enclosure, retaining other selected substances therein and preventing entry of yet other selected substances into the enclosure. The enclosure of the ~~invention~~ disclosure can be employed to release one or more selected substances into an environment external to the enclosure, to allow entry into the enclosure of one or more selected substances from an environment external to the enclosure, to inhibit and preferably prevent entry of one or more selected substances from the external environment into the enclosure, to retain (inhibit or preferably prevent exit) one or more selected substances within the enclosure or a combination of these applications. The hole or aperture size or range of sizes is selected based on the specific application of the enclosure. The term enclosure refer to a space for receiving one or more substances formed at least in part by perforated two-dimensional material, such as a graphene-based material, where one or more substances in the enclosure can exit the enclosure by passage through the perforated two-dimensional material. Similarly, in certain embodiments, one or more substances from the external environment can enter the enclosure by passage through the perforated two-dimensional material. In specific embodiments the external environment is a biological environment, which may be an in vivo biological environment or an in vitro biological environment.

In one aspect, there is provided an enclosure comprising perforated two-dimensional material encapsulating a substance, such that the substance is released to an environment external to the enclosure by passage through the holes in the perforated two-dimensional material.

In embodiments, an enclosure comprises one or more than one sub-compartments each sub-compartment comprising perforated two-dimensional material such that at least a portion of the walls or sides forming the sub-compartment are perforated two-dimensional material. Fluid communication is achieved by selective passage of one or more substance in and/or out of the enclosure or sub-compartment thereof. The fluid may be liquid or gas and includes fluids having entrained gases. Substances may be dissolved or suspended or otherwise carried in a fluid. The fluid can be aqueous. A sub-compartment can be in direct fluid communication with adjacent sub-compartments or the external environment (where adjacent sub-compartments share at least one wall or side). In an embodiment one or more sub-compartments can be in direct fluid communication with adjacent sub-compartments, but not in direct fluid communication with the external environment. At least one sub-compartment in an enclosure is in direct fluid communication with an external environment. An enclosure can have various configurations of sub-compartments. A sub-compartment can have any shape. A sub-compartment may, for example, be spherical, cylindrical or rectilinear In an embodiment, sub-compartments can be nested. In an embodiment, the enclosure can have a central sub-compartment which shares a wall or side with a plurality of surrounding sub-compartments. In an embodiment, sub-compartments may be linearly aligned within the

In another ~~embodiment~~aspect, the ~~invention~~ disclosure provides a method comprising: introducing an enclosure comprising perforated two-dimensional material to a an environment, the enclosure containing at least one substance; and releasing at least a portion of at least one substance through the holes of the two-dimensional material to the environment external to the enclosure. Any enclosure herein can be employed in this method.

In a further aspect, the disclosure provides a method comprising: introducing an enclosure as disclosed herein into an environment, the enclosure containing at least one substance; and releasing at least a portion of at least one substance through the holes of the two-dimensional material to the environment external to the enclosure.

In another aspect, the disclosure provides a method comprising; introducing an enclosure as disclosed herein into an environment; and releasing at least a portion of at least one substance through the holes of the two-dimensional material to the environment external to the enclosure wherein the at least one substance is a substance generated by the cells within the enclosure.

In another ~~embodiment~~aspect, the ~~invention~~ disclosure provides a method comprising: introducing an enclosure comprising perforated two-dimensional material to a environment, the enclosure containing at least one first substance; and migrating a second substance from the environment into the enclosure. In an embodiment, the first substance is cells, a second substance is nutrients and another second substance is oxygen.

The foregoing has outlined rather broadly the features of the present disclosure in order that the detailed description that follows can be better understood. Additional features and advantages of the disclosure will be described hereinafter. These and other advantages and features will become more apparent from the following description.

BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding of the present disclosure, and the advantages thereof, reference is now made to the following descriptions to be taken in conjunction

with the accompanying drawings describing specific embodiments of the disclosure, wherein:

FIG. 1 shows an illustrative schematic demonstrating the thickness of graphene-based material in comparison to conventional drug delivery vehicles and devices. This figure also illustrates an embodiment of the invention in a biological environment in contact with biological tissue in which enclosure is provided with one or more support materials which re external to the perforated two-dimensional material and indicates possible capillary vascularization into such support materials.

FIGs. 2A-D shows illustrative schematics of various configurations of enclosure configurations prepared from two-dimensional material useful according to various embodiments of the present disclosure.