CLAIMS

1. A system for producing a serial flow emulsion comprising

(i) an intake system to sequentially transport a plurality of separate samples or portions of samples from a series of sample containers, wherein the intake system comprises

(a) a first source of a first fluid, and a first intake conduit that is in fluid communication between the first source of the first fluid and a first injector conduit when the injector is in a first configuration, and

(b) a second source of a second fluid and a first process conduit that is in fluid communication between the second source of the second fluid and the first injector conduit when the injector is in a second configuration,

wherein the first and second sources of fluid and the first and second fluids are different;

(ii) a process system, wherein the process system comprises a partitioner to generate a plurality of partitions in a continuous phase from each of the samples; and

(iii) an injector positioned between the intake system and the process system, wherein the injector ~~is~~ comprises the first injector conduit, configured to be in fluid communication with the intake system when the injector is in the first configuration, or to be in fluid communication with the process system when the injector is in the second configuration, but not both simultaneously, and a second injector conduit, different from the first injector conduit, wherein the second injector conduit is configured to be in fluid communication with the process system when the injector is in the first configuration and to be in fluid communication with the intake system when the injector is in the second configuration, but not both simultaneously.

2. The system of claim 1 further comprising a reactor fluidly connected to the partitioner to initiate or modulate one or more reactions in one or more of the partitions.

3. The system of claim 2 wherein the reactor comprises a conduit fluidly connected to the partitioner through which partitions flow, wherein the reactor comprises at least two different thermal zones, and wherein the conduit repeatedly contacts the at least two different thermal zones.

4. The system of claim 2 further comprising a detector fluidly connected to the reactor to detect a characteristic of one or more of the partitions.

5. The system of claim 4 wherein the detector comprises at least one of

(a) an optical restriction that limits the amount of electromagnetic radiation that reaches a detection element in the detector from an interrogation region in the detector where partitions are detected to less than 10% of the electromagnetic radiation that would reach the detection element without the optical restriction;

(b) an interrogation region comprising a conduit wherein partitions flow in single file through the conduit, and wherein the cross-sectional area of the conduit is less than 90% of the average spherical cross-sectional area of the partitions;

(c) an excitation source to provide electromagnetic radiation to the interrogation region and a system to provide lock-in amplification of the excitation source;

(d) a system to separate partitions prior to the interrogation region of the detector.

6. The system of claim 4 wherein the detector comprises at least two of

(a) an optical restriction that limits the amount of electromagnetic radiation that reaches a detection element in the detector from an interrogation region in the detector where partitions are detected to less than 10% of the electromagnetic radiation that would reach the detection element without the optical restriction;

(b) an interrogation region comprising a conduit wherein partitions flow in single file through the conduit, and wherein the cross-sectional area of the conduit is less than 90% of the average spherical cross-sectional area of the partitions;

(c) an excitation source to provide electromagnetic radiation to the interrogation region and a system to provide lock-in amplification of the excitation source;

(d) a system to separate partitions prior to the interrogation region of the detector.

7. The system of claim 1 wherein the intake system is configured to provide a sample comprising a first fluid to the process system and the process system is configured to provide a second fluid to the system after the first fluid, and wherein at least 80, 90, 95, 96, 97, 98, 99, 99.5, 99.9, 99.99% surfaces of all components of the system that come into contact with the sample or portions of the sample have greater affinity for the second fluid than for the first fluid.

8. A method comprising

(i) transporting a first sample comprising a first dispersed phase from a first sample container into an intake system, wherein the intake system comprises

(a) a first source of a first fluid, and a first intake conduit that is in fluid communication between the first source of the first fluid and a first injector conduit when the injector is in a first configuration, and

(b) a second source of a second fluid and a first process conduit that is in fluid communication between the second source of the second fluid and the first injector conduit when the injector is in a second configuration,

wherein the first and second sources of fluid and the first and second fluids are different;

(ii) flowing the first sample from the intake system to an injector that is fluidly connected to the injection system but not to a process system wherein the injector comprises the first injector conduit, configured to be in fluid communication with the intake system when the injector is in the first configuration, or to be in fluid communication with the process system when the injector is in the second configuration, but not both simultaneously, and a second injector conduit, different from the first injector conduit, wherein the second injector conduit is configured to be in fluid communication with the process system when the injector is in

the first configuration and to be in fluid communication with the intake system when the injector is in the second configuration, but not both simultaneously;

(iii) repositioning the injector so that it is fluidly connected to the process system but not the intake system;

(iv) flowing the first sample from the injector into the process system;

(v) partitioning the first sample into a plurality of partitions of the first dispersed phase in a continuous phase;

(vi) repositioning the injector so that it is fluidly connected to the injection system but not to the process system;

(vii) transporting a second sample comprising a second dispersed phase from a first ~~second~~ sample container into the intake system and into the injector;

(viii) repositioning the injector so that it is fluidly connected to the process system but not the intake system;

(ix) flowing the second sample from the injector into the process system; and

(x) partitioning the second sample into a plurality of partitions of the second dispersed phase in the continuous phase.

9. The method of claim 8 further comprising flowing the partitions through a detector fluidly connected to the reactor to detect one or more of the partitions.

10. The method of claim 9 wherein the detector comprises at least one of

(a) an optical restriction that limits the amount of electromagnetic radiation that reaches a detection element in the detector from an interrogation region in the detector where partitions are detected to less than 10% of the electromagnetic radiation that would reach the detection element without the optical restriction;

(b) an interrogation region comprising a conduit wherein partitions flow in single file through the conduit, and wherein the cross-sectional area of the conduit is less than 90% of the average spherical cross-sectional area of the partitions;

(c) an excitation source to provide electromagnetic radiation to the interrogation region and a system to provide lock-in amplification of the excitation source;

(d) a system to separate partitions prior to the interrogation region of the detector.

11. The method of claim 9 wherein the detector comprises at least two of

(a) an optical restriction that limits the amount of electromagnetic radiation that reaches a detection element in the detector from an interrogation region in the detector where partitions are detected to less than 10% of the electromagnetic radiation that would reach the detection element without the optical restriction;

(b) an interrogation region comprising a conduit wherein partitions flow in single file through the conduit, and wherein the cross-sectional area of the conduit is less than 90% of the average spherical cross-sectional area of the partitions;

(c) an excitation source to provide electromagnetic radiation to the interrogation region and a system to provide lock-in amplification of the excitation source;

(d) a system to separate partitions prior to the interrogation region of the detector.

12. The method of claim 8 further comprising performing a reaction in at least a portion of the partitions.

13. The method of claim 12 wherein the portion of the partitions comprise at least one nucleic acid per partition, and the reaction is a polymerase chain reaction (PCR).

14. The method of claim 8 wherein the samples comprise a first fluid and the process system provides a second fluid to the system after the first fluid, and wherein at least 80, 90, 95, 96, 97, 98, 99, 99.5, 99.9, 99.99% surfaces of all components of the system that come into contact with the sample or portions of the sample have greater affinity for the second fluid than for the first fluid.

15. The method of claim 14 where the first fluid comprises first or second dispersed phase and the second fluid comprises continuous phase.

~~16. A system comprising a detector for detecting one or more partitions in a flowing series of partitions comprising~~

~~(i) a conduit configured to flow the partitions within the conduit in single file, comprising an interrogation region wherein partitions are detected;~~

~~(ii) a detection element for detecting the electromagnetic radiation emitted by the partitions in the interrogation region, if present; and~~

~~(iii) an optical restriction configured and positioned between the interrogation region and the detection element so that only a portion of the electromagnetic radiation from the interrogation region that can be detected by the detection element is actually detected.~~

~~17. The system of claim 16 wherein the portion of electromagnetic radiation that can be detected due to the optical restriction is less than 10% of the amount that would be detected without the optical restriction.~~

~~18. The system of claim 16 wherein the interrogation region has a cross-sectional area equal to or less than 90% of the average spherical cross-sectional area of the partitions.~~

~~19. The system of claim 16 wherein the interrogation region has a cross-sectional area equal to or less than 50% of the average spherical cross-sectional area of the partitions.~~

~~20. The system of claim 16 further comprising (iv) an excitation source for supplying electromagnetic radiation to the interrogation region.~~

~~21. The system of claim 20 comprising a plurality of excitation sources, each of which supplies electromagnetic radiation to the interrogation region.~~

~~22. The system of claim 21 wherein the excitation source or sources comprises a lock-in amplifier.~~

~~23. The system of claim 16 further comprising a partitioner fluidly connected to the detector, wherein the partitioner is configured to generate partitions of dispersed phase in a continuous phase from a sample, wherein the partitioner is configured to produce partitions of an average volume of 0.05-50 nL.~~

~~24. The system of claim 16 further comprising a partition separation system configured to add a separation fluid to the flow of partitions prior to the interrogation region of the detector.~~

~~25. The system of claim 16 further comprising a partitioner for creating the partitions.~~

~~26. The system of claim 25 further comprising~~

~~(i) an intake system to sequentially transport a plurality of separate samples or portions of samples from a series of sample containers;~~

~~(ii) a process system, wherein the process system comprises the partitioner to generate a plurality of partitions in a continuous phase from each of the samples; and~~

~~(iii) an injector positioned between the intake system and the process system, wherein the injector is configured to be in fluid communication with the intake system, or to be in fluid communication with the process system, but not both simultaneously.~~