NAGASE's Library of Unnatural Amino Acids

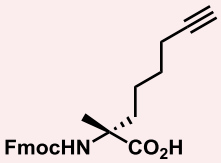
Jan. 2017 Ver.23

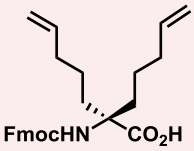
NAGASE provides unique α-mono- and α,α-disubstituted unnatural amino acids (UNAA) that can open new avenues for drug development and accelerate the development of drug candidates in your pipeline

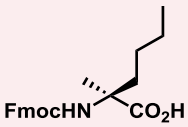
NAGASE UNAAs can be supplied in gram to multi-kg and larger quantities manufactured via stereoselective alkylation of glycine or alanine

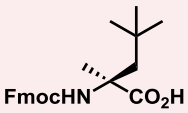
NAGASE UNAAs are manufactured without the use of metal catalysts by a safe and environmentally friendly process

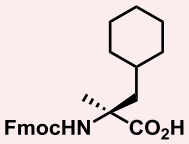
NEW PRODUCTS RELEASED

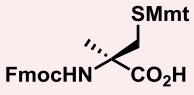


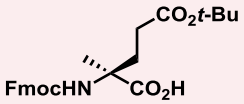


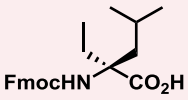


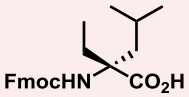


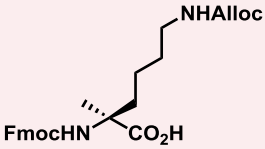


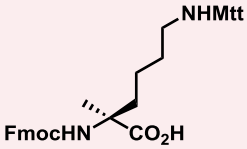


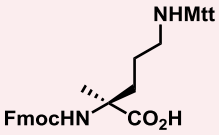


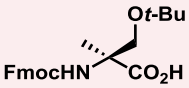


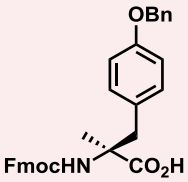


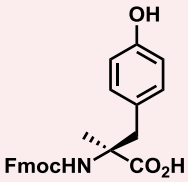


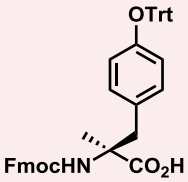


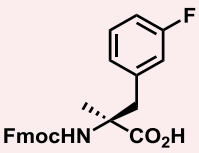












NAGASE

Reactive Amino Acids (α-Alkenyl or α-Alkynyl Glycines and Alanines)

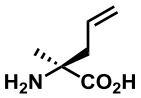
α-AlkenylAla

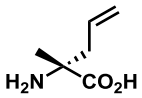
335438 **(*S*)-α-Allylalanine·H_2O** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 300

[CAS No.96886-55-4] $C_6H_{11}NO_2 \cdot H_2O$ = 147.17

335437 **(*R*)-α-Allylalanine·H_2O** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 300

[CAS No.96886-56-5] $C_6H_{11}NO_2 \cdot H_2O$ = 147.17





358028 **(*S*)-N-Fmoc-α-Allylalanine** (≥ 98.0%, ≥ 98.0%ee) (refrigerated transport) (NET) 1 g $ 900(*)

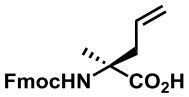
[CAS No.288617-71-0] $C_{21}H_{21}NO_4$ = 351.40

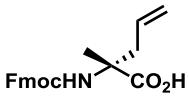
Containing 20-50% Methyl *tert*-butyl ether

358027 **(*R*)-N-Fmoc-α-Allylalanine** (≥ 98.0%, ≥ 98.0%ee) (refrigerated transport) (NET) 1 g $ 900(*)

[CAS No.288617-76-5] $C_{21}H_{21}NO_4$ = 351.40

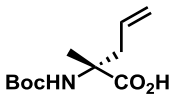
Containing 20-50% Methyl *tert*-butyl ether





354283 **(*R*)-N-Boc-α-Allylalanine ethyl ester** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 600

[CAS No.1263046-12-3] $C_{13}H_{23}NO_4$ = 257.33



365023 **(*S*)-N-Fmoc-α-(4-Pentenyl)alanine** (≥ 98.0%, ≥ 98.0%ee) (refrigerated transport) (NET) 1 g $ 800(*)

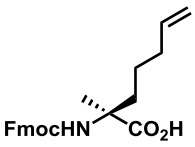
[CAS No.288617-73-2] $C_{23}H_{25}NO_4$ = 379.46 (NET) 5 g $ 1,800(*)

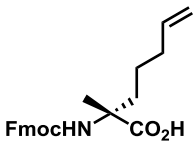
Containing 20-50% Methyl *tert*-butyl ether

364440 **(*R*)-N-Fmoc-α-(4-Pentenyl)alanine** (≥ 98.0%, ≥ 98.0%ee) (refrigerated transport) (NET) 1 g $ 800(*)

[CAS No.288617-77-6] $C_{23}H_{25}NO_4$ = 379.46 (NET) 5 g $ 1,800(*)

Containing 20-50% Methyl *tert*-butyl ether



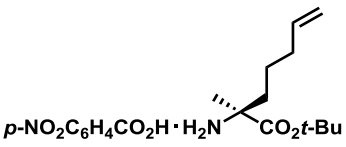


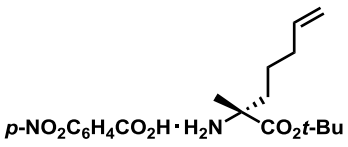
411751 **(*S*)-α-(4-Pentenyl)alanine *tert*-butyl ester *p*-Nitrobenzoate** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 350

[CAS No.1323987-70-7] $C_{12}H_{23}NO_2 \cdot C_7H_5NO_4$= 380.44 5 g $ 1,400

411752 **(*R*)-α-(4-Pentenyl)alanine *tert*-butyl ester *p*-Nitrobenzoate** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 350

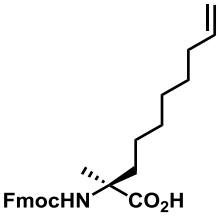
[CAS No.1323987-68-3] $C_{12}H_{23}NO_2 \cdot C_7H_5NO_4$= 380.44 5 g $ 1,400

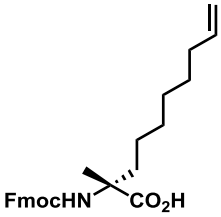




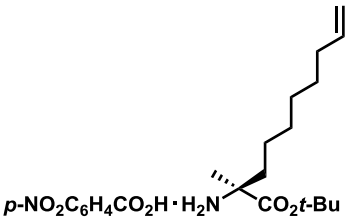
(*) – see Pricing section at rear of catalog for additional details

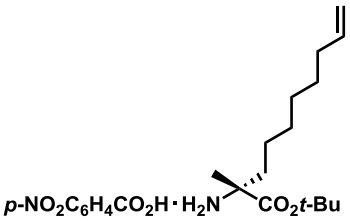
364441	**(*S*)-N-Fmoc-α-(7-Octenyl)alanine** (≥ 98.0%, ≥ 98.0%ee) (refrigerated transport)	(NET) 1 g	$ 1,000(*)
	[CAS No.288617-75-4] $C_{26}H_{31}NO_4$ = 421.54	(NET) 5 g	$ 1,900(*)
	Containing 10-40% of Methyl *tert*-butyl ether		
363955	**(*R*)-N-Fmoc-α-(7-Octenyl)alanine** (≥ 98.0%, ≥ 98.0%ee) (refrigerated transport)	(NET) 1 g	$ 1,000(*)
	[CAS No.945212-26-0] $C_{26}H_{31}NO_4$ = 421.54	(NET) 5 g	$ 1,900(*)
	Containing 10-40% of Methyl *tert*-butyl ether		





411915	**(*S*)-α-(7-Octenyl)alanine *tert*-butyl ester *p*-Nitrobenzoate** (≥ 98.0%, ≥ 98.0%ee)	1 g	$ 700
	[CAS No.1375908-92-1] $C_{15}H_{29}NO_2 \cdot C_7H_5NO_4$= 422.52	5 g	$ 1,500
388630	**(*R*)-α-(7-Octenyl)alanine *tert*-butyl ester *p*-Nitrobenzoate** (≥ 98.0%, ≥ 98.0%ee)	1 g	$ 700
	[CAS No.1375904-22-5] $C_{15}H_{29}NO_2 \cdot C_7H_5NO_4$= 422.52	5 g	$ 1,500

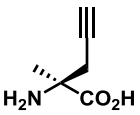


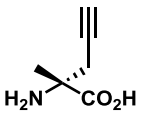


Hydrocarbon-stapling of natural peptides enhances helicity, protease resistance, and cell-permeability as well as improves pharmacologic properties.
C. E. Schafmeister, *et. al*. *J. Am.Chem.Soc*. **2000**, *122*, 5891-5892.
L. D . Walensky, *et. al. Science* **2004**, *305*, 1466-1470.
Young-Woo Kim *et. al*. *Org. Lett*. **2010**, *12*, 3046-3049.

α-AlkynylAla

339271	**(*S*)-α-Propargylalanine** (≥ 98.0%, ≥ 98.0%ee)	1 g	$ 300
	[CAS No.1231709-27-5] $C_6H_9NO_2$ = 127.14		
339270	**(*R*)-α-Propargylalanine** (≥ 98.0%, ≥ 98.0%ee)	1 g	$ 300
	[CAS No.403519-98-2] $C_6H_9NO_2$ = 127.14		





(*) – see Pricing section at rear of catalog for additional details

358026 **(*S*)-N-Fmoc-α-Propargylalanine** (≥ 98.0%, ≥ 98.0%ee) (refrigerated transport) (NET) 1 g $ 800(*)

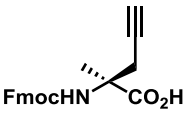
[CAS No.1198791-58-0] $C_{21}H_{19}NO_4$ = 349.39

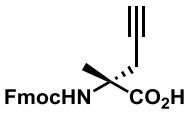
Containing 20-50% Methyl *tert*-butyl ether

358029 **(*R*)-N-Fmoc-α-Propargylalanine** (≥ 98.0%, ≥ 98.0%ee) (refrigerated transport) (NET) 1 g $ 800(*)

[CAS No.1198791-65-9] $C_{21}H_{19}NO_4$ = 349.39

Containing 20-50% Methyl *tert*-butyl ether





385412 **(*S*)-N-Fmoc-α-(4-Pentynyl)alanine** (≥ 98.0%, ≥ 98.0%ee) (refrigerated transport) (NET) 1 g $ 800(*)

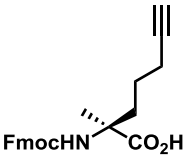
[CAS No.1050501-65-9] $C_{23}H_{23}NO_4$ = 377.44 (NET) 5 g $ 2,400(*)

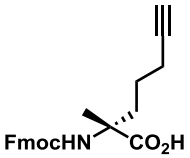
Containing 20-50% Methyl *tert*-butyl ether

385411 **(*R*)-N-Fmoc-α-(4-Pentynyl)alanine** (≥ 98.0%, ≥ 98.0%ee) (refrigerated transport) (NET) 1 g $ 800(*)

[CAS No.1198791-56-8] $C_{23}H_{23}NO_4$ = 377.44 (NET) 5 g $ 2,400(*)

Containing 20-50% Methyl *tert*-butyl ether



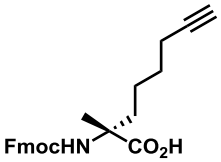


468736 **(*R*)-N-Fmoc-α-(5-Hexynyl)alanine** (≥ 98.0%, ≥ 98.0%ee) (refrigerated transport) (NET) 1 g $ 850(*)

[CAS No.1198791-69-3] $C_{24}H_{25}NO_4$ = 391.47 (NET) 5 g $ 2,750(*)

Containing 5-40% of Methyl *tert*-butyl ether

New



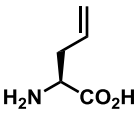
α-AlkenylGly

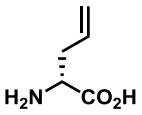
345277 **(*S*)-α-Allylglycine** (≥ 98.0%, ≥ 98.0%ee) 5 g $ 500

[CAS No.16338-48-0] $C_5H_9NO_2$ = 115.13

345276 **(*R*)-α-Allylglycine** (≥ 98.0%, ≥ 98.0%ee) 5 g $ 500

[CAS No.54594-06-8] $C_5H_9NO_2$ = 115.13

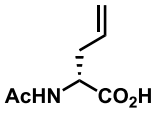




(*) – see Pricing section at rear of catalog for additional details

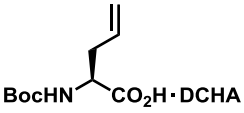
354273 **(*R*)-N-Acetyl-α-Allylglycine** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 500

[CAS No.121786-40-1] $C_7H_{11}NO_3$ = 157.17



358025 **(*S*)-N-Boc-α-Allylglycine Dicyclohexylamine salt** (≥ 98.0%, ≥ 98.0%ee) 25 g $ 800

[CAS No.143979-15-1] $C_{10}H_{17}NO_4 \cdot C_{12}H_{23}N$ = 396.57 100 g $ 2,500



363068 **(*S*)-α-Allylglycine ethyl ester *p*-Toluenesulfonate** (≥ 97.0%, ≥ 98.0%ee) 5 g $ 200

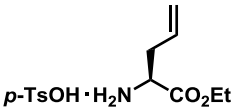
[CAS No.1231709-21-9] $C_7H_{13}NO_2 \cdot C_7H_8O_3S$ = 315.39 25 g $ 800

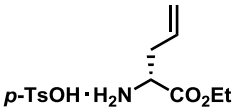
100 g $ 2,500

413726 **(*R*)-α-Allylglycine ethyl ester *p*-Toluenesulfonate** (≥ 97.0%, ≥ 98.0%ee) 5 g $ 200

[CAS No.1432914-51-6] $C_7H_{13}NO_2 \cdot C_7H_8O_3S$ = 315.39 25 g $ 800

100 g $ 2,500





Applycation of Allylglycine as the building block for intermediate of pharmaceutical compounds.
Rutjes, F. P. J. T. *et al*. *Org. Biomol. Chem.* **2005**, *3*, 3435.
Rutjes, F. P. J. T. *et al*. *J. Chem. Soc. Perkin Trans. 1,* **2000**, 4197.

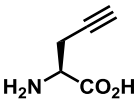
α-AlkynylGly

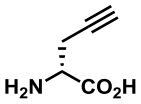
345279 **(*S*)-α-Propargylglycine** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 250

[CAS No.23235-01-0] $C_5H_7NO_2$ = 113.12

345278 **(*R*)-α-Propargylglycine** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 250

[CAS No.23235-03-2] $C_5H_7NO_2$ = 113.12





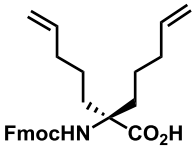
α-Propargyl Amino Acids – Derived Optically Active Novel Substituted Polyacetylenes: Synthesis, Second Structures, and Responsiveness to Ions.
Sogawa, H. *et al. J. Poly. Sci., Part A: Polym. Chem.* **2012**, 50, 2008.

α,α-DialkenylGly

462304 **N-Fmoc-α,α-Bis(4-pentenyl)glycine** (≥ 98.0%) 1 g $ 600

[CAS No.1068435-19-7] $C_{27}H_{31}NO_4$ = 433.55 5 g $ 2,400

New



α-Substituted Alanine derivatives

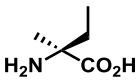
Alanine (Ala)

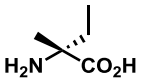
328959 **(*S*)-α-Ethylalanine·H_2O** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 250

[CAS No.595-40-4] $C_5H_{11}NO_2 \cdot H_2O$ = 135.16 5 g $ 800

328962 **(*R*)-α-Ethylalanine·H_2O** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 250

[CAS No.3059-97-0] $C_5H_{11}NO_2 \cdot H_2O$ = 135.16 5 g $ 800



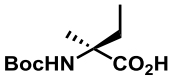


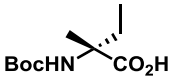
358835 **(*S*)-N-Boc-α-Ethylalanine** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 300

[CAS No.151171-11-8] $C_{10}H_{19}NO_4$ = 217.27 5 g $ 900

395454 **(*R*)-N-Boc-α-Ethylalanine** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 300

[CAS No.123254-58-0] $C_{10}H_{19}NO_4$ = 217.27 5 g $ 900



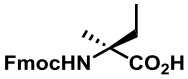


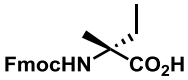
354274 **(*S*)-N-Fmoc-α-Ethylalanine** (≥ 98.0%, ≥ 98.0%ee) (refrigerated transport) 1 g $ 700(*)

[CAS No.857478-30-9] $C_{20}H_{21}NO_4$ = 339.39 5 g $ 1,600(*)

354275 **(*R*)-N-Fmoc-α-Ethylalanine** (≥ 98.0%, ≥ 98.0%ee) (refrigerated transport) 1 g $ 700(*)

[CAS No.1231709-22-0] $C_{20}H_{21}NO_4$ = 339.39 5 g $ 1,600(*)

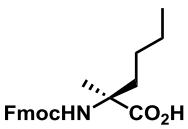




472923 **(*S*)-N-Fmoc-α-Methylnorleucine** (≥ 98.0%, ≥ 98.0%ee) (refrigerated transport) 1 g $ 700(*)

$C_{22}H_{25}NO_4$ = 367.45

New

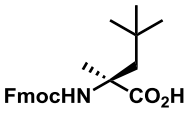


(*) – see Pricing section at rear of catalog for additional details

467664 **(*S*)-N-Fmoc-α-Methyl-β-*tert*-butylalanine** (≥ 98.0%, ≥ 98.0%ee) (refrigerated transport) 1 g $ 1,800(*)

[CAS No.1934266-56-4] $C_{23}H_{27}NO_4$ = 381.47

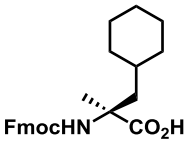
New



470629 **(*S*)-N-Fmoc-α-Methylcyclohexylalanine** (≥ 98.0%, ≥ 98.0%ee) (refrigerated transport) 1 g $ 700(*)

[CAS No.1934266-55-3] $C_{25}H_{29}NO_4$ = 407.51

New



α-Methyl or α-Ethyl derivatives of natural Amino Acids

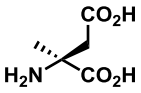
Aspartic acid (Asp)

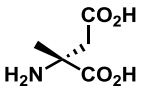
346838 **(*S*)-α-Methylaspartic acid** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 400

[CAS No.3227-17-6] $C_5H_9NO_4$ = 147.13

346839 **(*R*)-α-Methylaspartic acid** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 400

[CAS No.14603-76-0] $C_5H_9NO_4$ = 147.13



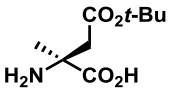


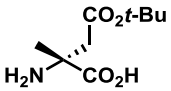
357392 **(*S*)-α-Methylaspartic acid 4-*tert*-butyl ester** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 300

[CAS No.1217977-71-3] $C_9H_{17}NO_4$ = 203.24 5 g $ 650

359455 **(*R*)-α-Methylaspartic acid 4-*tert*-butyl ester** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 300

[CAS No.1231709-25-3] $C_9H_{17}NO_4$ = 203.24 5 g $ 650





357393 **(*S*)-N-Fmoc-α-Methylaspartic acid 4-*tert*-butyl ester** (≥ 98.0%, ≥ 98.0%ee) (refrigerated transport)

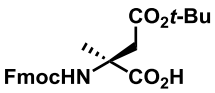
[CAS No.1072845-47-6] $C_{24}H_{27}NO_6$ = 425.48 (NET) 1 g $ 800(*)

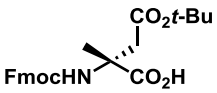
Containing ≤10% Methyl *tert*-butyl ether (NET) 5 g $ 1,400(*)

359457 **(*R*)-N-Fmoc-α-Methylaspartic acid 4-*tert*-butyl ester** (≥ 98.0%, ≥ 98.0%ee) (refrigerated transport)

[CAS No.1231709-26-4] $C_{24}H_{27}NO_6$ = 425.48 (NET) 1 g $ 800(*)

Containing ≤10% Methyl *tert*-butyl ether (NET) 5 g $ 1,400(*)





(*) – see Pricing section at rear of catalog for additional details

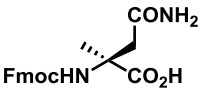
Asparagine (Asn)

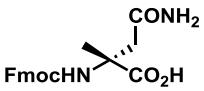
412813 **(*S*)-N-Fmoc-α-Methylasparagine** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 600

[CAS No.1403590-49-7] $C_{20}H_{20}N_2O_5$ = 368.39 5 g $ 1,800

412814 **(*R*)-N-Fmoc-α-Methylasparagine** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 600

[CAS No.1403590-50-0] $C_{20}H_{20}N_2O_5$ = 368.39 5 g $ 1,800





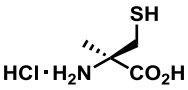
Cysteine (Cys)

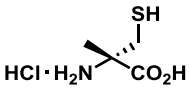
369043 **(*R*)-L-α-Methylcysteine·HCl** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 400

[CAS No.148766-37-4] $C_4H_9NO_2S·HCl$ = 171.65 5 g $ 1,600

388254 **(*S*)-D-α-Methylcysteine·HCl** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 1,500

[CAS No.151062-55-4] $C_4H_9NO_2S·HCl$ = 171.65

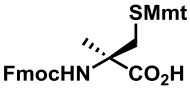




467668 **(*R*)-L-N-Fmoc-S-Mmt-α-Methylcysteine** (≥ 98.0%, ≥ 98.0%ee) (refrigerated transport) 1 g $ 600(*)

[CAS No.1198791-74-0] $C_{39}H_{35}NO_5S$ = 629.77 5 g $ 2,400(*)

New



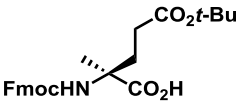
Glutamine (Glu)

462535 **(*S*)-N-Fmoc-α-Methylglutamic acid 5-*tert*-butyl ester** (≥ 98.0%, ≥ 98.0%ee) (refrigerated transport)

[CAS No.1072845-48-7] $C_{25}H_{30}NO_6$ = 440.51 1 g $ 900(*)

5 g $ 3,600(*)

New



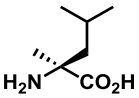
Leucine (Leu)

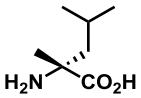
328961 **(*S*)-α-Methylleucine** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 250

[CAS No.105743-53-1] $C_7H_{15}NO_2$ = 145.20

328960 **(*R*)-α-Methylleucine** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 250

[CAS No.29589-03-5] $C_7H_{15}NO_2$ = 145.20





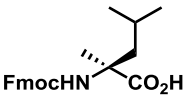
(*) – see Pricing section at rear of catalog for additional details

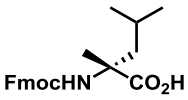
357394 **(*S*)-N-Fmoc-α-Methylleucine** (≥ 98.0%, ≥ 98.0%ee) (refrigerated transport) 1 g $ 800(*)

[CAS No.312624-65-0] $C_{22}H_{25}NO_4$ = 367.45

357395 **(*R*)-N-Fmoc-α-Methylleucine** (≥ 98.0%, ≥ 98.0%ee) (refrigerated transport) 1 g $ 800(*)

[CAS No.1231709-23-1] $C_{22}H_{25}NO_4$ = 367.45





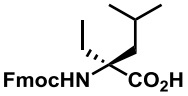
465357 **(*S*)-N-Fmoc-α-Ethylleucine** (≥ 98.0%, ≥ 98.0%ee) (refrigerated transport) 1 g $ 800(*)

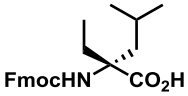
[CAS No.1934266-50-8] $C_{23}H_{27}NO_4$ = 381.47 5 g $ 2,400(*)

465358 **(*R*)-N-Fmoc-α-Ethylleucine** (≥ 98.0%, ≥ 98.0%ee) (refrigerated transport) 1 g $ 800(*)

[CAS No.1934266-51-9] $C_{23}H_{27}NO_4$ = 381.47 5 g $ 2,400(*)

New





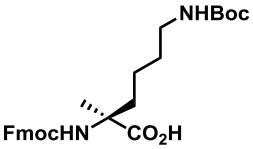
Lysine (Lys)

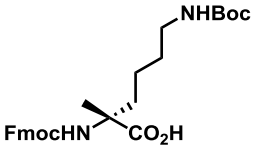
369412 **(*S*)-$N_α$-Fmoc-$N_ω$-Boc-α-Methyllysine** (≥ 98.0%, ≥ 98.0%ee) (refrigerated transport) 1 g $ 800(*)

[CAS No.1202003-49-3] $C_{27}H_{34}N_2O_6$ = 482.58 5 g $ 2,400(*)

369414 **(*R*)-$N_α$-Fmoc-$N_ω$-Boc-α-Methyllysine** (≥ 98.0%, ≥ 98.0%ee) (refrigerated transport) 1 g $ 800(*)

[CAS No.1315449-94-5] $C_{27}H_{34}N_2O_6$ = 482.58 5 g $ 2,400(*)

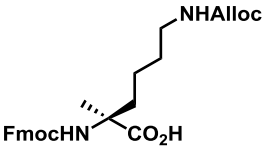




454268 **(*S*)-$N_α$-Fmoc-$N_ω$-Alloc-α-Methyllysine** (≥ 98.0%, ≥ 98.0%ee) (refrigerated transport) 1 g $ 1,200(*)

[CAS No.1934266-47-3] $C_{26}H_{30}N_2O_6$ = 466.53 5 g $ 4,800(*)

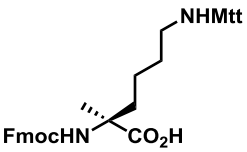
New



468644 **(*S*)-$N_α$-Fmoc-$N_ω$-Mtt-α-Methyllysine** (≥ 98.0%, ≥ 98.0%ee) (refrigerated transport) 1 g $ 800(*)

[CAS No.1934266-54-2] $C_{42}H_{42}N_2O_4$ = 638.81 5 g $ 2,400(*)

New



(*) – see Pricing section at rear of catalog for additional details

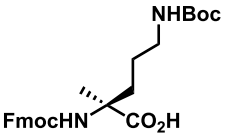
Ornithine (Orn)

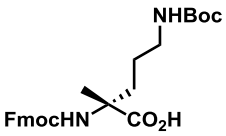
369026 **(*S*)-N_α-Fmoc-N_ω-Boc-α-Methylornithine** (≥ 98.0%, ≥ 98.0%ee) (refrigerated transport) 1 g $ 800(*)

[CAS No.1315449-95-6] $C_{26}H_{32}N_2O_6$ = 468.55 5 g $ 2,000(*)

369413 **(*R*)-N_α-Fmoc-N_ω-Boc-α-Methylornithine**(≥ 98.0%, ≥ 98.0%ee) (refrigerated transport) 1 g $ 800(*)

[CAS No.171860-40-5] $C_{26}H_{32}N_2O_6$ = 468.55 5 g $ 2,000(*)

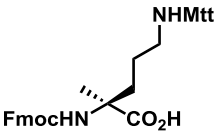




467089 **(*S*)-N_α-Fmoc-N_ω-Mtt-α-Methylornithine** (≥ 98.0%, ≥ 98.0%ee) (refrigerated transport) 1 g $ 800(*)

[CAS No.1934266-52-0] $C_{41}H_{40}N_2O_4$ = 624.78 5 g $ 2,000(*)

New



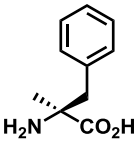
Phenylalanine (Phe) *Substituted benzene ring derivatives are shown in pp. 13-15*

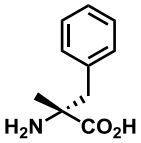
322901 **(*S*)-α-Methylphenylalanine·H_2O** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 300

[CAS No.23239-35-2] $C_{10}H_{13}NO_2 \cdot H_2O$ = 197.23 5 g $ 900

322898 **(*R*)-α-Methylphenylalanine·H_2O** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 300

[CAS No.17350-84-4] $C_{10}H_{13}NO_2 \cdot H_2O$ = 197.23 5 g $ 900



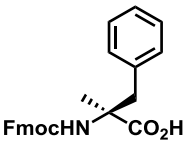


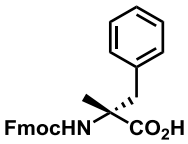
366011 **(*S*)-N-Fmoc-α-Methylphenylalanine·3/2H_2O** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 300

[CAS No.135944-05-7] $C_{25}H_{23}NO_4 \cdot 3/2H_2O$ = 428.48 5 g $ 900

366012 **(*R*)-N-Fmoc-α-Methylphenylalanine·3/2H_2O** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 300

[CAS No.152436-04-9] $C_{25}H_{23}NO_4 \cdot 3/2H_2O$ = 428.48 5 g $ 900





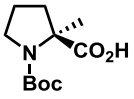
Proline (Pro)

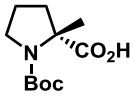
363402 **(*S*)-N-Boc-α-Methylproline** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 400

[CAS No. 103336-06-7] $C_{11}H_{19}NO_4$ = 229.28 5 g $ 1,200

363401 **(*R*)-N-Boc-α-Methylproline** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 400

[CAS No. 166170-15-6] $C_{11}H_{19}NO_4$ = 229.28 5 g $ 1,200





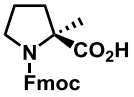
(*) – see Pricing section at rear of catalog for additional details

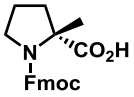
386844 **(*S*)-N-Fmoc-α-Methylproline** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 500

[CAS No.167275-47-0] $C_{21}H_{21}NO_4$ = 351.40 5 g $ 1,500

386843 **(*R*)-N-Fmoc-α-Methylproline** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 500

[CAS No.1286768-33-9] $C_{21}H_{21}NO_4$ = 351.40 5 g $ 1,500



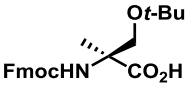


Serine (Ser)

471548 **(*S*)-N-Fmoc-O-*tert*-Butyl-α-Methylserine** (≥ 98.0%, ≥ 98.0%ee) (refrigerated transport) 1 g $ 850(*)

[CAS No.914399-98-7] $C_{23}H_{27}NO_5$ = 397.47 5 g $ 2,550(*)

New



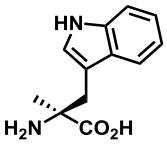
Tryptophan (Trp)

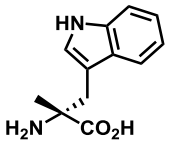
350920 **(*S*)-α-Methyltryptophan·1/2H_2O** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 700

[CAS No.16709-25-4] $C_{12}H_{14}N_2O_2 \cdot 1/2H_2O$ = 227.26

350921 **(*R*)-α-Methyltryptophan·1/2H_2O** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 700

[CAS No.56452-52-9] $C_{12}H_{14}N_2O_2 \cdot 1/2H_2O$ = 227.26





359456 **(*S*)-N-Fmoc-N'-Boc-α-Methyltryptophan** (≥ 98.0%, ≥ 98.0%ee) (refrigerated transport)

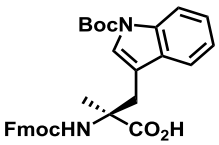
[CAS No.1315449-98-9] $C_{32}H_{32}N_2O_6$ = 540.62 (NET) 200 mg $ 800(*)

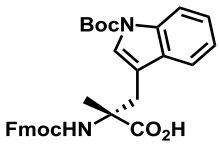
Containing 5% *n*-Heptane (NET) 1 g $ 1,200(*)

365299 **(*R*)-N-Fmoc-N'-Boc-α-Methyltryptophan** (≥ 98.0%, ≥ 98.0%ee) (refrigerated transport)

[CAS No.220155-72-6] $C_{32}H_{32}N_2O_6$ = 540.62 (NET) 200 mg $ 800(*)

Containing 5% *n*-Heptane (NET) 1 g $ 1,200(*)





Boyle, S. *et al*. *Bioorganic & Medicinal Chemistry* **1994**, *2*, 357.
van Megen, H. J. *et al*. *Psychophormacology (Berlin)* **1997**, *129*, 243.
Dethlof, L. A. *et al*. *Food Chem. Toxicol*. **1998**, *36*, 61.
Valerie, A. *et al*. *J. Med. Chem*. **2001**, *44*, 2276.

(*) – see Pricing section at rear of catalog for additional details

Tyrosine (Tyr)

339269 **(*S*)-α-Methyl-4-hydroxyphenylalanine** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 250

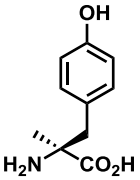
(*S*)-α-Methyltyrosine

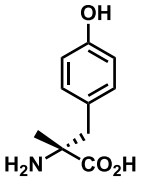
[CAS No.672-87-7] $C_{10}H_{13}NO_3$ = 195.22

339268 **(*R*)-α-Methyl-4-hydroxyphenylalanine** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 250

(*R*)-α-Methyltyrosine

[CAS No.672-86-6] $C_{10}H_{13}NO_3$ = 195.22



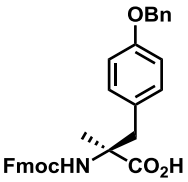


468643 **(*S*)-N-Fmoc-α-Methyl-4-benzyloxyphenylalanine** (≥ 98.0%, ≥ 98.0%ee) (refrigerated transport)

(*S*)-N-Fmoc-O-Benzyl-α-Methyltyrosine 1 g $ 500(*)

[CAS No.1283766-46-0] $C_{32}H_{29}NO_5$ = 507.59 5 g $ 2,000(*)

New

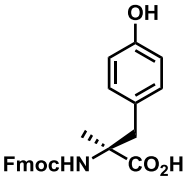


468642 **(*S*)-N-Fmoc-α-Methyl-4-hydroxyphenylalanine** (≥ 98.0%, ≥ 98.0%ee) (refrigerated transport)

(*S*)-N-Fmoc-α-Methyltyrosine 1 g $ 500(*)

[CAS No.246539-83-3] $C_{25}H_{23}NO_5$ = 417.46 5 g $ 2,000(*)

New

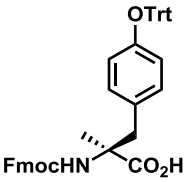


467091 **(*S*)-N-Fmoc-α-Methyl-4-triphenylmethoxyphenylalanine** (≥ 98.0%, ≥ 98.0%ee) (refrigerated transport)

(*S*)-N-Fmoc-O-Trityl-α-Methyltyrosine 1 g $ 800(*)

[CAS No.1934266-53-1] $C_{44}H_{37}NO_5$ = 659.78 5 g $ 3,200(*)

New

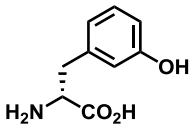


(*) – see Pricing section at rear of catalog for additional details

387902 **(*R*)-3-Hydroxyphenylalanine** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 500

(*R*)-*m*-Tyrosine

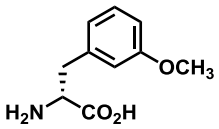
[CAS No.32140-49-1] $C_9H_{11}NO_3$ = 181.19



387901 **(*R*)-3-Methoxyphenylalanine·H_2O** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 700

(*R*)-O-Methyl-*m*-tyrosine

[CAS No.145306-65-6] $C_{10}H_{13}NO_3 \cdot H_2O$ = 213.23



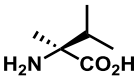
Valine (Val)

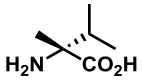
333444 **(*S*)-α-Methylvaline** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 300

[CAS No.53940-83-3] $C_6H_{13}NO_2$ = 131.18

333443 **(*R*)-α-Methylvaline** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 300

[CAS No.53940-82-2] $C_6H_{13}NO_2$ = 131.18





358030 **(*S*)-N-Fmoc-α-Methylvaline** (≥ 98.0%, ≥ 98.0%ee) (refrigerated transport) (NET) 1 g $ 800(*)

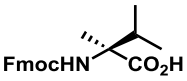
[CAS No.169566-81-8] $C_{21}H_{23}NO_4$ = 353.42

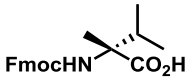
Containing ≤10% Methyl *tert*-butyl ether

358031 **(*R*)-N-Fmoc-α-Methylvaline** (≥ 98.0%, ≥ 98.0%ee) (refrigerated transport) (NET) 1 g $ 800(*)

[CAS No.616867-28-8] $C_{21}H_{23}NO_4$ = 353.42

Containing ≤10% Methyl *tert*-butyl ether





(*) – see Pricing section at rear of catalog for additional details

α-Methyl substituted Phenylalanines

F-Phe

410325 **(*S*)-α-Methyl-3-fluorophenylalanine** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 400

[CAS No.130855-56-0] $C_{10}H_{12}FNO_2$ = 197.21 5 g $ 1,200

411825 **(*R*)-α-Methyl-3-fluorophenylalanine** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 400

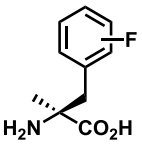
[CAS No.1270184-80-9] $C_{10}H_{12}FNO_2$ = 197.21 5 g $ 1,200

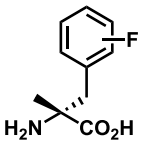
410133 **(*S*)-α-Methyl-4-fluorophenylalanine** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 300

[CAS No.130855-57-1] $C_{10}H_{12}FNO_2$ = 197.21 5 g $ 900

410132 **(*R*)-α-Methyl-4-fluorophenylalanine** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 300

[CAS No. 422568-68-1] $C_{10}H_{12}FNO_2$ = 197.21 5 g $ 900



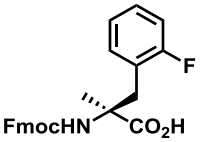


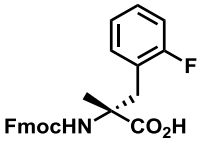
365442 **(*S*)-N-Fmoc-α-Methyl-2-fluorophenylalanine** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 300

[CAS No.1172127-44-4] $C_{25}H_{22}FNO_4$ = 419.45

364680 **(*R*)-N-Fmoc-α-Methyl-2-fluorophenylalanine** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 300

[CAS No.1315449-93-4] $C_{25}H_{22}FNO_4$ = 419.45

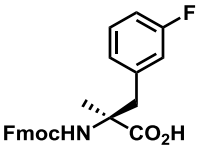




468735 **(*S*)-N-Fmoc-α-Methyl-3-fluorophenylalanine** (≥ 98.0%, ≥ 98.0%ee) (refrigerated transport)

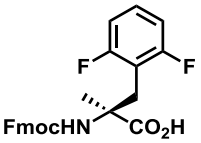
[CAS No.1410792-22-1] $C_{25}H_{22}FNO_4$ = 419.45 1 g $ 500(*)

New



386761 **(*S*)-N-Fmoc-α-Methyl-2,6-difluorophenylalanine** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 400

[CAS No.1223105-51-8] $C_{25}H_{21}F_2NO_4$ = 437.44

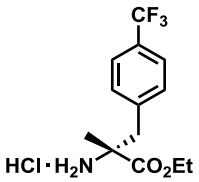


Mapelli C. *et. al*. *J. Med. Chem.* **2009**, *52*, 7788-7799.

(*) – see Pricing section at rear of catalog for additional details

387097 **(*R*)-α-Methyl-4-trifluoromethylphenylalanine ethyl ester·HCl·H_2O** (≥ 98.0%, ≥ 98.0%ee)

[CAS No.1315449-99-0] $C_{13}H_{16}F_3NO_2 \cdot HCl \cdot H_2O$ = 329.75 1 g $ 600

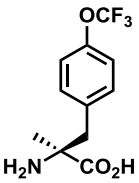


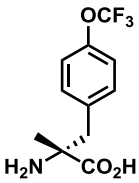
411843 **(*S*)-α-Methyl-4-trifluoromethoxyphenylalanine** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 800

[CAS No. 1269926-90-0] $C_{11}H_{12}F_3NO_3$= 263.22 5 g $ 3,200

410538 **(*R*)-α-Methyl-4-trifluoromethoxyphenylalanine** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 800

[CAS No.1269835-58-6] $C_{11}H_{12}F_3NO_3$= 263.22 5 g $ 3,200





Br-Phe

322899 **(*S*)-α-Methyl-2-bromophenylalanine·H_2O** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 450

[CAS No.1212180-27-2] $C_{10}H_{12}BrNO_2 \cdot H_2O$ = 276.13

322894 **(*R*)-α-Methyl-2-bromophenylalanine·H_2O** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 450

[CAS No.1212307-90-8] $C_{10}H_{12}BrNO_2 \cdot H_2O$ = 276.13

328956 **(*S*)-α-Methyl-3-bromophenylalanine·H_2O** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 300

[CAS No.1212117-73-1] $C_{10}H_{12}BrNO_2 \cdot H_2O$ = 276.13

328957 **(*R*)-α-Methyl-3-bromophenylalanine·H_2O** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 300

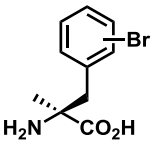
[CAS No.1212321-90-8] $C_{10}H_{12}BrNO_2 \cdot H_2O$ = 276.13

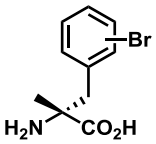
322900 **(*S*)-α-Methyl-4-bromophenylalanine** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 400

[CAS No.747397-27-9] $C_{10}H_{12}BrNO_2$ = 258.11

322897 **(*R*)-α-Methyl-4-bromophenylalanine** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 400

[CAS No.752971-41-8] $C_{10}H_{12}BrNO_2$ = 258.11





I-Phe

329205 **(*S*)-α-Methyl-3-iodophenylalanine·H_2O** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 350

[CAS No.457653-01-9] $C_{10}H_{12}INO_2 \cdot H_2O$ = 323.13

329207 **(*R*)-α-Methyl-3-iodophenylalanine·H_2O** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 350

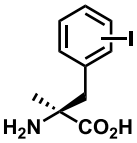
[CAS No.457652-83-4] $C_{10}H_{12}INO_2 \cdot H_2O$ = 323.13

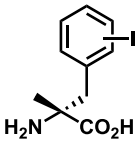
329206 **(*S*)-α-Methyl-4-iodophenylalanine** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 300

[CAS No.1215092-16-2] $C_{10}H_{12}INO_2$ = 305.11

329204 **(*R*)-α-Methyl-4-iodophenylalanine** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 300

[CAS No.213203-06-6] $C_{10}H_{12}INO_2$ = 305.11





NO_2-Phe

333075 **(*S*)-α-Methyl-2-nitrophenylalanine·H_2O** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 200

[CAS No.1241680-71-6] $C_{10}H_{12}N_2O_4 \cdot H_2O$ = 242.23

333080 **(*R*)-α-Methyl-2-nitrophenylalanine·H_2O** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 200

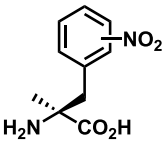
[CAS No.1241680-73-8] $C_{10}H_{12}N_2O_4 \cdot H_2O$ = 242.23

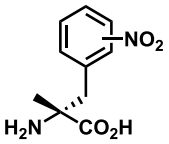
333078 **(*S*)-α-Methyl-3-nitrophenylalanine·H_2O** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 200

[CAS No.1215092-14-0] $C_{10}H_{12}N_2O_4 \cdot H_2O$ = 242.23

333076 **(*R*)-α-Methyl-3-nitrophenylalanine·H_2O** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 200

[CAS No. 1215092-13-9] $C_{10}H_{12}N_2O_4 \cdot H_2O$ = 242.23

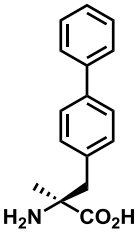




4-Ph-Phe

335436 **(*S*)-α-Methyl-β-(4-biphenyl)alanine·H_2O** (≥ 98.0%, ≥ 98.0%ee) 1 g $ 500

[CAS No.1231709-24-2] $C_{16}H_{17}NO_2 \cdot H_2O$ = 273.33



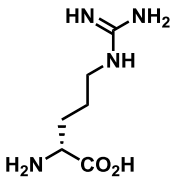
D-Amino acids

New

Arg

477449 **(*R*)-Arginine** (≥ 98.0%, ≥ 98.0%ee) 25 g $ 150

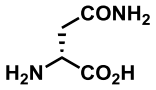
[CAS No.157-06-2] $C_6H_{14}N_4O_2$ = 174.20



Asn

477452 **(*R*)-Asparagine·H_2O** (≥ 98.0%, ≥ 98.0%ee) 25 g $ 130

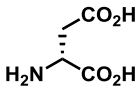
[CAS No.5794-24-1] $C_4H_8N_2O_3 \cdot H_2O$ = 150.13



Asp

477473 **(*R*)-Aspartic acid** (≥ 98.0%, ≥ 98.0%ee) 25 g $ 120

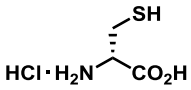
[CAS No.1783-96-6] $C_4H_7NO_4$ = 133.10



Cys

477470 **(*S*)-D-Cysteine·HCl·H_2O** (≥ 98.0%, ≥ 98.0%ee) 25 g $ 170

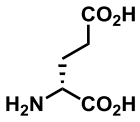
[CAS No.32443-99-5] $C_3H_7NO_2S \cdot HCl \cdot H_2O$ = 175.63



Glu

477465 **(*R*)-Glutamic acid** (≥ 98.0%, ≥ 98.0%ee) 25 g $ 130

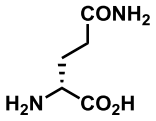
[CAS No.6893-26-1] $C_5H_9NO_4$ = 147.13



Gln

477466 **(*R*)-Glutamine** (≥ 98.0%, ≥ 98.0%ee) 25 g $ 150

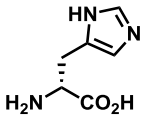
[CAS No.5959-95-5] $C_5H_{10}N_2O_3$ = 146.15



His

477467 **(*R*)-Histidine** (≥ 98.0%, ≥ 98.0%ee) 25 g $ 150

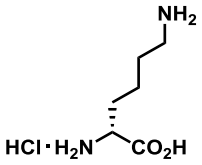
[CAS No.351-50-8] $C_6H_9N_3O_2$ = 155.16



Lys

477469 **(*R*)-Lysine·HCl** (≥ 98.0%, ≥ 98.0%ee) 25 g $ 145

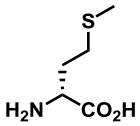
[CAS No.7274-88-6] $C_6H_{14}N_2O_2 \cdot HCl$ = 182.65



Met

477464 **(*R*)-Methionine** (≥ 98.0%, ≥ 98.0%ee) 25 g $ 130

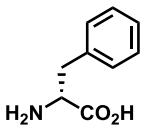
[CAS No.348-67-4] $C_5H_{11}NO_2S$ = 149.21



Phe

477442 **(*R*)-Phenylalanine** (≥ 98.0%, ≥ 98.0%ee) 25 g $ 135

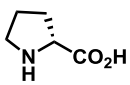
[CAS No.673-06-3] $C_9H_{11}NO_2$ = 165.19



Pro

477476 **(*R*)-Proline** (≥ 98.0%, ≥ 98.0%ee) 25 g $ 125

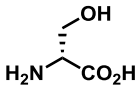
[CAS No.344-25-2] $C_5H_9NO_2$ = 115.13



Ser

477443 **(*R*)-Serine** (≥ 98.0%, ≥ 98.0%ee) 25 g $ 135

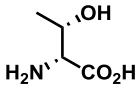
[CAS No.312-84-5] $C_3H_7NO_3$ = 105.09



Thr

477468 **(*R*)-Threonine** (≥ 98.0%, ≥ 98.0%ee) 25 g $ 145

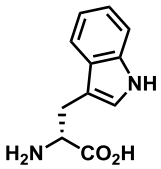
[CAS No.632-20-2] $C_4H_9NO_2$ = 119-12



Trp

477446 **(*R*)-Tryptophan** (≥ 98.0%, ≥ 98.0%ee) 25 g $ 150

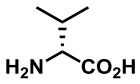
[CAS No.153-94-6] $C_{11}H_{12}N_2O_2$ = 204.23



Val

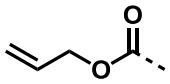
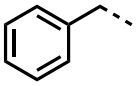
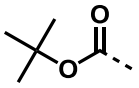
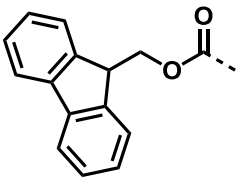
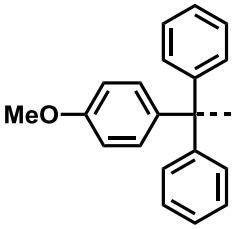
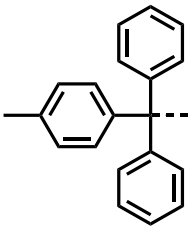
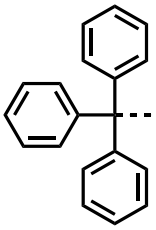
477479 **(*R*)-Valine** (≥ 98.0%, ≥ 98.0%ee) 25 g $ 120

[CAS No.640-68-6] $C_5H_{11}NO_2$ = 117.15



Chemical Abbreviation Definitions

We listed the abbreviations used in this catalog.

Abbreviation	Chemical Name	Chemical Structure
Ac	Acetyl	
Alloc	Allyloxycarbonyl	
Bn	Benzyl	
Boc	*tert*-Butoxycarbonyl	
Fmoc	9-Fluorenylmethoxycarbonyl	
Mmt	4-Methoxytrityl	
Mtt	4-Methyltrityl	
Trt	Triphenylmethyl Trityl	

Di-Peptides synthesized from our Unnatural Amino Acids

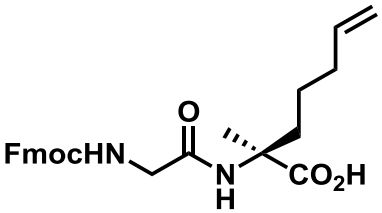
NAGASE is developing a range di-peptides which are composed of a natural amino acid connected to N-terminal of our unnatural, α,α-dialkylated amino acids.

Usually α,α-dialkylated amino acids are not so reactive with other natural amino acids at the N-terminal position because of their steric hindrance around the chiral carbon center.

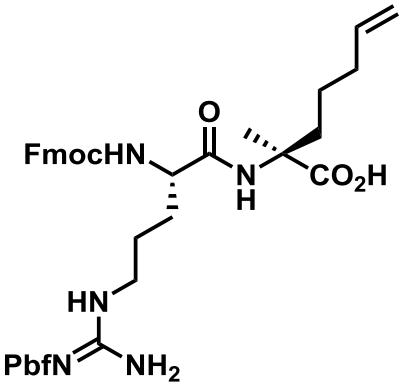
That is the reason why you may have obtained a peptide in low yield as a result of incomplete conjugation of the amino acid adjacent to the dialkylated amino acid.

As a result NAGASE commissioned certain peptide custom synthesis companies in Japan and China to provide N-Fmoc-protected di-peptide which is composed of a natural amino acid and α,α-dialkylated amino acid and can be used in solid phase peptide synthesis

Examples



Fmoc-Gly-(*S*)-Ala(4-Pte)-OH



Fmoc-Arg(Pbf)-(*S*)-Ala(4-Pte)-OH

Application of Unnatural Amino Acids for Pharmaceuticals

Replacement of the α-hydrogen atom of L-α-amino acids with an alkyl substituent results in α,α-disubstituted amino acids has been reported in numerous scientific publications and is seen in APIs and developmental drug candidates. The modification changes the properties of amino acids as follows: 1) increased chemical stability, 2) increased hydrophobicity, 3) restriction of conformational freedom of side chains in amino acids. Incorporation of α,α-disubstituted amino acids into peptides results in the restriction of conformational freedom and increased metabolic stability of the resultant peptides.

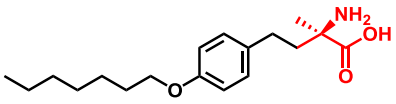
Reference:

Tanaka, M. *Chem. Pharm. Bull.* **2007**, *55*, 349-358.

Walensky, L. D.; Kung, A. L.; Escher, I.; Malia, T. J.; Barbuto, S.; Wright, R. D.; Wagner, G.; Verdine, G. L. *Science*, **2004**, *305*, 1466.

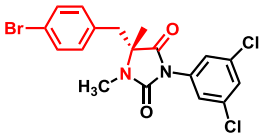
Walensky, L. D.; Bird, G. H. *J. Med. Chem.* **2014**, *57*, 6275.

Examples of investigational APIs including α,α-disubstituted amino acids.



Chiral Analogue of Single S1P Receptor

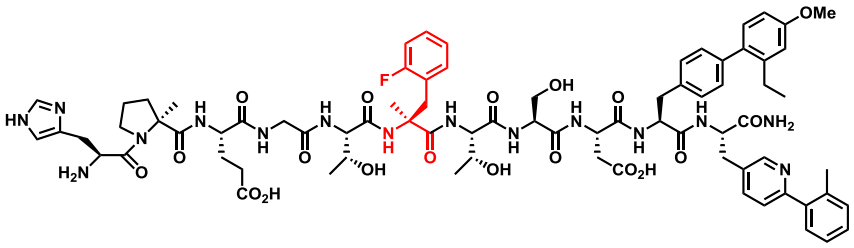
Högenauer, K. *et al*. *Bioorg. Med. Chem*. *Lett.* **2010**, *20*, 1485-1487.



Integrin ab-2 (LFA-1) Antagonist

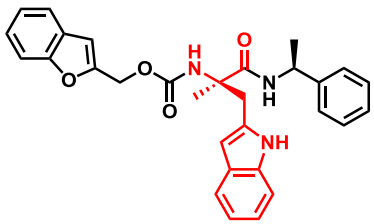
LFA-1/ICAM-1 Interaction Inhibitors

Kelly, T.A. *et al. J. Immunol,* **1999**, *163*, 5173-5177.



Glucagon –like Peptide-1 Receptor Agonist with Antidiabetic Activity

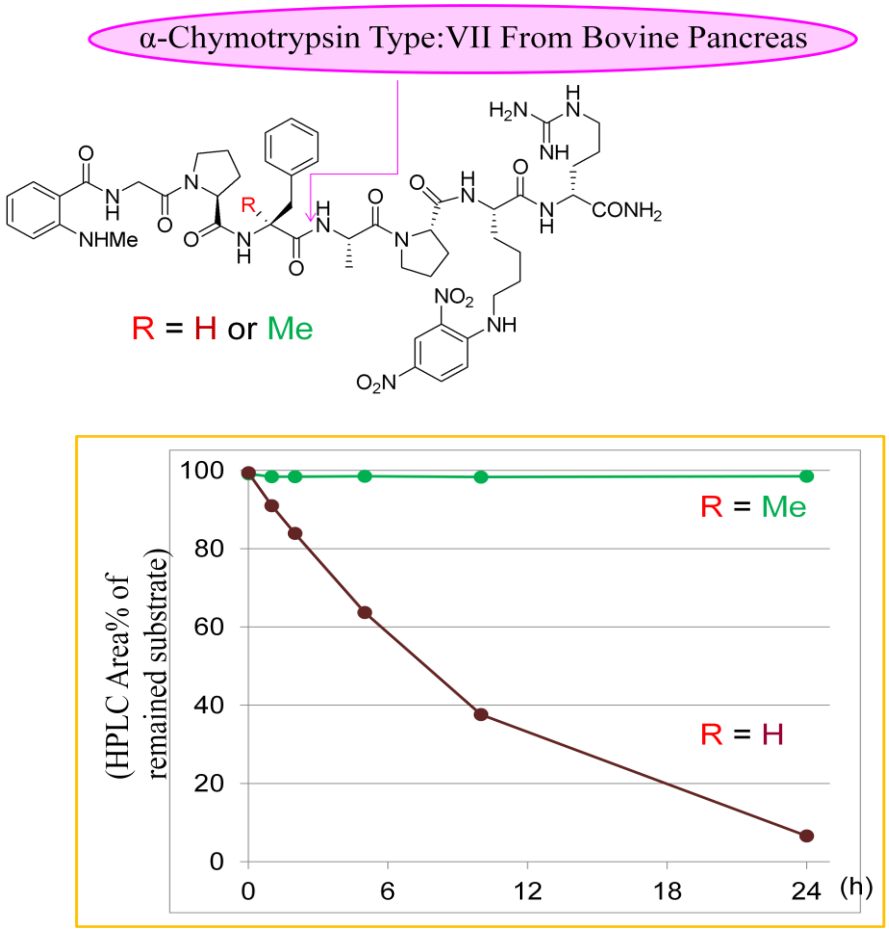
Mapelli, C. et. al. *J. Med. Chem.* **2009**, *52*, 7788-7799.



NK1 Receptor Antagonist

Boyle, S.et al. *Bioorganic & Medicinal Chemistry* **1994**, *2*, 357-370.

Resistance of a Peptide with α,α-disubstituted Amino Acid against Protease



Incubated at 30 °C in 10% DMSO / 0.1 M Pi buffer (pH=8.0) solution

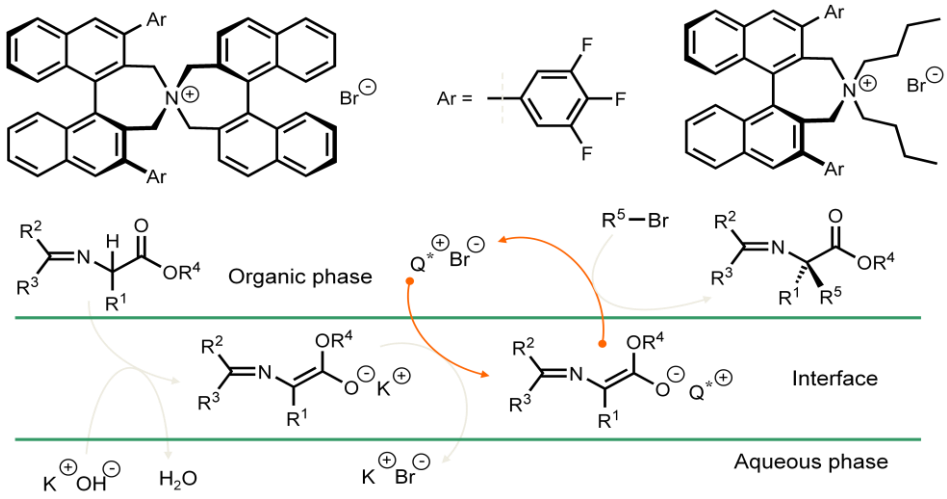
A tryptic digestion assay of an α-methylphenylalanine-containing peptide was carried out to investigate the effect of the replacement of an α,α-dialkylamino acid residue on resistance to protease degradation. The introduction of an α,α-dialkylamino acid residue (α-Methylphenylalanine) to the peptide backbone resulted in greater resistance to protease degradation over 24 hours than the peptide with α-monoalkyl amino acid (phenylalanine). The peptide containing the α,α-dialkylamino acid residue exhibited complete resistance to degradation under the experimental conditions.

Reference:

Matsuyama, K.; Yamamoto, K.; Murakami, S.; Anzai, K. Construction of an unnatural amino acids library through asymmetric alkylation of glycine or alanine ester Shiff-base utilizing Maruoka Catalyst®.

Presented at the 5th International Peptide Symposium, Kyoto, Japan, December 4-9, 2010; P2-204.

Asymmetric Phase-Transfer Reaction with Maruoka Catalyst® to Synthesize α-Monosubstituted and α,α-Disubstituted Amino Acids.



Ikunaka, M. and Maruoka, K. 'Asymmetric Phase-Transfer Catalysts for the Production of Non-Proteinogenic alpha-Amino Acids' in *Asymmetric Catalysis on Industrial Scale* *2nd edition*, Blaser, H-U. and Federsel, H.-J. eds. Wiley-VCH Verlag GmbH & Co. KGaA (**2010**)

According to the Makosza interfacial mechanism, protected α-amino acid is converted into the potassium *E*-enolate. Due to the lipophilic nature of the quaternary ammonium salt it can move easily into the interface layer where cation exchange takes place with the potassium *E*-enolate. As the *si* face of the *E*-enolate is shielded by the molecular cavity of the catalyst, an alkyl halide can only approach the *re* face of the enolate. This results in the Maruoka Catalyst® exhibiting high reactivity and selectivity of the alkylation process.

Reference:

Ooi, T., Kameda, M., and Maruoka, K. *J. Am. Chem. Soc*., **2003**, *125*, 5139-5151.

Ooi, T., Kameda,M., Tannai, H., and Maruoka, K. *Tetrahedron Lett.*, **2000**, *41*, 8339-8342.

Ooi, T., Takeuchi.,M., and Maruoka, K. *Synthesis* **2001**, 1716-1718.

Maruoka, K. *Org. Process Research & Development* **2008**, *12*, 679-687.

Patents:

USP	6,340,753; 6,441,231; 7,928,224; 8,110,680; 8,252,952; 8,263,798; 8,614,316; 8,697,910; 8,716,524; 8,722,919
JP	4,217,085; 4,502,293; 4,605,606; 4,802,191; 4,879,896; 5,008,553; 5,108,777; 5,244,149; 5,344,523
CA	2,549,431; 2.610,776
SG	139,249; 149,879
IN	252,017; 260,006
CN	ZL200580003716.6; ZL200680027800.6

Trade mark

Maruoka Catalyst is the registered trade mark in Japan, US, UK, Germany and France.

Sales Information for Unnatural Amino Acids:

Pricing:

All prices are in U.S. dollars. All catalog products are available from inventory in Japan and can be delivered CIP to the designated airport (port of entry) by air within two weeks of confirmed Purchase Order. Prices are subject to change without notice. Products marked with an asterisk (*) mark may require an additional fee for refrigerated transport.

Ordering:

Orders can be placed by e-mail, phone or fax with the contact person in your region (see Contacts below).

Inquiries:

NAGASE offers a wide range of custom products not listed in this catalog. If you do not find a product you need in this catalog, please inquire about its availability by e-mail, phone or fax. NAGASE will promptly evaluate your request and a NAGASE representative will promptly contact you.

Bulk Quantities & Custom Manufacturing under cGMP:

NAGASE has the technology, experience and capacity to supply bulk and commercial quantities of products as well as custom manufacturing to meet your specific needs. For further information, please contact NAGASE and a technical representative will contact you to discuss your specific project needs.

General Information:

Company Profile: *'a technology and intelligence oriented company that turns wisdom into business.'*

Mission: 'Maintain Good and Fair Business Practice'

NAGASE & CO., LTD., the nucleus of our group, was established as a dyestuffs wholesaler in Kyoto, Japan in 1832. Since then, NAGASE has opened up new markets worldwide together with its customers and accumulated considerable know-how in its role as 'a technology and intelligence oriented trading company.' At the same time, it has enhanced its product offer with new R&D, manufacturing and processing technology. Today, **The NAGASE Group** is a 740 billion JPY (FY 2015) company and offers customers trading, marketing, R&D and manufacturing functions in its four strategic areas of Chemicals, Plastics, Electronics and Life Sciences.

R&D Sites and Nagase Pharmaceutical Group:

NAGASE & CO., LTD. NAGASE R&D CENTER

2-2-3, Murotani, Nishi-ku, Kobe, Hyogo 651-2241 JAPAN

Nagase Medicals Co.,Ltd.

4-323, Senzo, Itami, Hyogo, 664-0898 JAPAN

www.nagase-medicals.co.jp

HAYASHIBARA CO., LTD.

www.hayashibara.co.jp

Contacts!!

New York, US	**Nagase America Corporation**
	546 Fifth Avenue 16th Floor New York, NY 10036-5000 USA
	Phone: +1-212-703-1340 Fax: +1-212-398-0687
	Rick J. Offerman **e-mail: rickofferman@hotmail.com**
Düsseldorf, Germany	**Nagase (Europe) GmbH**
	Immermannstrasse 65c D-40210 Düsseldolf Germany
	Phone: +49 211 866 2040 / 2031 Fax: +49 211 323 7068/69
London, UK	**Nagase (Europe) GmbH, London Branch**
	Suite1.02, Winchester House 259-269 Old Marylebone Road London NW1 5RA, UK
	Phone:+44-20-7170-4103 Fax:+44-20-7170-4380
Osaka, Japan	**NAGASE & CO., LTD. Life & Healthcare Products Department**
	1-1-17, Shinmachi, Nishi-ku, Osaka 550-8668 JAPAN
	Yasumasa Watanabe **e-mail: yasumasa.watanabe@nagase.co.jp**
	Phone: +81-6-6535-2327 Fax: +81-6-6535-2480
Tokyo, Japan	**NAGASE & CO., LTD. Life & Healthcare Products Department**
	5-1, Nihonbashi-Kobunacho, Chio-ku, Tokyo 103-8355 JAPAN
	Phone: +81-3-3665-3840 Fax: +81-3-6535-3940

E-mail: pharma@nagase.co.jp URL: www.nagase.co.jp/pharma/english

Bringing it all together