CLAIMS

1. A method for linearly expanding a peptide comprising:

(a) contacting the peptide with a binding element that interacts with a terminal amino acid or a terminal amino acid derivative of the peptide to form an element-peptide complex;

(b) tethering the element-peptide complex to a substrate; and

(c) cleaving the element-peptide complex from the peptide resulting in an element-amino acid complex bound to the substrate,

wherein the element-amino acid complex comprises a linker that provides an attachment point for a further element-peptide complex.

2. The method of claim 1, further comprising (d) attaching the linker to the binding element of the element-amino acid complex.

3. The method of claim 1, wherein the further element-peptide complex is generated by contacting the peptide with a further binding element that interacts with a next amino acid of the peptide.

4. The method of claim 1, further comprising repeating (a) through (c) one or more times.

5. The method of claim 4, wherein (a) through (c) are repeated for all amino acids of the peptide.

6. The method of claim 1, wherein, prior to (a), the peptide is affixed to a substrate.

7. The method of claim 6, wherein the substrate comprises a functionalized surface.

8. The method of claim 1, further comprising (d) contacting the next, now terminal amino acid of the peptide with a further binding element to form the further element-peptide complex.

9. The method of claim 8, further comprising, (e) tethering the further element-peptide complex to the linker of the element-amino acid complex of (c).

10. The method of claim 9, further comprising, (f) cleaving the further element-peptide complex from the peptide, thereby providing linked element-amino acid complexes bound to the substrate, wherein the distance between the amino acids has been increased.

11. The method of claim 1, wherein the binding element comprises a terminal amino acid reactive group, a tetherable group, and the linker or an attachment point for the linker.

12. The method of claim 11, wherein the terminal amino acid reactive group is an isothiocyanate, phenyl isothiocyanate (PITC), an isocyanate, an acyl azide, an N-hydroxysuccinimide ester (NHS ester), a sulfonyl chloride, an aldehyde, a glyoxal, an epoxide, a carbonate, an aryl halide, an imidoesters, a carbodiimide, an anhydride, or a fluorophenyl ester.

13. The method of claim 1, wherein the linker is a charged linker.

14. The method of claim 1, further comprising detecting the amino acid of the element-amino acid complex.

15. The method of claim 14, wherein detecting the amino acid of the element-amino acid complex comprises contacting the element-amino acid complex with an element-amino acid complex binder and detecting the element-amino acid complex binder bound to the element-amino acid complex.

16. The method of claim 14, wherein detecting the amino acid of the element-amino acid complex comprises use of a nanopore.

17. The method of claim 1, further comprising performing (a) through (c) on one or more additional peptides, thereby linearly expanding the two or more peptides.

18. The method according to claim 17, wherein, prior to (a), the two or more peptides are independently affixed to the substrate.

19. The method of claim 1, wherein the linker is configured to couple two or more element-amino acid complexes.

20. An element-amino acid complex binder comprising:

(a) a binder that binds to one or a subgroup of the 20 natural proteinogenic amino acids complexed with a binding element;

(b) a binder that binds to one or a subgroup of post-translationally modified amino acids complexed with the binding element; or

(c) a binder that binds to a derivative of (a) or (b).