthand to signify a genetic construct introduced by a two-point crossover

The symbol ω (lower case letter)

The minuscule letter ω is used as a symbol:

- Biochemistry and chemistry:
  - Denotes the carbon atom furthest from the carboxyl group of a fatty acid.
  - In biochemistry, for one of the RNA Polymerase subunits.
  - In biochemistry, for the dihedral angle associated with the peptide group, involving the backbone atoms Cα-C'-N-Cα
  - In genomics, as a measure of evolution at the protein level (also denoted as d_N/d_S or K_a/K_s ratio).
- Physics
  - angular velocity or angular frequency
  - Computational fluid dynamics: the specific turbulence dissipation rate
  - In meteorology, the change of pressure with respect to time of a parcel of air.
  - In circuit analysis and signal processing to represent natural frequency, related to frequency f by $\omega = 2\pi f$
  - In astronomy, as a ranking of a star's brightness within a constellation
  - In astronomy (orbital mechanics), as designation of the argument of periapsis of an orbit
  - In particle physics to represent the omega meson
- Computer science:
  - In notation related to Big O notation, the asymptotically dominant nature of functions
  - In relational database theory to represent NULL, a missing or inapplicable value.
- Mathematics:
  - The first transfinite ordinal number, often identified with the set of natural numbers including 0 (sometimes written ω_0)
  - In set theory, the first uncountable ordinal number (more commonly written as ω_1)
  - The complex cube roots of 1
  - The Wright Omega function
  - A generic differential form
  - In number theory, $\omega(n)$ is the number of distinct prime divisors of n.

- In number theory, an arithmetic function
- In combinatory logic, the self-application combinator, *(λ x. x x)*
- In mathematical/options finance, the elasticity of financial options
- In analytical investment management, the tracking error of an investment manager

- Other:
  - Used in place of ℏ in Japanese typing shorthand.
  - In linguistics, the phonological word
  - In textual criticism, the archetype of a manuscript tradition
  - In sociology, used to refer to the lowest ranking member of a group

Character Encodings

- Greek Omega / Coptic Oou

Character	Ω		ω		ⲱ		ⲱ	
Unicode name	GREEK CAPITAL LETTER OMEGA		GREEK SMALL LETTER OMEGA		COPTIC CAPITAL LETTER OOU		COPTIC SMALL LETTER OOU	
Encodings	**decimal**	**hex**	**decimal**	**hex**	**decimal**	**hex**	**decimal**	**hex**
Unicode	937	U+03A9	969	U+03C9	11440	U+2CB0	11441	U+2CB1
UTF-8	206 169	CE A9	207 137	CF 89	226 178 176	E2 B2 B0	226 178 177	E2 B2 B1
Numeric character reference	Ω	Ω	ω	ω	Ⲱ	Ⲱ	ⲱ	ⲱ
Named character reference	Ω		ω					
DOS Greek	151	97	224	E0				
DOS Greek-2	213	D5	250	FA				
Windows 1253	217	D9	249	F9				
TeX	\Omega		\omega					

[7]

- Cyrillic Omega

Character	Ѡ		ѡ		◌	
Unicode name	CYRILLIC CAPITAL LETTER OMEGA		CYRILLIC SMALL LETTER OMEGA		COMBINING CYRILLIC LETTER OMEGA	
Encodings	**decimal**	**hex**	**decimal**	**hex**	**decimal**	**hex**
Unicode	1120	U+0460	1121	U+0461	42619	U+A67B
UTF-8	209 160	D1 A0	209 161	D1 A1	234 153 187	EA 99 BB
Numeric character reference	Ѡ	Ѡ	ѡ	ѡ	ꙻ	ꙻ

Character	Ѿ		ѽ		Ꙍ		ꙍ	
Unicode name	CYRILLIC CAPITAL LETTER ROUND OMEGA		CYRILLIC SMALL LETTER ROUND OMEGA		CYRILLIC CAPITAL LETTER BROAD OMEGA		CYRILLIC SMALL LETTER BROAD OMEGA	
Encodings	**decimal**	**hex**	**decimal**	**hex**	**decimal**	**hex**	**decimal**	**hex**
Unicode	1146	U+047A	1147	U+047B	42572	U+A64C	42573	U+A64D
UTF-8	209 186	D1 BA	209 187	D1 BB	234 153 140	EA 99 8C	234 153 141	EA 99 8D
Numeric character reference	Ѻ	Ѻ	ѻ	ѻ	Ꙍ	Ꙍ	ꙍ	ꙍ

- Latin / IPA Omega

Character	ɷ	
Unicode name	LATIN SMALL LETTER CLOSED OMEGA	
Encodings	**decimal**	**hex**
Unicode	631	U+0277
UTF-8	201 183	C9 B7
Numeric character reference	ɷ	ɷ

- Technical Omega symbols

Character	⍵		⍹		Ω		℧	
Unicode name	APL FUNCTIONAL SYMBOL OMEGA		APL FUNCTIONAL SYMBOL OMEGA UNDERBAR		OHM SIGN		INVERTED OHM SIGN	
Encodings	**decimal**	**hex**	**decimal**	**hex**	**decimal**	**hex**	**decimal**	**hex**
Unicode	9077	U+2375	9081	U+2379	8486	U+2126	8487	U+2127
UTF-8	226 141 181	E2 8D B5	226 141 185	E2 8D B9	226 132 166	E2 84 A6	226 132 167	E2 84 A7
Numeric character reference	⍵	⍵	⍹	⍹	Ω	Ω	℧	℧

- Mathematical Omega

Character	𝛀		𝛚		𝛺		𝜔		𝝮		𝞨	
Unicode name	MATHEMATICAL BOLD CAPITAL OMEGA		MATHEMATICAL BOLD SMALL OMEGA		MATHEMATICAL ITALIC CAPITAL OMEGA		MATHEMATICAL ITALIC SMALL OMEGA		MATHEMATICAL BOLD ITALIC CAPITAL OMEGA		MATHEMATICAL BOLD ITALIC SMALL OMEGA	
Encodings	**decimal**	**hex**	**decimal**	**hex**	**decimal**	**hex**	**decimal**	**hex**	**decimal**	**hex**	**decimal**	**hex**
Unicode	120512	U+1D6C0	120538	U+1D6DA	120570	U+1D6FA	120596	U+1D714	120628	U+1D734	120654	U+1D74E
UTF-8	240 157 155 128	F0 9D 9B 80	240 157 155 154	F0 9D 9B 9A	240 157 155 186	F0 9D 9B BA	240 157 156 148	F0 9D 9C 94	240 157 156 180	F0 9D 9C B4	240 157 157 142	F0 9D 9D 8E
UTF-16	55349 57024	D835 DEC0	55349 57050	D835 DEDA	55349 57082	D835 DEFA	55349 57108	D835 DF14	55349 57140	D835 DF34	55349 57166	D835 DF4E
Numeric character reference	𝛀	𝛀	𝛚	𝛚	𝛺	𝛺	𝜔	𝜔	𝜴	𝜴	𝝎	𝝎

Character	𝛀		𝛚		𝜴		𝝮		𝞨	
Unicode name	MATHEMATICAL SANS-SERIF BOLD CAPITAL OMEGA		MATHEMATICAL SANS-SERIF BOLD SMALL OMEGA		MATHEMATICAL SANS-SERIF BOLD ITALIC CAPITAL OMEGA		MATHEMATICAL SANS-SERIF BOLD ITALIC SMALL OMEGA		MATHEMATICAL SANS-SERIF BOLD ITALIC P.OOO OMEGA	
Encodings	**decimal**	**hex**	**decimal**	**hex**	**decimal**	**hex**	**decimal**	**hex**	**decimal**	**hex**
Unicode	120686	U+1D76E	120712	U+1D788	120744	U+1D7A8	120770	U+1D7C2	120788	U+1D7D4
UTF-8	240 157 157 174	F0 9D 9D AE	240 157 158 136	F0 9D 9E 88	240 157 158 168	F0 9D 9E A8	240 157 159 130	F0 9D 9F 82	240 157 159 148	F0 9D 9F 94
UTF-16	55349 57198	D835 DF6E	55349 57224	D835 DF88	55349 57256	D835 DFA8	55349 57282	D835 DFC2	55349 57300	D835 DFD4
Numeric character reference	𝝮	𝝮	𝞈	𝞈	𝞨	𝞨	𝟂	𝟂	𝟔	𝟔

These characters are used only as mathematical symbols. Stylized Greek text should be encoded using the normal Greek letters, with markup and formatting to indicate text style.

Notes

[1] http://en.wikipedia.org/w/index.php?title=Template:Greek_alphabet_sidebar&action=edit

[2] The Greek Alphabet (http://www.quinapalus.com/gr0.1.html)

[3] Herbert Weir Smyth. *A Greek Grammar for Colleges*. §1

[4] Anne Jeffery (1961), *The local scripts of archaic Greece*, p.37–38.

[5] Edward M. Thompson (1912), *Introduction to Greek and Latin paleography*, Oxford: Clarendon. p.144

[6] Excerpts from *The Unicode Standard, Version 4.0* (http://www.unicode.org/versions/Unicode4.0.0/ch07.pdf#search="character U+2126 maps OR map OR mapping"). Retrieved 11 October 2006.

[7] Unicode Code Charts: Greek and Coptic (Range: 0370-03FF) (http://www.unicode.org/charts/PDF/U0370.pdf)

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Omega-6 fatty acid

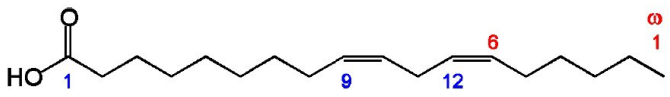
For an explanation of *n* and numerical nomenclature (such as *n*-6 or 18:2), see Fatty acid#Nomenclature.

For the 1920s French automobile - see Oméga-Six

Types of fats in food

• Unsaturated fat
  • Monounsaturated fat
  • Polyunsaturated fat
  • Trans fat
  • Omega numbering:
  • ω−3
  • ω−6
  • ω−7
  • ω−9
• Saturated fat
  • Interesterified fat

See also
• Fatty acid • Essential fatty acid
• v • t • e [1]



The chemical structure of linoleic acid, a common omega-6 fatty acid found in many nuts, seeds and vegetable oils.

Omega-6 fatty acids (also referred to as **ω-6 fatty acids** or ***n*-6 fatty acids**) are a family of polyunsaturated fatty acids[2] that have in common a final carbon-carbon double bond in the *n*-6 position, that is, the sixth bond, counting from the methyl end. Some medical research suggests that eating a lot of certain omega−6 fatty acids may lead to some diseases.

The biological effects of the omega-6 fatty acids are largely mediated by their conversion to omega-6 eicosanoids that bind to diverse receptors found in every tissue of the body. The conversion of tissue arachidonic acid (20:4n-6) to omega-6 prostaglandin and omega-6 leukotriene hormones provides many targets for pharmaceutical drug development and treatment to diminish excessive omega-6 actions in atherosclerosis, asthma, arthritis, vascular disease, thrombosis, immune-inflammatory processes, and tumor proliferation. Competitive interactions with the omega-3 fatty acids affect the relative storage, mobilization, conversion and action of the omega-3 and omega-6 eicosanoid precursors (see Essential fatty acid interactions).

Key omega−6 fatty acids

Linoleic acid (18:2, *n*−6), the shortest-chained omega−6 fatty acid, is an essential fatty acid. Arachidonic acid (20:4) is a physiologically significant omega−6 fatty acid and is the precursor for prostaglandins, endocannabinoids and other physiologically active molecules.

Suggested negative health effects

Some medical research suggests that excessive levels of certain omega−6 fatty acids relative to certain omega-3 fatty acids may increase the probability of a number of diseases. However, scientific research indicates that air pollution, smoking, second-hand smoke, and other exogenous toxins cause the initial inflammation in the cells which leads to the overexpression of the COX-2 enzyme and subsequently to the overproduction of inflammatory promoting prostaglandins from Arachidonic acid for the purpose of alerting the immune system of the cell damage and eventually to the production of anti-inflammatory prostaglandins during the resolution phase of inflammation, after the cell damage has been repaired.

Modern Western diets typically have ratios of omega−6 to omega−3 in excess of 10 to 1, some as high as 30 to 1; the average ratio of omega-6 to omega-3 in the Western diet is 15/1−16.7/1. Humans are thought to have evolved with a diet of a 1-to-1 ratio of omega-6 to omega-3 and the optimal ratio is thought to be 4 to 1 or lower, and it is even better if there is more omega−3 than omega−6 (especially healthy ratio of omega−6 to omega−3 is from 1:1 to 1:4). A ratio of 2−3/1 omega 6 to omega 3 helped reduce inflammation in patients with rheumatoid arthritis. A ratio of 5/1 had a beneficial effect on patients with asthma but a 10/1 ratio had a negative effect. A ratio of 2.5/1 reduced rectal cell proliferation in patients with colorectal cancer, whereas a ratio of 4/1 had no effect.

Excess omega−6 fatty acids from vegetable oils interfere with the health benefits of omega−3 fats, in part because they compete for the same rate-limiting enzymes. A high proportion of omega−6 to omega−3 fat in the diet shifts the physiological state in the tissues toward the pathogenesis of many diseases: prothrombotic, proinflammatory and proconstrictive.

Chronic excessive production of omega−6 eicosanoids is correlated with arthritis, inflammation, and cancer. Many of the medications used to treat and manage these conditions work by blocking the effects of the COX-2 enzyme. Many steps in formation and action of omega-6 prostaglandins from omega-6 arachidonic acid proceed more vigorously than the corresponding competitive steps in formation and action of omega-3 hormones from omega-3 eicosapentaenoic acid. The COX-1 and COX-2 inhibitor medications, used to treat inflammation and pain, work by preventing the COX enzymes from turning arachidonic acid into inflammatory compounds. (See Cyclooxygenase for more information.) The LOX inhibitor medications often used to treat asthma, work by preventing the LOX enzyme from converting arachidonic acid into the leukotrienes. Many of the anti-mania medications used to treat bipolar disorder work by targeting the arachidonic acid cascade in the brain.

A high consumption of oxidized polyunsaturated fatty acids (PUFAs), which are found in most types of vegetable oil, may increase the likelihood that postmenopausal women will develop breast cancer. Similar effect was observed on prostate cancer, but the study was performed on mice. Another "analysis suggested an inverse association between total polyunsaturated fatty acids and breast cancer risk, but individual polyunsaturated fatty acids behaved differently [from each other]. [...] a 20:2 derivative of linoleic acid [...] was inversely associated with the risk of breast cancer".

List of omega−6 fatty acids

Common name	Lipid name	Chemical name
Linoleic acid (LA)	18:2 (*n*−6)	*all-cis*-9,12-octadecadienoic acid
Gamma-linolenic acid (GLA)	18:3 (*n*−6)	*all-cis*-6,9,12-octadecatrienoic acid
Calendic acid	18:3 (*n*−6)	8E,10E,12Z-octadecatrienoic acid
Eicosadienoic acid	20:2 (*n*−6)	*all-cis*-11,14-eicosadienoic acid
Dihomo-gamma-linolenic acid (DGLA)	20:3 (*n*−6)	*all-cis*-8,11,14-eicosatrienoic acid
Arachidonic acid (AA)	20:4 (*n*−6)	*all-cis*-5,8,11,14-eicosatetraenoic acid
Docosadienoic acid	22:2 (*n*−6)	*all-cis*-13,16-docosadienoic acid
Adrenic acid	22:4 (*n*−6)	*all-cis*-7,10,13,16-docosatetraenoic acid
Docosapentaenoic acid	22:5 (*n*−6)	*all-cis*-4,7,10,13,16-docosapentaenoic acid
Tetracosatetraenoic acid	24:4 (*n*−6)	*all-cis*-9,12,15,18-tetracosatetraenoic acid
Tetracosapentaenoic acid	24:5 (*n*−6)	*all-cis*-6,9,12,15,18-tetracosapentaenoic acid

Dietary linoleic acid requirement

Adding more controversy to the omega−6 fat issue is that the dietary requirement for linoleic acid has been questioned, because of a significant methodology error proposed by University of Toronto scientist Stephen Cunnane. Cunnane proposed that the seminal research used to determine the dietary requirement for linoleic acid was based on feeding animals linoleic acid-deficient diets, which were simultaneously deficient in omega−3 fats. The omega−3 deficiency was not taken into account. The omega−6 oils added back systematically to correct the deficiency also contained trace amounts of omega−3 fats. Therefore the researchers were inadvertently correcting the omega−3 deficiency as well. Ultimately, it took more oil to correct both deficiencies. According to Cunnane, this error overestimates linoleic acid requirements by 5 to 15 times.

Dietary sources

Four major food oils (palm, soybean, rapeseed, and sunflower) provide more than 100 million metric tons annually, providing more than 32 million metric tons of omega-6 linoleic acid and 4 million metric tons of omega-3 alpha-linolenic acid.

Dietary sources of omega−6 fatty acids include:

- poultry
- nuts
- cereals
- durum wheat
- whole-grain breads
- most vegetable oils
- evening primrose oil
- borage oil
- blackcurrant seed oil
- flax/linseed oil
- rapeseed or canola oil
- hemp oil

The evening primrose flower (*O. biennis*) produces an oil containing a high content of γ-linolenic acid, a type of omega−6 fatty acid.

- soybean oil
- cottonseed oil
- sunflower seed oil
- corn oil
- safflower oil
- pumpkin seeds
- acai berryWikipedia:Citation needed
- cashews
- pecans
- pine nuts
- walnuts[3]
- spirulinaWikipedia:Citation needed

[4]

Notes and references

[1] http://en.wikipedia.org/w/index.php?title=Template:Fats&action=edit

[2] Omega-3 Fatty Acids, Hepatic Lipid Metabolism, and Nonalcoholic Fatty Liver Disease

Annual Review of Nutrition

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DOI: 10.1146/annurev-nutr-071812-161230

[3] Kids veggie food, omega 6 sources (http://www.kidsveggiefood.com/omega-oils/) Various sources referenced including pine nuts, pecans and walnuts

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Article Sources and Contributors

Omega-6 fatty acid *Source*: http://en.wikipedia.org/w/index.php?oldid=617622206 *Contributors*: AThing, Accurizer, Alexhangartner, Alfredo E., Angry bee, Anrnusna, Blanchardb, Bork, Bradshej, Briantw, ChemNerd, Chienlit, Chris Capoccia, Cobgenius, Coppertwig, Croscher, D.M. from Ukraine, Dadaist6174, Dananderson, David.Throop, Dcirovic, Deli nk, Dennis Brown, Drphilharmonic, Edgar181, Etribole, Fothergill Volkensniff IV, Frankg, Grandia01, Gyrofrog, Haus, Hydrargyrum, Jay L09, Jeffq, Jengod, JeramieHicks, Jon513, Jovianeye, Kenckar, Kitsunegami, Kjramesh, Koavf, Kupirijo, Lagrantierra, Lambanog, Leopard, LilHelpa, LucioP, Madmagic, Mahemoff, Makanar44, Makeswell, Materialscientist, Molbiolprof, Monsterparty, Morelipids, Next-Genn-Gamer, Nick Number, Onco p53, OrenBochman, OsamaBinLogin, Panek, Permacultura, Plantsurfer, Pro crast in a tor, Queenoffats, RYNORT, Rich Farmbrough, Rjwilmsi, Shaddack, Shevek, Shoefly, SidP, SimonPerera, Slastic, Snacks, Taxman, Tencv, TeH nOmInAtOr, Teemu08, The Anome, The Real Marauder, Tide rolls, Toytoy, Tushayakovleva, Uncle Dick, Utcursch, Vivaelnino9, Vivaldi, Werson, Wikishotaro, Woohookitty, Xandi, YakbutterT, आशीष भटनागर, 126 anonymous edits

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