



Liberty Blue™

Automated Microwave Peptide Synthesizer





Synthesize peptides more efficiently than ever before.

The Liberty Blue™ automated microwave peptide synthesizer features a 4-minute cycle time along with a 90% solvent reduction, based on High Efficiency Solid Phase Peptide Synthesis (HE-SPPS), developed in 2013 and CarboMAX™ methodology, developed in 2018. This system is utilized in hundreds of laboratories worldwide and provides unparalleled peptide quality, based on its unique methodology and use of microwave energy. The Liberty Blue features the latest in engineering for fluidic deliveries, true internal temperature feedback control, and software control with 21 CFR Part 11 compliance.



1. Amino Acid Bottles

- 27 amino acid positions
- Up to 120-mL capacity per position
- Utilizes Flex-Add™ critical reagent delivery system (patented¹)

2. Fiber Optic

- True internal fiber-optic temperature control

3. Reaction Vessels

- Only two vessel sizes for 0.005 to 5.0 mmol synthetic scales
- Replaceable reaction vessel frits reduce consumable costs

4. Microwave Reactor

- Fastest and most controlled technology for peptide synthesis at elevated temperature
- Technology for applying microwave energy to both the coupling and deprotection (patented²)

5. Solvent-resistant Composite Covers

- Maintains instrumentation finish and laboratory appearance



2014 R&D 100 Award Winner

Also Features

Reagent Bottles

- Optional pressure rated, stainless steel bottles incorporating visual liquid level detection. Available in 2 L, 5 L, 10 L, and 20 L sizes (GL45 cap size).

LED Lights

- Visual indicator of the current system status and operation
- Assist with setup of the instrument

Integrated Camera

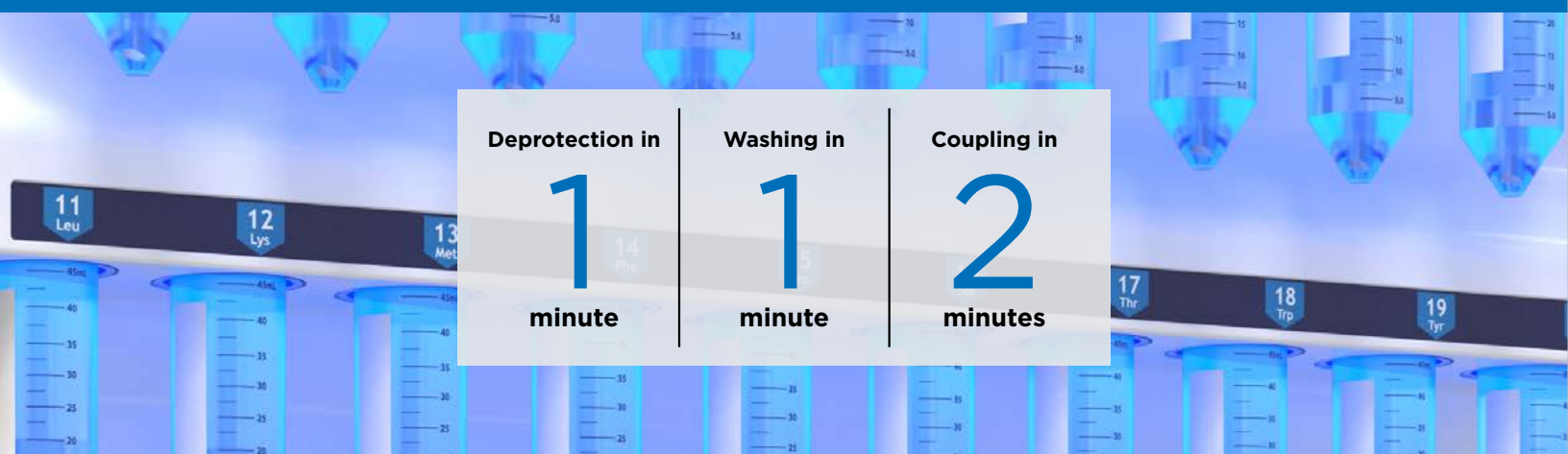
- The fully integrated camera allows researchers the ability to monitor microwave peptide synthesis as never before. This optional feature provides complete visibility of the reaction vessel at any time and is beneficial for optimization of synthetic methods and system troubleshooting.

Compact Footprint

- 20"W x 18"D x 30"H (51 cm x 46 cm x 76 cm) with bottles
- Fits in standard fume hoods (minimal benchtop space)

¹EP2823884A2, CA2854638A1, CN104231034A, EP2823884A3, US20140374238

²US8314208



Access to your peptides in less than a day.

CEM developed an improved methodology for microwave SPPS, based on the use of higher temperature carbodiimide-based coupling at 90 °C, along with the elimination of all washing after each coupling step.¹ These insights led to significant time and solvent savings, while providing peptides of incredibly high purity. The instrumentation design used on the Liberty Blue is also a critical component of HE-SPPS to eliminate inefficient internal fluidic and reagent path cleaning that increases waste generated. This synthesizer is now used in hundreds of laboratories worldwide and provides very fast, high-purity peptides with incredibly low waste generated.

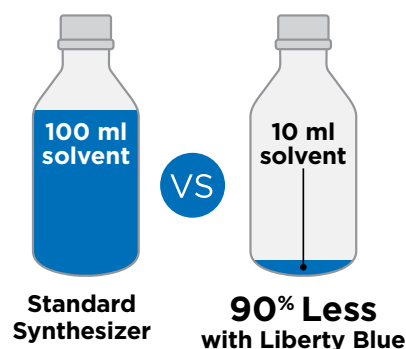
Improve Peptide Purity with the Liberty Blue

Peptide	Sequence	Crude Purity CarboMAX (%)	Synthesis Time	Total Waste
Thymosin	SDAAVDTSEITTKDLKEKKEVVEAEN	75	2 hours 12 minutes	458 mL
GRP	VLPAGGGTVLTKMYPRGNHWAVGHLM	74	2 hours 21 minutes	728 mL
Bivalirudin	fPRPGGGGNGDFEEIPEEYL	82	1 hours 46 minutes	546 mL
1-34 ^p TH	SVSEIQLMHNLGKHLNSMERVEWLRKKLQDVHNF	85	3 hours	916 mL
35-55 ^{MOG}	MEVGWYRSPFSRVVHLYRNGK	91	1 hours 56 minutes	584 mL
Magainin 1	GIGKFLHSAGKFGKAFVGEIMKS	79	2 hours	678 mL
Dynorphin A	YGGFLRRIRPKLKWDNQ	82	1 hours 36 minutes	480 mL
Liraglutide	HAEGTFTSDVSSYLEGQAAK (γ-Glu-palmitoyl) EFLAWLVRGRG	88	2 hours 31 minutes	518 mL

The 4-minute cycle time of the Liberty Blue system is not limited to easily synthesized peptides. These pre-optimized methods can be used to routinely synthesize a wide range of peptides with varying degrees of difficulty including: incorporation of non-natural residues, branching, cyclization, phosphopeptides, glycopeptides, peptoids, PNA, and more.

Reduced Solvent Use

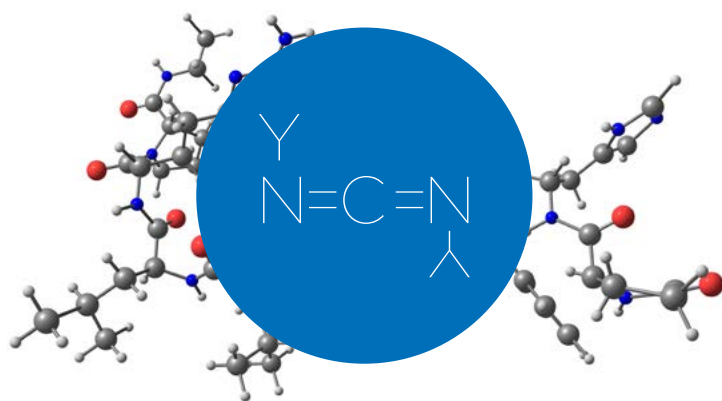
Pre-optimized washing and synthetic protocols combined with highly accurate reagent delivery contribute to a 90% solvent reduction from standard peptide synthesizers. The Liberty Blue's superior system design with independent reagent delivery lines minimizes calibration, cleaning, and maintenance needs, therefore reducing the overall solvent use.



Improve purity and reduce epimerization.

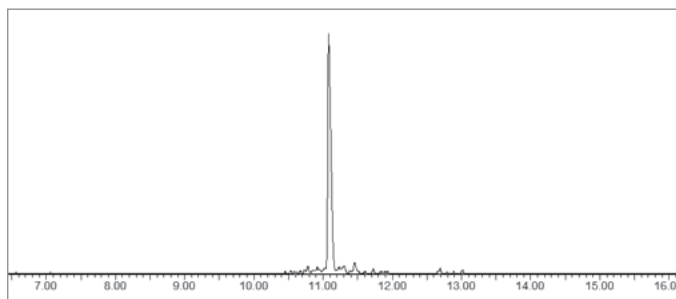
Coupling with carbodiimide chemistry has significant benefits over aminium/phosphonium salts (ex. HATU, HCTU, PyBOP) at elevated temperature. This includes major reductions of epimerization for cysteine and γ -lactam formation of arginine. However, activation by carbodiimides is relatively slow. We developed an improved coupling process, which allows for faster formation of the key O-acylisourea intermediate by increasing the amount of carbodiimide to 2 equivalents relative to the amino acid.²

By forming more activated amino acid faster than standard carbodiimide chemistry, the subsequent coupling will happen quicker. This provides not only a faster coupling time, but also less epimerization from less time as a sensitive activated amino acid. This methodology, termed CarboMAX, is patent pending and exclusively licensed for use on CEM's peptide synthesizers.



Reduced Epimerization (ex. Liraglutide)

Epimer	DIC/Oxyma (%)	CarboMAX (%)
D-Asp	0.23	0.31
D-Ala	0.33	0.25
D-Arg	0.29	0.2
D-Glu	0.39	0.3
D-His	N/A	N/A
D-Ile	< 0.10	< 0.10
L-allo Ile	< 0.10	< 0.10
D-allo Ile	< 0.10	< 0.10
D-Leu	0.17	0.13
D-Lys	< 0.10	0.1
D-Phe	0.2	0.16
D-Ser	0.16	0.12
D-Thr	< 0.10	< 0.10
L-allo Thr	< 0.10	< 0.10
D-allo Thr	< 0.10	< 0.10
D-Trp	0.24	< 0.10
D-Tyr	0.12	0.11
D-Val	< 0.10	< 0.10



UPLC-MS Analysis of crude Liraglutide (CarboMAX)

¹ J. Collins, K. Porter, S. Singh and G. Vanier, "High-Efficiency Solid Phase Peptide Synthesis (HE-SPPS)," *Org. Lett.*, vol. 16, pp. 940-943, 2014.

² Patent Pending: US15686719; EP17188963.7

Flex-Add Technology

Liberty Blue's Flex-Add™ technology utilizes pressure to measure reagent volume. This technology does not rely on optical sensors to control the amount of reagent added, and therefore, eliminates fixed sample loops common to many peptide synthesizers. Without sample loops, the Liberty Blue now has the flexibility to add exactly the volume desired and provides virtually infinite volume accessibility. Flex-Add technology is both accurate and precise over a large volume range, allowing for both small and large-scale syntheses to be performed on the system seamlessly.

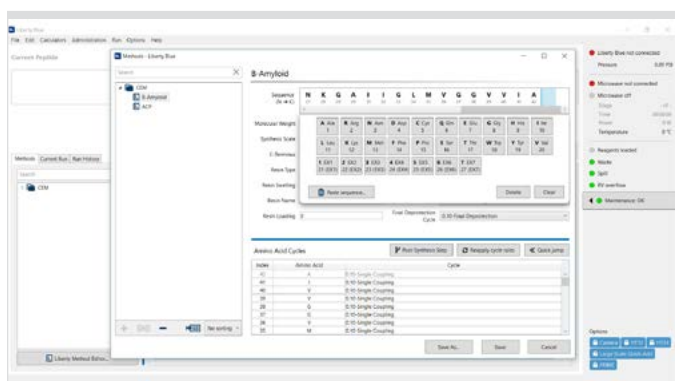
Verification Table

Requested Volume (mL)	Delivered Volume (mL)	Error (%)
0.5	0.495	-1.1%
1.0	0.992	-0.8%
1.5	1.485	-1.0%
3.0	3.037	1.2%
4.0	4.038	0.9%
8.0	7.960	-0.5%



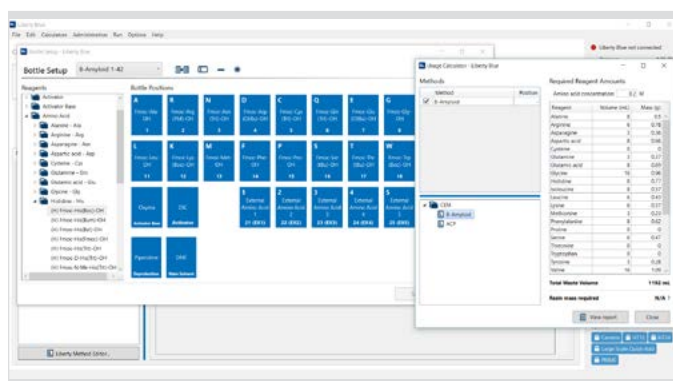
Flexible, simple software for a wide range of applications.

- Automated programming of standard and complex peptides, as well as post-synthetic modifications
- Fully customizable methods and cycles for the full synthesis scale range
- Equipped with user level access with full password protection and complete audit trail traceability
- Method import reduces programming error and allows easy access to niche chemistries
- Self diagnostics, maintenance tracking, and automated cleaning routines ensure smooth operation of the system



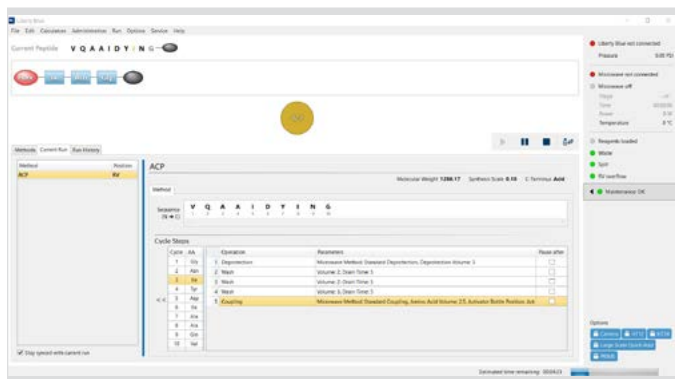
Customize Peptide Sequences

Create new sequences with the method editor, or import from another source. The Liberty Blue method editor will automatically make suggestions for pre-optimized default cycles, but users may incorporate any default or custom chemistry cycles.



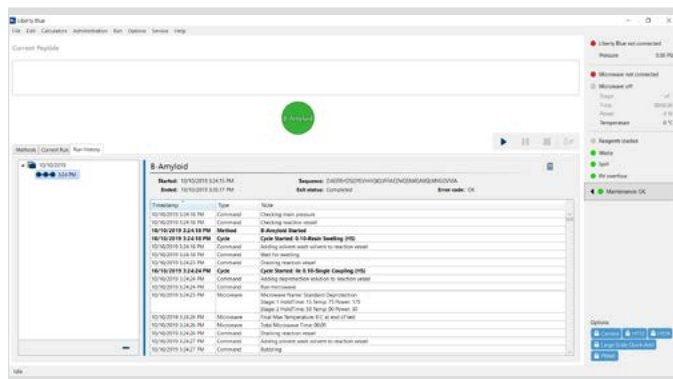
Bottle Setup and Calculators

Choose to use the default bottle setup for amino acids and reagents, or arrange a new setup for custom sequences and applications. Amino acids and reagents can be assigned to any location within the primary 27 bottle positions, or external reagent positions. Use the software to calculate the weights and volumes needed for all reagents, making preparation a breeze.



Synthesize

A synthesis can be started from the beginning, or at any cycle and step desired. While a synthesis is running, temperature and method details can be viewed and edited in real-time.



Run History

The run data, including temperature and method details, from any completed synthesis may be viewed and exported in a Run History report. Keeping with 21 CFR Part 11 compliance, this run data cannot be manipulated or deleted.



HT Resin Loader

The HT resin loader is a modular, high-throughput option ideal for scale-up, multi-user labs, Alanine scans, or library synthesis. With the ability to synthesize up to 24 peptides sequentially, the HT12 and HT24 resin loader modules significantly increase any lab's throughput. The Liberty Blue is easily comparable to conventional high-throughput systems, but with considerably better purity and less waste.

0.1 mmol Scale Cycle	Volume	Time
Deprotection	3 mL	1 minute
Wash	7 mL	1 minute
Coupling	6 mL	2 minutes
Total	16 mL	4 minutes
Transfer/Peptide	86 mL	14 minutes

For (24) 20-mer Peptides:

Total Crude Peptide Mass = ~6 g

Total Volume = 9.7 L

Total Synthesis Time = ~37.5 h

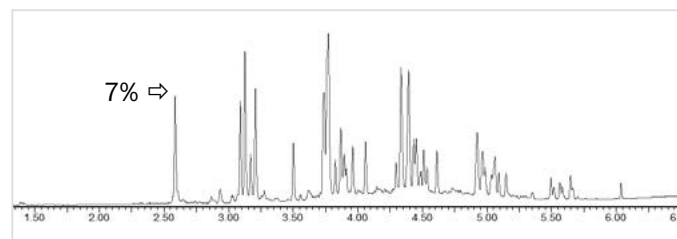
Razor[®]

Rapid Parallel Peptide Cleavage at Elevated Temperature

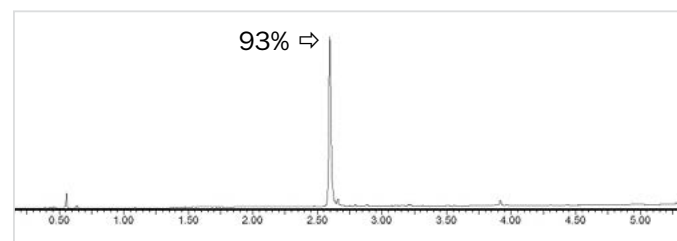
Cleave up to 12 peptides 85% faster than conventional cleavage methods. The Razor features a compact design that easily fits in a fume hood and allows for temperature at $\pm 1^\circ\text{C}$ control for up to 12 different vessels. Cleavage is typically complete in 30 minutes for standard peptides and allows for draining into a centrifuge tube for subsequent centrifugation. This system is ideal for both single peptides and large batches.

- Elevated temperature cleavage block with $\pm 1^\circ\text{C}$ control
- Valve control for independently draining each vessel
- Convenient tray for holding & transporting each collection tube
- Compact design that easily fits in standard fume hoods

Peptide: Fmoc-YGRKKRRQRRR
Conditions: TFA/TIS/ H_2O /DDT



30 minutes, room temperature



30 minutes, Razor



Peptide Synthesis Reagents

CEM offers a complete library of standard and unique high-quality Fmoc amino acids, polystyrene (PS) and PEG-PS resins, and the powerful Oxyma activator. Using CEM's unique, high-quality reagents provides the highest purity peptides with CEM's innovative methodology and instrumentation.



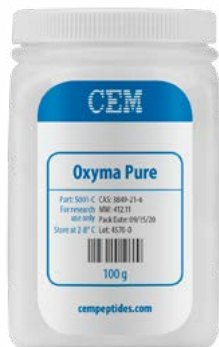
Amino Acids

CEM's Fmoc amino acids are the highest quality available on the market and provide the best purities and yields possible for peptide synthesis. All amino acids are 100% fully synthetic and rigorously tested to guarantee purity. All products are available as ready-to-use pre-weighed quantities, or in bulk quantities up to 1kg.



Resins

Choose from a variety of high-quality resins, including pre-loaded Wang, Rink, Cl-TCP(Cl), and Cl-MPA linkers on CEM's PEG-PS ProTide™ or PS core resins. Resins are available in 1 g, 5 g and 25 g sizes.



Reagents

Oxyma Pure used with DIC produces peptides with increased yield and decreased epimerization, when used as an alternative to HOBt. This safe, low cost, non-explosive auxiliary nucleophile works with carbodiimide coupling strategies to provide the best results for a peptide synthesis.

Visit the reagents store at cem.com/spps-chemicals



“The Liberty Blue is fast, reliable, and makes difficult peptides in high purity. We are very satisfied with the Liberty Blue and would highly recommend it for both protein synthesis and methodological development.”

Prof. Fernando Albericio

Group Leader Chemistry & Molecular Pharmacology
Institute for Research in Biomedicine (IRB)
University of Barcelona

“We are very satisfied with the Liberty Blue system. The system is one of the best peptide synthesizers available today for research and medicinal chemists...*HE*-SPPS using Liberty Blue, features overwhelming speed.”

Dr. Hajime Hibino

Research Chemist
Peptide Institute

“The Liberty Blue system is unquestionably the best peptide synthesizer available today and represents the major workhorse for PeptiDream (12 systems). It is highly recommended to any company looking to synthesize peptides chemically, specifically those containing nonstandard amino acids.”

Dr. Patrick C. Reid

President and Director
PeptiDream Inc.

“The Liberty Blue is the best peptide synthesizer on the market. It's synthesis speed and purity are unmatched. Using the Liberty Blue has also made our subsequent purifications easier, which is a major benefit.”

Prof. Anna Maria Papini

Coordinator of Interdepartmental Laboratory
PeptLab



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