CLAIMS:

1. An encoded chemical library microbead, which microbead has immobilized thereon and/or therein:

(i) an encoding tag which comprises DNA; and

(ii) a target assay system reporter moiety, wherein the reporter moiety exists in a first state in the absence of activity against the target and in a second state in the presence of said activity, and wherein said microbead further comprises a clonal population of one or more chemical structure(s) releasably linked thereto by a cleavable linker and encoded by said tag;

wherein:

(a) the cleavable linker is a self-immolative linker comprising a cleavage moiety and a self-immolative moiety (SIM);

(b) the cleavage moiety comprises a peptide, and wherein the chemical structure(s) can be released by contact with a peptidase;

(c) the cleavable linker is scarless, such that the chemical structure(s) can be cleaved from the microbead in a form in which they are completely or substantially free of linker residues;

(d) the target is an enzyme;

(e) wherein the target assay system reporter moiety is a substrate of the enzyme.

~~2. The microbead of claim 1, wherein said encoding tag also encodes the target assay system reporter moiety.~~

~~3. The microbead of claim 1 or claim 2, wherein said encoding tag also encodes the target.~~

~~4~~2. The microbead of ~~any one of the preceding claims~~claim 1, wherein the chemical structures are present at a loading of between 1 and 10^{13} molecules per microbead.

~~5. The microbead of any one of the preceding claims, wherein the microbead comprises non-DNA tags, non-RNA tags, modified nucleic acid tags, peptide tags, light-based barcodes~~

~~(e.g. quantum dots), RFID tags, reporter chemicals linked by click chemistry and mass spectrometry-decodable tags.~~

~~6. The microbead of any one of the preceding claims, wherein the chemical structures are releasably linked to the microbead by a cleavable linker.~~

~~7. The microbead of claim 6, wherein the linker is scarless, such that the chemical structure(s) can be cleaved from the microbead in a form in which they are completely or substantially free of linker residues.~~

~~8. The microbead of any one of the preceding claims, wherein the chemical structures are indirectly or directly linked to the microbead.~~

~~9. The microbead of any one of the preceding claims, wherein the target assay system reporter moiety is substrate and chemical structures which function as chromophore coatings can be identified by decoding the tags of microbeads having chromatic reporter moieties.~~

~~10. The microbead of any one of claims 1-8, wherein the target assay system reporter moiety is substrate and chemical structures which function as a substrate coating can be identified by decoding the tags of microbeads having coated reporter moieties.~~

~~11. A chemical library microcompartment which contains a microbead as defined in any one of the preceding claims and a solvent, for example an aqueous solvent.~~

3. The microbead of claim 1 or 2, wherein the target assay system reporter moiety is fluorescent and chemical structures having quenching activity can be identified by decoding the tags of microbeads having reporter moieties in the quenched state.

4. A chemical library microcompartment which contains a microbead as defined in any one of the preceding claims and a solvent, wherein the microcompartiment is a microdroplet of a water-in-oil emulsion having a surfactant-stabilized interface.

5. The microcompartment of claim 4 which further contains a cleaving agent for releasing the chemical structure(s) from the microbead into solution.

6. The microcompartment of claim 4 or 5 in which the chemical structure(s) have been released from the microbead to produce free, tagless chemical structure(s) (TCSs) dissolved in the solvent and spatially associated with the encoding tag.

~~12~~7. An encoded chemical library (ECL) comprising a plurality of microcompartments as defined in ~~claim 11~~claims 4-6, wherein each of the microcompartments contains a different chemical structure.

~~13~~8. The ECL of claim ~~12~~7, which comprises a number *n* of different clonal populations of chemical structures, each clonal population being confined to *n* discrete library microcompartments.

9. The ECL of claim 8, wherein $n = 10^6$ to 10^9.

~~14~~10. A method for screening an ECL as defined in ~~either of claims 12 or 13~~any one of claims 7-9 for chemical structures having activity against a target, the method comprising the steps of:

(a) releasing the chemical structures from the microbeads to produce a plurality of free, tagless chemical structures (TCSs) dissolved in the solvent and contained within microcompartments together with the microbeads from which they were released, such that a spatial association between each TCS and its encoding tag is maintained;
(b) assaying the TCSs by incubating the ECL microcompartments of step (b) under conditions such that the state of the reporter moieties immobilized in or on the microbeads contained therein is determined by the level of activity against the target;
(c) releasing the assayed microbeads by opening the microcompartments; and
(d) screening the released and assayed microbeads by determining the state of the reporter moieties, whereby chemical structures having activity against the target

can be identified by decoding the tags of microbeads having reporter moieties in the second state.

~~15. The method of claim 14, wherein step (d) further comprises stopping the incubation, for example by heat denaturation, freezing, addition of inhibitors or breaking of the microcompartments.~~

~~16. The method of claim 15, wherein the microcompartments are broken by centrifugation, sonication and/or filtration or by the addition of solvents and/or surfactants.~~

~~17. The method of any one of claims 14 to 16 further comprising the step of isolating the microbeads released in step (d) during or prior to screening step (e).~~

11. The method of claim 10 wherein step (a) comprises the step of DNA-recorded, synthesis of the chemical structures.

12. The method of claim 10 wherein step (a) comprises the step of split-and-pool nucleic acid-recorded synthesis of the chemical structures.

~~18~~13. The method of any one of claims ~~14 to 17~~10 to 12, wherein the screening step comprises fractionation and/or selection of the released and assayed microbeads via FACS.

~~19. The method of any one of claims 14 to 18, wherein the screening step (e) comprises determining the level of activity against the target by measuring the ratio of reporter moieties in the first state to the second state.~~

~~20. The method of claims 14 to 19, wherein the microbead comprises a clonal population of a plurality of chemical structures and said encoding tag also encodes the loading of the chemical structures, and wherein the screening step (e) comprises determining the level of activity against the target by correlating the loading of the chemical structures with the ratio of reporter moieties in the first state to the second state.~~