Supplementary Information

Table S1. Parameter for HPLC-MSⁿ analysis of champacyclin (1a) and synthetic reference peptides (1b, 2).

Table S2. Parameter for NMR analytics of the natural product champacyclin (1a).

Table S3. NMR parameters for ¹H- and 2D-NMR experiments for (**1a**) measurements on a DRX 600 (Bruker, Karlsruhe, Germany) NMR spectrometer at the FMP Berlin.

Table S4. Parameter for HPLC-MS analysis of Partial hydrolysis of the natural product champacyclin (1a).

Table S5. Parameters for GC/MS analysis of amino acids and dipeptides.

Table S6. Peak areas and relative Quantification of the *N*-pentafluoropropionic 2-propyl ester derivatives of the total hydrolysate of (**1a**) as shown in Figure S13.

Figure S1. LC-MS analysis. (A) Total ion chromatogram (TIC). (B) Extracted ion chromatogram (EIC) of (1a) (m/z 912-914) (C) Mass spectrum for the EIC as shown in (B).

Figure S2. In-source-fragmentation-MS^{*n*}-experiments for (1a). (A) SID for (1a) with 70 eV. MS^2 for the 185 Da isobaric ion fragment y_2/b_7y_3 with the ESI-(+)-Ion-Trap (CE 15 eV). (B) MS³ on 86 Da ion with ESI-(+)-Ion-Trap (CE 20 eV) for the isobaric ions y_2/b_7y_3 . Formation of 69 Da Ion is indicative for an Ile-residue. (C) Possible mechanism for the subsequent MS^n -fragmentation series suggesting at least one Ile at position 6 and/or 8.

Figure S3. HR-ESI-(+)-SID-Orbitrap-MS of (**A**) natural product (**1a**) with SID at 65eV (**B**) Head-to-tail cyclization $N^{\alpha}_{(L)}Lys^{1}$ -CO-_(*AlloD*)Ile⁸ in (**1b**) (**C**) Head-to-side-chain cyclization $N^{\zeta}_{-(L)}Lys$ -CO-_(*AlloD*)Ile⁸ in (**2**). Note: the relative abundance for the b₁ Ion *m/z* 129 [M + H]⁺ is dramatically decreased in (**C**). Thus is indicative that the natural product in A (**1a**) is head-to-tail cyclized.

Figure S4. ¹H-NMR of (1a) in d_6 -DMSO at 600 MHz.

Figure S5. ¹H-(PRESAT)-NMR of (1a) in d_6 -DMSO at 600 MHz. PRESAT was used for water suppression.

Figure S6. ¹H-¹³C-HMQC of (1a) in d_6 -DMSO at 600 MHz.

Figure S7. HMQC-TOCSY (spin lock 80 ms) of (1a) in *d*₆-DMSO at 600 MHz.

Figure S8. ¹H-¹³C-HMBC of (1a) in d_6 -DMSO at 600 MHz.

Figure S9. ¹H-¹H-COSY of (**1a**) in d_6 -DMSO at 600 MHz.

Figure S10. ¹H-¹H-NOESY (mixing time 100 ms) of (1a) in d_6 -DMSO at 600 MHz.

Figure S11. ¹H-¹H-TOCSY (spin lock 60 ms) data of (1a) in d_6 -DMSO at 600 MHz.

Figure S12. HPLC-ESI-(+)-MS analysis of partial hydrolysate of (1a) after 7 h at 110 $^{\circ}$ C with 6 M HCl. (A) EICs for dipeptides, (B) EICs for tripeptides (C) EIC for tetrapeptides. Note: Absolute stereochemistry and constitution of dipeptides was assigned by GC/MS analysis. This analysis shows the status of the hydrolysis reaction, required for subsequent derivatization and analytics. Formation of lysine-dipeptides could not be observed.

Figure S13. Chiral GC-MS analysis of total hydrolysate of (**1a**) on a Chirasil[®]-(*L*)-Val column. Amino acids were analyzed as their *N*-pentafluoropropionic 2-propyl esters and identified by their $[M + H]^+$ -Ions and their fragmentation products using positive chemical ionization (PCI) with methane as reagent gas.

Figure S14. Chiral GC-PCI-MS analysis on a Chirasil[®]-(L)-Val column of Xle amino acid standards as *N*-pentafluoropropionic 2-propyl esters and identified by their $[M + H]^+$ -Ions using positive chemical ionization (PCI) with methane as reagent gas.

Figure S15. PCI-MS spectra of *N*-trifluoroacetyl- $_{(L)}$ Ile- $_{(D)}$ Ala-methyl ester found in partial hydrolysate of (**1a**) at $R_t = 19.97$ min on a Chirasil[®]-(L)-Val column.

Figure S16. EI-MS spectra of *N*-trifluoroacetyl-_(L)Ile-_(D)Ala-methyl ester found in partial hydrolysate of (**1a**) at $R_t = 19.97$ min on a Chirasil[®]-(L)-Val column.

Figure S17. PCI-MS spectra of *N*-trifluoroacetyl-_(L)Ile-_(L)Ile-methyl ester found in partial hydrolysate of (**1a**) at $R_t = 22.5$ min on a Chirasil[®]-(L)-Val column.

Figure S18. EI-MS spectra of *N*-trifluoroacetyl-_(L)Ile-_(L)Ile-methyl ester found in partial hydrolysate of (**1a**) at $R_t = 22.5$ min on a Chirasil[®]-(L)-Val column.

Figure S19. PCI-MS spectra of *N*-trifluoroacetyl- $_{(D)}$ Leu- $_{(L)}$ Ile-methyl ester found in partial hydrolysate of (**1a**) at $R_t = 24.6$ min on a Chirasil[®]-(L)-Val column.

Figure S20. EI-MS spectra of *N*-trifluoroacetyl-_(D)Leu-_(L)IIe-methyl ester found in partial hydrolysate of (**1a**) at $R_t = 24.6$ min on a Chirasil[®]-(L)-Val column.

Figure S21. PCI-MS spectra of *N*-trifluoroacetyl- $_{(L)}$ Ile- $_{(D)}$ Phe-methyl ester found in partial hydrolysate of (**1a**) at $R_t = 46.68$ min on a Chirasil[®]-(L)-Val column.

Figure S22. EI-MS spectra of *N*-trifluoroacetyl-_(L)Ile-_(D)Phe-methyl ester found in partial hydrolysate of (**1a**) at $R_t = 46.68$ min on a Chirasil[®]-(L)-Val column.

Figure S23. PCI-MS spectra of synthetic *N*-trifluoroacetyl-Leu-Leu-methyl ester.

Figure S24. EI-MS spectra of synthetic *N*-trifluoroacetyl-Leu-Leu-methyl ester.

Figure S25. PCI-MS spectra of synthetic *N*-trifluoroacetyl-Ile-Ile-methyl ester.

Figure S26. EI-MS spectra of synthetic *N*-trifluoroacetyl-IIe-IIe-methyl ester.

Figure S27. PCI-MS spectra of synthetic *N*-trifluoroacetyl-Leu-IIe-methyl ester.

Figure S28. EI-MS spectra of synthetic *N*-trifluoroacetyl-Leu-IIe-methyl ester.

Figure S29. PCI-MS spectra of synthetic *N*-trifluoroacetyl-lle-Leu-methyl ester.

Figure S30. EI-MS spectra of synthetic *N*-trifluoroacetyl-Ile-Leu-methyl ester.

Figure S31. PCI-MS spectra of synthetic N-trifluoroacetyl-Ala-Leu-methyl ester.

Figure S32. EI-MS spectra of synthetic N-trifluoroacetyl-Ala-Leu-methyl ester.

Figure S33. PCI-MS spectra of synthetic N-trifluoroacetyl-Leu-Ala-methyl ester.

Figure S34. EI-MS spectra of synthetic *N*-trifluoroacetyl-Leu-Ala-methyl ester.

Figure S35. PCI-MS spectra of synthetic *N*-trifluoroacetyl-Ala-IIe-methyl ester.

Figure S36. EI-MS spectra of synthetic *N*-trifluoroacetyl-Ala-IIe-methyl ester.

Figure S37. PCI-MS spectra of synthetic *N*-trifluoroacetyl-Ile-Ala-methyl ester.

Figure S38. EI-MS spectra of synthetic *N*-trifluoroacetyl-Ile-Ala-methyl ester.

Figure S39. PCI-MS spectra of synthetic N-trifluoroacetyl-Leu-Phe-methyl ester.

Figure S40. EI-MS spectra of synthetic *N*-trifluoroacetyl-Leu-Phe-methyl ester.

Figure S41. PCI-MS spectra of synthetic *N*-trifluoroacetyl-Phe-Leu-methyl ester.

Figure S42. EI-MS spectra of synthetic *N*-trifluoroacetyl-Phe-Leu-methyl ester.

Figure S43. PCI-MS spectra of synthetic *N*-trifluoroacetyl-Ile-Phe-methyl ester.

Figure S44. EI-MS spectra of synthetic *N*-trifluoroacetyl-IIe-Phe-methyl ester.

Figure S45. PCI-MS spectra of synthetic *N*-trifluoroacetyl-Phe-Ile-methyl ester.

Figure S46. EI-MS spectra of synthetic *N*-trifluoroacetyl-Phe-IIe-methyl ester.

Parameter for HPLC-MSn Analysis			
Mass Spectrometer	LTQ Orbitrap XL Mass Spectrometer (Thermo Fisher Scientific, Waltham, MA, USA)		
HPLC	1260 HPLC-system (Agilent, Santa Clara, CA, USA)		
Column	Thermo, Waltham, MA, USA, Hypersil-Gold, 5 μ m, 50 \times 2.1 mm		
Solvent System	A: H ₂ O + 0.1% HCOOH		
	B: ACN + 0.1% HCOOH		
Flow Rate	0.25 mL/min		
Gradient	B%	Time	
	5% B	0 min	
	5% B 1 min		
	100% B 6 min		
	100% B	10 min	
	5% B	10.10 min	
	5% B	13 min	

Table S1. Parameter for HPLC-MSⁿ analysis of champacyclin (1a) and synthetic reference peptides (1b, 2).

Table S2. Parameter for NMR analytics of the natural product champacyclin (1a).

Parameter for the NMR Analytics		
NMR-Spectrometer	DRX 600 MHz (¹ H) (Bruker, Karlsruhe, Germany)	
Solvent	<i>d</i> ₆ -DMSO, 500 μL	
Probe Head	TXI 5 mm, with Z-Gradient	

Table S3. NMR parameters for ¹H- and 2D-NMR experiments for (**1a**) measurements on a DRX 600 (Bruker, Karlsruhe, Germany) NMR spectrometer at the FMP Berlin.

Experiment	Pulse Program	Scans	TD (F1/F2)	Additional Information
¹ H-NMR	zg30	64	65536	/
¹ H-NMR-PRESAT	MF1hpresat	32	8192	/
¹ H- ¹ H-COSY	MFdqfcosypre	8	4096/1024	/
¹ H- ¹ H-NOESY	MFnoesypre	32	4096/1024	100 ms
¹ H- ¹ H-TOCSY	Psdipsi2pre	8	4096/1024	60 ms
¹ H- ¹³ C-HMQC	MFbihmqceaf2	128	1024/512	/
¹ H- ¹³ C-HMBC	MFhmbceaf2	80	4096/1024	/
HSQC-TOCSY	MFbihmqctocf2	8	1024/512	80 ms

	Parameter for HPLC-MS Analysis	
Mass Spectrometer	QQQ-MS-6460 (Agilent Technologies, Waldbronn Germany)	
HPLC	Agilent 1290 UHPLC-system (Agilent Technologies, Waldbronn, Germany)	
Column	Agilent, Waldbronn Germany, Eclipse Plus C18 RRHD column, 1.8 $\mu m,$ 2.1 $\times 50$ mm	
Solvent System	A: H ₂ O + 0.1% HCOOH	
	B: ACN + 0.1% HCOOH	
Flow Rate	0.3 mL/min	
Gradient	B%	Time
	5% B	0 min
	5% B	1 min
	20% B	20 min
	70% B	6 min
	100% B	6.5 min
	100% B	8 min
	5% B	8.5 min
	5% B	10 min

Table S4. Parameter for HPLC-MS analysis of Partial hydrolysis of the natural product champacyclin (1a).

Table S5. Parameters for GC/MS analysis of amino acids and dipeptides.

Parameters for GC/MS Analysis		
GC Column	Chirasil [®] -(L)-Val (Agilent CP7495, Waldbronn Germany), 200 °C, 25 m,	
	250 μm ×0.12 μm	
Temperature Program	140 °C (10 min isothermal), 190 °C, 5 °C/min (33min isothermal), 195 °C,	
N-trifluoroacetyl methyl ester:dipeptides	5 °C/min (20 min isothermal)	
Temperature Program	70 °C (5 min isothermal), 100 °C, 2 °C/min, 190 °C, 3.5 °C/min	
N-pentafluoropropionic 2-propyl ester: amino acids	(10 min isothermal)	
Gas Chromatograph	GC/MS 5975C (Agilent Technologies, Waldbronn, Germany)	
Mass Spectrometer (GC-MS)		
Scan	Full-Scan, 50–800 <i>m/z</i>	
Heater/MSD-Transfer Line	300 °C/280 °C	
Flow	1.2 mL/min, 40.3 cm/s with He as carrier gas	
PCI-Mode	Energy: 105.2 eV, Emission: 182 µA,	
	MS-Source: 300 °C, MS Quad: 150 °C	
	Collision gas: Methane with flow rate 19%	
EI-Mode using CI-Source	Energy: 105.2 eV, Emission: 250 µA,	
	MS-Source: 300 °C, MS Quad: 150 °C	
	Collision gas: Methane with flow rate 0%	
Single Ion Monitoring	SIM was used with ions represented in all	
(SIM)	N-trifluoroacetyl methyl ester dipeptide derivatives	
for Higher Sensitivity	#1: <i>m</i> /z 389 [M + H] ⁺ (Phe-Xle/Xle-Phe)	
	#2: <i>m</i> / <i>z</i> 313 [M + H] ⁺ (Ala-Xle/Xle-Ala)	
	#3: m/z 355 [M + H] ⁺ (Xle-Xle)	

Amino Acids	Peak Areas (Absolute)	Ratio/Racemization Factor (%)
(N-Pentafluoropropionic	RTE Integrator	
2-Propyl Ester Derivatives)		
(D)Ala:(L)Ala	64,586,729: <i>n.d.</i>	n.d.
(AlloD)Ile:(L)Ile	40,548,258:114,743,611	1:2.8
(D)Leu:(L)Leu	92,808,033:5,641,417	93.9%:6.1%
(D)Phe:(L)Phe	97,483,637:3,178,567	96.8%:3.2%
$_{(D)}Lys:_{(L)}Lys$	3,493,779:69,688,561	95%:5.0%
$(D) = J \sim (D) = J^{-1}$	nd - not determined	

Table S6. Peak areas and relative Quantification of the *N*-pentafluoropropionic 2-propyl ester derivatives of the total hydrolysate of (**1a**) as shown in Figure S13.

Figure S1. LC-MS analysis. (A) Total ion chromatogram (TIC). (B) Extracted ion chromatogram (EIC) of (1a) (m/z 912-914) (C) Mass spectrum for the EIC as shown in (B).



Figure S2. In-source-fragmentation- MS^n -experiments for (1a). (A) SID for (1a) with 70 eV. MS^2 for the 185 Da isobaric ion fragment y_2/b_7y_3 with the ESI-(+)-Ion-Trap (CE 15 eV). (B) MS^3 on 86 Da ion with ESI-(+)-Ion-Trap (CE 20 eV) for the isobaric ions y_2/b_7y_3 . Formation of 69 Da Ion is indicative for an Ile-residue. (C) Possible mechanism for the subsequent MS^n -fragmentation series suggesting at least one Ile at position 6 and/or 8.



Figure S3. HR-ESI-(+)-SID-Orbitrap-MS of (**A**) natural product (**1a**) with SID at 65eV (**B**) Head-to-tail cyclization $N^{\alpha}_{(L)}Lys^{1}$ -CO-_(*AlloD*)Ile⁸ in (**1b**) (**C**) Head-to-side-chain cyclization $N^{\zeta}_{-(L)}Lys$ -CO-_(*AlloD*)Ile⁸ in (**2**). Note: the relative abundance for the b₁ Ion m/z 129 [M + H]⁺ is dramatically decreased in (**C**). Thus is indicative that the natural product in A (**1a**) is head-to-tail cyclized.







Figure S5. ¹H-(PRESAT)-NMR of (1a) in d_6 -DMSO at 600 MHz. PRESAT was used for water suppression.





Figure S6. 1 H- 13 C-HMQC of (**1a**) in *d*₆-DMSO at 600 MHz.

Figure S7. HMQC-TOCSY (spin lock 80 ms) of (**1a**) in d_6 -DMSO at 600 MHz.





Figure S8. 1 H- 13 C-HMBC of (1a) in d_{6} -DMSO at 600 MHz.

Figure S9. 1 H- 1 H-COSY of (1a) in d_{6} -DMSO at 600 MHz.





Figure S10. ¹H-¹H-NOESY (mixing time 100 ms) of (1a) in d_6 -DMSO at 600 MHz.

Figure S11. ¹H-¹H-TOCSY (spin lock 60 ms) data of (**1a**) in d_6 -DMSO at 600 MHz.



Figure S12. HPLC-ESI-(+)-MS analysis of partial hydrolysate of (1a) after 7 h at 110 $^{\circ}$ C with 6 M HCl. (A) EICs for dipeptides, (B) EICs for tripeptides (C) EIC for tetrapeptides. Note: Absolute stereochemistry and constitution of dipeptides was assigned by GC/MS analysis. This analysis shows the status of the hydrolysis reaction, required for subsequent derivatization and analytics. Formation of lysine-dipeptides could not be observed.



Figure S13. Chiral GC-MS analysis of total hydrolysate of (**1a**) on a Chirasil[®]-(L)-Val column. Amino acids were analyzed as their *N*-pentafluoropropionic 2-propyl esters and identified by their $[M + H]^+$ -Ions and their fragmentation products using positive chemical ionization (PCI) with methane as reagent gas.



Figure S14. Chiral GC-PCI-MS analysis on a Chirasil[®]-(L)-Val column of Xle amino acid standards as *N*-pentafluoropropionic 2-propyl esters and identified by their $[M + H]^+$ -Ions using positive chemical ionization (PCI) with methane as reagent gas.



Figure S15. PCI-MS spectra of *N*-trifluoroacetyl- $_{(L)}$ Ile- $_{(D)}$ Ala-methyl ester found in partial hydrolysate of (**1a**) at $R_t = 19.97$ min on a Chirasil[®]-(L)-Val column.





Figure S16. EI-MS spectra of *N*-trifluoroacetyl-_(L)Ile-_(D)Ala-methyl ester found in partial hydrolysate of (**1a**) at $R_t = 19.97$ min on a Chirasil[®]-(L)-Val column.

Figure S17. PCI-MS spectra of *N*-trifluoroacetyl-_(L)Ile-_(L)Ile-methyl ester found in partial hydrolysate of (**1a**) at $R_t = 22.5$ min on a Chirasil[®]-(L)-Val column.



Figure S18. EI-MS spectra of *N*-trifluoroacetyl-_(L)Ile-_(L)Ile-methyl ester found in partial hydrolysate of (**1a**) at $R_t = 22.5$ min on a Chirasil[®]-(L)-Val column.



Figure S19. PCI-MS spectra of *N*-trifluoroacetyl- $_{(D)}$ Leu- $_{(L)}$ Ile-methyl ester found in partial hydrolysate of (**1a**) at $R_t = 24.6$ min on a Chirasil[®]-(L)-Val column.



Figure S20. EI-MS spectra of *N*-trifluoroacetyl- $_{(D)}$ Leu- $_{(L)}$ Ile-methyl ester found in partial hydrolysate of (**1a**) at $R_t = 24.6$ min on a Chirasil[®]-(L)-Val column.



Figure S21. PCI-MS spectra of *N*-trifluoroacetyl- $_{(L)}$ Ile- $_{(D)}$ Phe-methyl ester found in partial hydrolysate of (**1a**) at $R_t = 46.68$ min on a Chirasil[®]-(L)-Val column.





Figure S22. EI-MS spectra of *N*-trifluoroacetyl-_(L)Ile-_(D)Phe-methyl ester found in partial hydrolysate of (**1a**) at $R_t = 46.68 \text{ min on a Chirasil[®]-(L)-Val column.}$

Figure S23. PCI-MS spectra of synthetic *N*-trifluoroacetyl-Leu-Leu-methyl ester.





Figure S24. EI-MS spectra of synthetic *N*-trifluoroacetyl-Leu-Leu-methyl ester.

Figure S25. PCI-MS spectra of synthetic *N*-trifluoroacetyl-Ile-Ile-methyl ester.





Figure S26. EI-MS spectra of synthetic *N*-trifluoroacetyl-Ile-Ile-methyl ester.







Figure S28. EI-MS spectra of synthetic *N*-trifluoroacetyl-Leu-Ile-methyl ester.







Figure S30. EI-MS spectra of synthetic *N*-trifluoroacetyl-Ile-Leu-methyl ester.

Figure S31. PCI-MS spectra of synthetic *N*-trifluoroacetyl-Ala-Leu-methyl ester.





Figure S32. EI-MS spectra of synthetic *N*-trifluoroacetyl-Ala-Leu-methyl ester.

Figure S33. PCI-MS spectra of synthetic *N*-trifluoroacetyl-Leu-Ala-methyl ester.





Figure S34. EI-MS spectra of synthetic *N*-trifluoroacetyl-Leu-Ala-methyl ester.

Figure S35. PCI-MS spectra of synthetic *N*-trifluoroacetyl-Ala-Ile-methyl ester.





Figure S36. EI-MS spectra of synthetic *N*-trifluoroacetyl-Ala-IIe-methyl ester.

Figure S37. PCI-MS spectra of synthetic *N*-trifluoroacetyl-Ile-Ala-methyl ester.





Figure S38. EI-MS spectra of synthetic *N*-trifluoroacetyl-Ile-Ala-methyl ester.

Figure S39. PCI-MS spectra of synthetic *N*-trifluoroacetyl-Leu-Phe-methyl ester.





Figure S40. EI-MS spectra of synthetic *N*-trifluoroacetyl-Leu-Phe-methyl ester.

Figure S41. PCI-MS spectra of synthetic *N*-trifluoroacetyl-Phe-Leu-methyl ester.





Figure S42. EI-MS spectra of synthetic *N*-trifluoroacetyl-Phe-Leu-methyl ester.

Figure S43. PCI-MS spectra of synthetic *N*-trifluoroacetyl-Ile-Phe-methyl ester.





Figure S44. EI-MS spectra of synthetic *N*-trifluoroacetyl-Ile-Phe-methyl ester.







Figure S46. EI-MS spectra of synthetic *N*-trifluoroacetyl-Phe-Ile-methyl ester.