N-METHYLATED AMINO ACID DERIVATIVES

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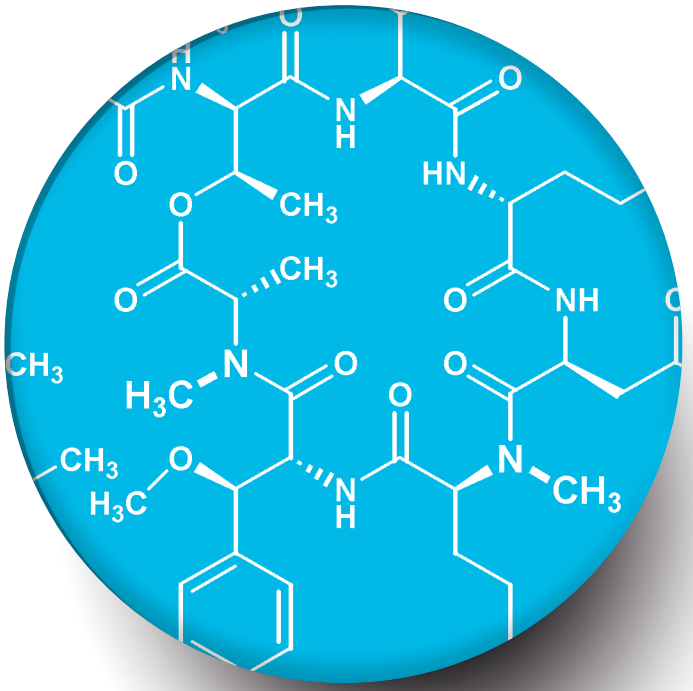


N-METHYL AMINO ACID DERIVATIVES OFFERED BY BACHEM

N-Methylated amino acids are present in a wide variety of biological molecules such as complex molecular structures of certain microbial peptides and nucleic acid-binding proteins involved in gene regulation and gene expression. Methylation reactions generally increase the biochemical synthesis repertoire of cells and can serve as regulatory mechanisms.

PROTEIN METHYLATION

Proteins can be modified post-translationally in many ways including methylation at oxygen, nitrogen and sulfur atoms. The methylation reactions are catalyzed by protein methyltransferases, which use S-adenosylmethionine as the methyl donor. Protein methyltransferases can be classified into two major groups. One group modifies carboxyl groups to form methyl esters, the other one catalyzes the methylation of the sulfur atom of cysteine and methionine residues and of nitrogen atoms at the N-terminus or at the side chains of arginine, histidine, lysine, asparagine, and glutamine residues.

Carboxyl methylations have been observed at glutamate residues of several membrane bound bacterial chemoreceptors. Moreover, they have been detected at the carboxy-terminal isoprenylcysteine or leucine residues of various proteins involved in signal transduction such as the Ras and Rho family of small G-proteins and the γ-subunit of heterotrimeric G-proteins.

In aged damaged proteins containing deamidated, isomerized, and racemized aspartyl and asparaginyl residues, this kind of modification of carboxyl groups has also been found and might be part of repair processes. In contrast to methylation of carboxyl groups, which is typically reversible, N- and S-methylations are generally irreversible and their cellular roles are less well defined.

N- and S-methylated amino acids are found in prokaryotic and eukaryotic organisms in a multitude of proteins of various cellular functions.

Many microbial proteins containing N^{α}-methylated amino acids and other unusual building blocks (like D-amino acids and hydroxy acids) are synthesized by nucleic acid independent mechanisms. The synthetases are either multimeric complexes or large proteins consisting of modules performing enzymatic synthesis steps such as adenylation, thiolation, condensation, epimerization, and N-methylation. Many of these microbial compounds are of pharmacological interest, for example the immunosuppressive drug cyclosporin A, the mycotoxins beauvericin and enniatin, and the antibiotic actinomycin D.

N-METHYL AMINO ACIDS

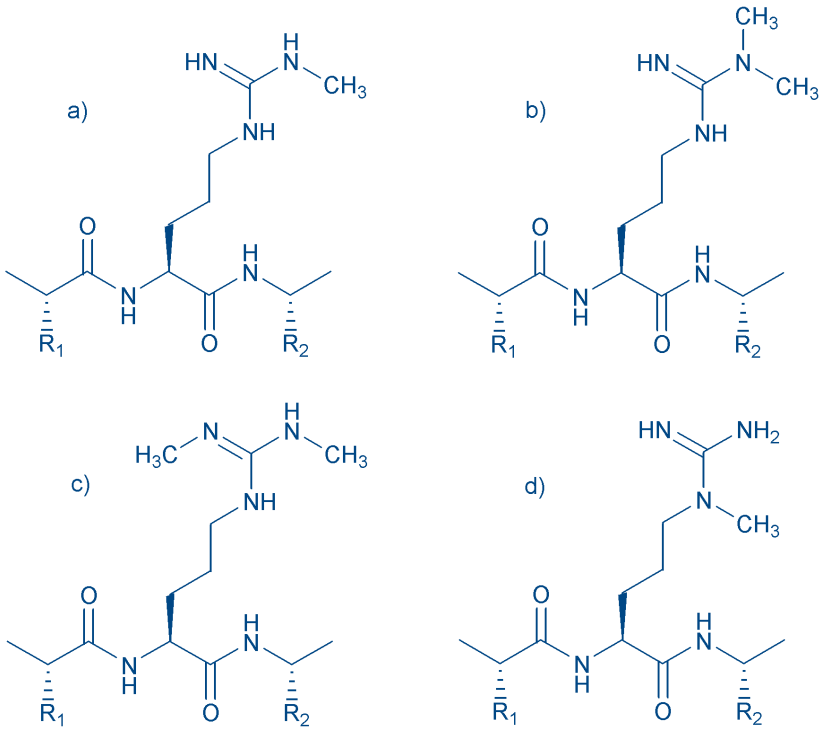
In pharmaceutical, chemical, and biological sciences, N-methylated amino acids can be used as building blocks for the design and synthesis of peptides with modified characteristics and find applications in drug discovery processes and structure activity relationship (SAR) studies.

N-METHYLATED AMINO ACIDS

Methylation at the ε-amino-group of lysine residues
Mono-, di- and trimethylated side chain nitrogens of lysine residues have been detected in a variety of proteins. These include bacterial flagellins, ribosomal proteins, protein synthesis factors, mycobacterial adhesins as well as eukaryotic histones, myosin, actin, cytochrome c (from certain plants and fungi), calmodulin, members of the 70 kD heat shock protein (hsp70) family, and the large subunit of ribulose-1,5-bisphosphate carboxylase/oxygenase (Rubisco).

The functions of these modifications have not been completely elucidated. For some proteins there is evidence that methylation of lysine residues might confer resistance to proteolysis. This has been shown for flagellin of *Salmonella typhimurium* and for certain mycobacterial adhesins.
In the case of calmodulin, trimethylation at the lysine residue 115 has been suggested to be involved in the negative regulation of nicotinamide adenine dinucleotide (NAD) kinase in certain species.

N-METHYLATED PEPTIDES FIND APPLICATION IN STRUCTURE ACTIVITY RELATIONSHIP (SAR) STUDIES



Nω-Methylated Arginine Residues
Arginine residues can either be monomethylated (a) or asymmetrically dimethylated at the ω-guanidino nitrogen N^G (b), or symmetrically dimethylated at the ω-guanidino nitrogens N^G and $N^{G'}$ (c). Monomethylation at the δ-amino group (d) has also been described.

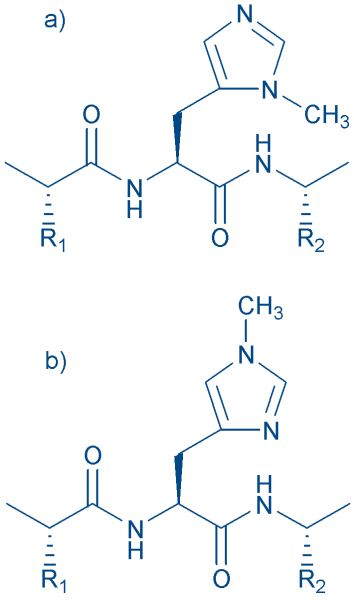
Considerable research effort has been directed to the role of histone lysine and arginine N-methylation. In addition to other post-translational modifications including phosphorylation, ubiquitination, and acetylation, N-methylation is suggested to be involved in eukaryotic genome and gene regulation processes such as development and differentiation as well as epigenetic control mechanisms. The manifold modifications are supposed to bear information which orchestrates chromatin organization, replication, and transcription. This concept is also known as the 'histone code'.
Methylation at lysine residues is enzymatically reversible and is regulated by specific methyltransferases and demethylases.

Methylation at the ω-guanidino nitrogens N^G, $N^{G'}$ of arginine residues

Arginine residues can either be mono- or dimethylated post-translationally at their ω-guanidino nitrogens N^G and $N^{G'}$or, as has been shown in a recent yeast protein study, at the ω-nitrogen. The three main forms identified in eukaryotes include N^G-monomethylarginine, N^G, $N^{G'}$ (symmetric) dimethylarginine, and N^G, N^G (asymmetric) dimethylarginine. N^ω-Methylated arginine residues are present in myelin basic protein, nucleic acid-binding proteins such as heterogenous ribonucleoproteins (hRNPs), spliceosomal small nuclear ribonucleoproteins (snRNPs), RNA helicase A, and histones, but also in proteins involved in signal transduction and transcription like the type I interferon receptor and the Stat1 transcription factor.
Recently, a proteomic approach has added over 200 new proteins that are putatively methylated at arginine residues.
Proteins required for pre-mRNA splicing, polyadenylation, and signal transduction, but also cytoskeletal molecules and components involved in DNA repair were among the candidates identified with arginine-methyl-specific antibodies. The functions of N^ω-methylation have only been partially elucidated. Methylation might play a role in protein sorting, in signal transduction involving protein-protein interactions, and also in pathogenic processes, since many of the arginine-methylated proteins such as myelin basic protein and several RNPs have been implicated in autoimmune diseases. The function of N^δ-methylation is unknown.
N^ω-Methylation is catalyzed by members of the protein arginine methyltransferase (PRMT) family, which can be broadly divided into two types of enzymes: type I, which can catalyze the formation of N^G-monomethylarginine and N^G, N^G (asymmetric) dimethylarginine and type II which forms NG-monomethylarginine and N^G, $N^{G'}$ (symmetric) dimethylarginine.

Methylation at the N^τ and N^π of histidine residues

There are two different systems of numbering the atoms in the imidazole ring of histidine. Both have been used for a considerable time. Biochemists generally number N^π, the nitrogen atom adjacent to the side chain, as 1, and N^τ as 3. Organic chemists, including Bachem, designate the position of N^τ as 1 and the position of N^π as 3.



N^{im}-Methylated Histidine Residues
The imidazole ring of histidine can be methylated either at N^π (a) or N^τ (b). Bachem's numbering system is 1 for N^τ and 3 for N^π.

N^τ-Methylated histidine ($N^{im\text{-}1}$-methyl-L-histidine) has been detected in the myofibrillar proteins actin and myosin. In actin molecules, this post-translational modification can be found at a highly conserved histidine residue situated in the nucleotide-binding cleft of actin at position 73. The function of this methylation is unknown. It has been suggested to regulate the rate of phosphate release after ATP hydrolysis during actin polymerization. Myosin which binds to actin

is only methylated in skeletal muscle and not in cardiac muscle tissue, presumably because of the absence of a histidine-methylating enzyme in cardiac muscles.
N^{π}-Methylated histidine ($N^{im\text{-}3}$-methyl-L-histidine) is a building block of the dipeptide anserine, a potent antioxidant with membrane-stabilizing function found in vertebrate skeletal muscles.

Methylation at the ω-carboxamide groups of asparagine and glutamine residues
N^{γ}-Methylated asparagine residues are present at position 72 of the β-subunit of many phycobilins. Together with the α-subunit they form the structural building blocks of phycobilisomes. These are multimeric complexes which harvest and transfer light energy to photosynthetic reaction centers of cyanobacteria and red algae. A role in energy transfer efficiency has been suggested for the site specific methylation of phycobilins.
Post-translational N^{δ}-methylation of glutamine residues is a modification detected in *E. coli* ribosomal protein L3. It is also present in the universally conserved GGQ motif of the characterized class I peptide release factors RF1 and RF2, which recognize stop codons on mRNAs. Methylation of RF2 has a stimulatory effect on its release activity.

Methylation of the N-terminal α-amino group
Amino-terminal methylation is found in several proteins including bacterial ribosomal proteins such as L11, L16, L33, and S11 of *E. coli.*, CheZ, a bacterial protein involved in chemotaxis, in myosin light chain proteins LC-1 and LC-2, and the histone H2B protein of several species. N-Methylations can be found at methionine, alanine, phenylalanine, or proline residues. Alanine can either be mono-, di- or trimethylated. In the case of proline, mono- and dimethylated amino-terminal residues have been detected in certain proteins.

N-Methylated Amino Acids in Peptide Chemistry

Incorporation of N^{α}-methylated amino acids in peptides results in conformationally constrained peptide backbones. This is widely used to modify the affinity and selectivity of peptide ligands, and to improve the biological properties, membrane permeability, and proteolytic stability of peptidic drugs. N^{α}-Methylated amino acids have been successfully used in standard Boc- and Fmoc-solid phase peptide synthesis and an enormous number of biologically and pharmaceutically interesting peptidic compounds containing N^{α}-methyl amino acids has been described in the literature. Among them are somatostatin analogs with high affinity and selectivity for somatostatin receptor subtypes, early angiotensin II type 1 (AT1) receptor antagonists containing sarcosine (N-methylglycine), and various analogs of oxytocin, bradykinin, cholecystokinin, substance P, dermorphin, and deltorphin. Recently, amyloid β-peptide fragments containing N^{α}-methylated amino acids were shown to prevent amyloid β fibril-formation, a hallmark of Alzheimer's disease. In one study with a pentapeptide, the modifications rendered the peptide permeable for both synthetic phospholipid bilayer vesicles and cell membranes. In this context, the term 'meptides' for short peptides containing N^{α}-methylated amino acids has been introduced. Meptides might constitute ideal drug candidates for the treatment of Alzheimer's disease since they are more soluble in water and are more resistant to proteolytic degradation than the non-modified peptides. In another interesting, entirely different study, incorporation of an N-methyl substitution at a specific position of a peptide antigen has been shown to increase its affinity for MHC class II molecules. Since the interaction with the T-cell receptor was not affected by this substitution this approach might be applicable to therapeutically relevant peptides with weak immunogenicity.

Marine organisms as sponges or ascidiae are a rich source of highly bioactive N^{α}-methylated peptides and cyclopeptides.

Practical Hints for Synthesizing Peptides Containing N-Methylated Amino Acids

N-methylation increases the basicity of the amino group, which has to be kept in mind especially during Fmoc-SPPS.

Laterally N-methylated amino acids
Adequate N^{ε}-protection is required for Lys(Me) derivatives, e.g. Fmoc-Lys(Me,

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Boc)-OH. The zwitterionic Fmoc-Lys(Me)$_2$-OH should be coupled under slightly acidic conditions (e.g. a carbodiimide and HOBt), as the lateral tertiary amine may prematurely cleave the Fmoc group. Accordingly, only N^G-protected N^G-methylated Arg derivatives should be used in peptide synthesis. Protonation of the methylated guanidino group can't completely prevent N^ω-acylation followed by cleavage of the acylated guanidino group yielding Orn. Preactivation has to be kept very short as, except for N^δ-methylation, activated N^G-methylated derivatives can cyclize yielding the inactive lactam.
Whereas N^π-methylation reduces the risk of racemization during the coupling of His, N^τ-methyl-histidine derivatives are prone to racemization during activation. The extent of racemization can be reduced by following the protocols optimized for the coupling of Fmoc-His(Trt)-OH, e.g. DEPBT (Q-2565)/DIPEA.
N^ω-Methylation improves the solubility of the N^α-protected derivatives of Asn and Gln. Aspartimide formation and N-terminal cyclization yielding Pyr can't be excluded when incorporating the N^ω-methylated derivatives of these amino acids.

N^α-Methylated amino acids

N^α-Methylation causes additional steric hindrance during coupling. Activated N-methylated amino acids are bulkier than their unsubstituted counterparts. The alkylated amino component may be more basic, but the slight gain in reactivity is more than outweighed by the additional steric hindrance. Therefore, highly efficient activating reagents and protocols are required for obtaining satisfactory conversion.
A few examples of reagents which have been successfully employed for coupling to N^α-methylated amino acids during Fmoc-SPPS:

1.	HATU/HOAt (F. Albericio et al.) and carbodiimides/HOAt
2.	PyBrop and PyClop (J. Coste et al.)
3.	Triphosgene/collidine (E. Falb et al.) and Fmoc amino acid chlorides
4.	TFFH (L.A. Carpino and A. El-Faham) and Fmoc amino acid fluorides (somewhat less reactive than 1., 2. and 3.)

For a more recent review of coupling reagents, please see S.Y. Han and Y.A. Kim.

The monitoring of the coupling may become a problem. When performing the chloranil test (the standard method for monitoring couplings to Pro) during coupling to N-methylamino groups, only weak color effects may be observed. But, except for His-containing peptides, the bromophenol blue test allows to monitor the coupling. Otherwise, samples have to be cleaved to assess the extent of conversion.
As Fmoc is labile towards secondary amines, it may be cleaved prematurely by remaining N-methylamino groups, if the coupling proceeds sluggishly. N-silylation prior to the coupling helps to overcome this problem. Me_3SiCl/triethylamine has been applied before coupling sterically demanding Boc derivatives, whereas neutral silylation reagents such as N,O-bis-(trimethylsilyl)acetamide should be preferred when coupling Fmoc derivatives (A. Brunissen et al.).
As with C-terminal Pro, diketopiperazines (DKP) will be formed when synthesizing peptides with a C-terminal N-methylamino acid. The established procedures for suppressing DKP-formation from Xaa-Pro-OR during deblocking and acylation of the penultimate amino acid can be adopted.
Additionally, N-alkylated peptide bonds are rather acid-labile. Even the conditions of the final cleavage following Fmoc-SPPS are sufficiently harsh to allow the cleavage of these weak links (J. Urban et al.). Hence, prolonged TFA treatment of N-methylated peptides should be avoided. Consequently, the Boc strategy cannot be recommended for synthesizing backbone-methylated peptides.

Conclusion

N-Methylated amino acids are widely distributed in nature and like other unusual amino acids, they are important building blocks in peptide science. They have been used for years in pharmaceutical, chemical, and biological disciplines and remain an attractive tool for the modification of peptide properties.

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N-METHYL AMINO ACIDS

Backbone N-methylation is a characteristic feature of nonribosomal peptides, a class of natural products from which many clinically important therapeutics as the cyclosporins were obtained. This backbone modification of natural peptides facilitates cyclization and increases conformational rigidity, membrane permeability, and protease resistance. Bachem offers N-methylated derivatives of most proteinogenic and many unusual amino acids.

N-Methylamino acids can show biological activity, such as the neurotransmitter NMDA or the nitric oxide synthase inhibitor NMMA.

ALANINE

Boc-N-Me-Ala-OH
A-2010

Boc-N-Me-D-Ala-OH
A-4630

Fmoc-N-Me-Ala-OH
B-3720

Fmoc-N-Me-D-Ala-OH
B-3845

N-Me-Ala-OH
E-2125

N-Me-DL-Ala-OH
F-1755

N-Me-Ala-OtBu · HCl
E-3670

N-Me-D-Ala-OtBu · HCl
F-4100

N-Me-Ala-OMe
E-3685

Z-N-Me-Ala-OH
C-4145

Z-N-Me-D-Ala-OH
C-4170

ARGININE

Boc-N-Me-Arg(Mtr)-OH
A-3430

Boc-N-Me-Arg(Tos)-OH
A-2955

Fmoc-Arg(Me)(Pbf)-OH
B-4010

Fmoc-Arg(Me)$_2$-OH (asymmetrical)
B-2745

Fmoc-Arg(Me)$_2$-OH (symmetrical)
B-3345

Fmoc-N-Me-Arg(Mtr)-OH
B-2840

Fmoc-N-Me-D-Arg(Mtr)-OH
B-4220

H-Arg(Me)-OH
(L-NMMA)
E-3745

H-Arg(Me)-OH · HCl
(L-NMMA · HCl)
E-2770

H-D-Arg(Me)-OH
(D-NMMA)
F-4275

ASPARTIC ACID

Fmoc-N-Me-Asp(OtBu)-OH
B-2195

N-Me-Asp-OH
E-2745

N-Me-D-Asp-OH
(NMDA)
F-2415

N-Me-Asp(OtBu)-OH
E-3190

Z-N-Me-Asp(OtBu)-OH · DCHA
C-3800

GLUTAMIC ACID

Boc-N-Me-Glu(OBzl)-OH
A-2050

Fmoc-N-Me-Glu(OtBu)-OH
B-2395

Z-N-Me-Glu(OtBu)-OH
C-3805

N-Me-Glu-OH
E-2130

N-Me-D-Glu-OH
F-4240

GLYCINE (SARCOSINE)

Boc-Sar-OH
(Boc-N-Me-Gly-OH)
A-2265

Boc-Sar-OSu
(Boc-N-Me-Gly-OSu)
A-2270

Fmoc-Sar-OH
(Fmoc-N-Me-Gly-OH)
B-1720

Fmoc-Sar-SASRIN™-resin (200-400 mesh)
(Fmoc-N-Me-Gly-SASRIN™-resin)
D-1645

Fmoc-Sar-Wang resin (200-400 mesh)
(Fmoc-N-Me-Gly-Wang resin)
D-1805

Z-Sar-OH
(Z-N-Me-Gly-OH)
C-2570

Z-Sar-OSu
(Z-N-Me-Gly-OSu)
C-2575

Phenylsulfonyl-Sar-OH
(Phenylsulfonyl-N-Me-Gly-OH)
F-3140

Sar-NH_2 · HCl
(N-Me-Gly-NH_2 · HCl)
E-2355

Sar-NMe_2
(N-Me-Gly-NMe_2)
E-2365

Sar-OtBu · HCl
(N-Me-Gly-OtBu · HCl)
E-2360

Sar-OBzl · p-tosylate
(N-Me-Gly-OBzl · p-tosylate)
E-1580

Sar-OMe · HCl
(N-Me-Gly-OMe · HCl)
E-2370

HISTIDINE

Boc-His(1-Me)-OH
(Boc-His(τ-Me)-OH)
A-2560

Boc-D-His(1-Me)-OH
(Boc-D-His(τ-Me)-OH)
A-3015

Boc-His(3-Me)-OH
(Boc-His(π-Me)-OH)
A-2565

Boc-D-His(3-Me)-OH
(Boc-D-His(π-Me)-OH)
A-3020

Fmoc-His(1-Me)-OH
(Fmoc-His(τ-Me)-OH)
B-3375

Fmoc-D-His(1-Me)-OH
(Fmoc-D-His(τ-Me)-OH)
B-4455

Fmoc-His(3-Me)-OH
(Fmoc-His(π-Me)-OH)
B-3365

H-His(1-Me)-OH
(H-His(τ-Me)-OH)
E-3665

H-D-His(1-Me)-OH Hydrochloride salt
(H-D-His(τ-Me)-OH)
F-2595

H-His(1-Me)-OMe Hydrochloride salt
(H-His(τ-Me)-OMe)
E-2795

H-His(3-Me)-OH
(H-His(π-Me)-OH)
E-2845

H-D-His(3-Me)-OH
(H-D-His(π-Me)-OH)
F-2600

N-Me-His-OH · HCl
E-2135

N-Me-D-His-OH · HCl
F-2260

N-Me-His-OMe · HCl
E-3300

ISOLEUCINE

Boc-N-Me-Ile-OH
A-2055

Boc-N-Me-D-Ile-OH
A-3725

Boc-N-Me-allo-Ile-OH
A-2025

Boc-N-Me-D-allo-Ile-OH
A-3730

Fmoc-N-Me-Ile-OH
B-4215

Z-N-Me-Ile-OH
C-3775

N-Me-Ile-OH
E-2140

N-Me-Ile-OMe · HCl
F-3915

LEUCINE

Boc-N-Me-Leu-OH
A-2060

Boc-N-Me-D-Leu-OH
A-4050

Fmoc-N-Me-Leu-OH
B-2035

Z-N-Me-Leu-OH
C-2240

N-Me-Leu-OH
E-2145

N-Me-DL-Leu-OH
F-1775

N-Me-Leu-OBzl · p-tosylate
E-2150

LYSINE

Boc-Lys(Me)$_2$-OH
A-3885

Boc-N-Me-Lys(Z)-OH · DCHA
A-3690

Fmoc-Lys(Boc)(Me)-OH
B-3575

Fmoc-Lys(Me)$_2$-OH · HCl
B-3290

Fmoc-Lys(Me)$_3$-OH chloride
B-2685

Fmoc-N-Me-Lys(Boc)-OH
B-3685

H-Lys(Me)-OH · HCl
E-2155

H-Lys(Me)$_2$-OH · HCl
E-1810

H-Lys(Me)$_3$-OH chloride
Hydrochloride salt
F-2665

N-Me-Lys-OH
E-3180

N-Me-Lys(Z)-OH
E-3185

PHENYLALANINE AND PROLINE

Boc-N-Me-Phe-OH
A-2075

Boc-N-Me-D-Phe-OH
A-3900

Fmoc-N-Me-Phe-OH
B-1725

Z-N-Me-Phe-OH
C-2245

N-Me-Phe-OH
E-2165

N-Me-D-Phe-OH
F-1785

N-Me-Phe-OBzl · p-tosylate
E-2755

N-Me-Phe-OMe · HCl
E-2170

N-Me-DL-Phe-OMe · HCl
F-3545

N-Me-Pro-OH
E-2185

SERINE

Boc-N-Me-Ser-OH
A-2085

Bzl-N-Me-Ser-OH
E-1570

Fmoc-N-Me-Ser(tBu)-OH
B-3400

Z-N-Me-Ser(tBu)-OH · DCHA
C-4100

Z-N-Me-D-Ser(tBu)-OH · DCHA
C-4165

N-Me-Ser-OH
E-2190

THREONINE

Boc-N-Me-Thr-OH
A-4445

Boc-N-Me-Thr(Bzl)-OH · CHA
A-4105

Fmoc-N-Me-Thr-OH
B-3235

Fmoc-N-Me-Thr(tBu)-OH
B-3420

Z-N-Me-Thr-OH · CHA
C-4025

Z-N-Me-Thr(tBu)-OH · CHA
C-4105

N-Me-Thr-OH
E-3480

N-Me-Thr(Bzl)-OH · HCl
E-3545

TRYPTOPHAN

Fmoc-N-Me-Trp-OH
B-3430

Fmoc-N-Me-Trp(Boc)-OH
B-3625

Fmoc-Trp(Me)-OH
B-3875

Fmoc-D-Trp(Me)-OH
B-3880

N-Me-Trp-OH
(L-Abrine)
E-3255

TYROSINE

Boc-N-Me-Tyr-OH · DCHA
A-2620

Boc-N-Me-D-Tyr-OH · DCHA
A-4420

Boc-N-Me-Tyr(Bzl)-OH
A-2040

Boc-N-Me-D-Tyr(Bzl)-OH
A-4425

Fmoc-N-Me-Tyr(tBu)-OH
B-3890

N-Me-Tyr-OH
F-2235

N-Me-D-Tyr-OH
F-3715

N-Me-Tyr-OMe · HCl
E-3730

N-Me-Tyr(Me)-OH
(N-Me-4-methoxy-Phe-OH)
E-2160

VALINE

Boc-N-Me-Val-OH
A-2100

Boc-N-Me-D-Val-OH
A-3980

Boc-N-Me-DL-Val-OH
A-3500

Fmoc-N-Me-Val-OH
B-1380

Z-N-Me-Val-OH
C-3700

N-Me-Val-OH
E-2195

N-Me-DL-Val-OH
F-1790

N-Me-Val-OBzl · p-tosylate
E-2200

N-Me-Val-OMe · HCl
E-1830

UNUSUAL AMINO ACIDS

Derivatives of N-methylnorleucine, which may serve as a substitute for N-methylmethionine, N-methylnorvaline, N-methylphenylglycine and further N-methylated non-proteinogenic amino acids.

NORLEUCINE

Boc-N-Me-Nle-OH
(Boc-N-Me-L-2-aminohexanoic acid)
A-4440

Fmoc-N-Me-Nle-OH
(Fmoc-N-Me-L-2-aminohexanoic acid)
B-3230

N-Me-Nle-OH
(N-Me-L-2-aminohexanoic acid)
F-3750

NORVALINE

Boc-N-Me-Nva-OH
(Boc-N-Me-L-2-aminovaleric acid)
A-4435

Fmoc-N-Me-Nva-OH
(Fmoc-N-Me-L-2-aminovaleric acid)
B-3225

N-Me-Nva-OH
(N-Me-L-2-aminovaleric acid)
F-3745

PHENYLGLYCINE

Boc-N-Me-Phg-OH
A-2080

Boc-N-Me-DL-Phg-OH
A-4690

N-Me-Phg-OH
E-2175

N-Me-D-Phg-OH
F-4140

N-Me-DL-Phg-OH
F-3595

VARIOUS

Boc-N-Me-Abz-OH
(Boc-N-methyl-anthranilic acid)
A-3715

N-Me-Aib-OH
F-1765

Boc-N-Me-p-chloro-D-Phe-OH
A-2880

Fmoc-N-Me-Homocys(Trt)-OH
(Fmoc-MeHcy(Trt)-OH)
B-3775

N-Me-cis-Hyp-OH
F-2370

N-Me-p-nitro-Phe-OH
F-1780

N-Me-Orn-OH · HCl
E-3630

BACHEM

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