**[0009]** In one configuration, a scaffold for tissue engineering is provided. The scaffold includes a vascular tube that defines a vascular diameter and is configured to receive vascular system seed cells, a non-vascular tube that defines a non-vascular tube diameter and is configured to receive organ system seed cells, and an opening formed between the vascular tube and the non-vascular tube and sized such that diffusion can occur but seeded cells are inhibited from migration between the vascular tube and the non-vascular tube. Thus, in one aspect, there is provided a scaffold for engineering tissues comprising:

a vascular tube defining a first diameter and suitable for receiving vascular system seed cells;

a non-vascular tube formed adjacent to the vascular tube along a length of the scaffold device, thereby forming an interface between the vascular tube and the non-vascular tube, wherein the non-vascular tube defines a second diameter and is suitable for receiving organ system seed cells; and

a barrier formed at the interface of the vascular tube and the non-vascular tube, wherein the barrier defines a width of the interface.

**[0010]** In another configuration, a method is provided for populating a tubular structure including a vascular tube configured to receive vascular system seed cells, and an organ tissue tube configured to receive organ system seed cells. The method includes flowing hydrogel through the vascular tube in a first direction, flowing hydrogel through the organ tissue tube in a second direction opposite the first direction, introducing a chelating agent, forming a barrier between the vascular tube and the organ tissue tube while maintaining flow through the vascular tube and through the organ tissue tube, flushing the hydrogel from the vascular tube and the organ tissue tube while maintain the barrier intact, seeding the vascular tube with vascular system cells, and seeding the organ tissue tube with organ tissue cells. Thus, provided is a method of populating a tubular structure including a vascular tube configured to receive vascular system seed cells, and an organ tissue tube configured to receive organ system seed cells, the method comprising:

flowing hydrogel through the vascular tube in a first direction;

flowing hydrogel through the organ tissue tube in a second direction opposite the first direction;

introducing a chelating agent;

forming a barrier between the vascular tube and the organ tissue tube while maintaining flow through the vascular tube and through the organ tissue tube;

flushing the hydrogel from the vascular tube and the organ tissue tube while maintain the barrier intact;

seeding the vascular tube with vascular system cells; and

seeding the organ tissue tube with organ tissue cells.

**[0011]** In another configuration, another method is provided for populating a tubular structure including a vascular tube configured to receive vascular system seed cells, and an organ tissue tube configured to receive organ system seed cells. The method includes filling the organ tissue tube with hydrogel, maintaining the tubular structure at about thirty-seven degrees Celsius, seeding the vascular tube with vascular system cells, cooling the tubular structure to below about thirty-seven degrees Celsius, draining the hydrogel from the organ tissue tube while creating a barrier at the interface of the vascular tube and the organ tissue tube, and seeding the organ tissue tube with organ tissue cells. Thus, also provided is a method of populating a tubular structure including a vascular tube configured to receive vascular system seed cells, and an organ tissue tube configured to receive organ system seed cells, the method comprising:

filling the organ tissue tube with hydrogel;

maintaining the tubular structure at about thirty-seven degrees Celsius;

seeding the vascular tube with vascular system cells;

cooling the tubular structure to below about thirty-seven degrees Celsius;

draining the hydrogel from the organ tissue tube while creating a barrier at the interface of the vascular tube and the organ tissue tube; and

seeding the organ tissue tube with organ tissue cells.

**[0012]** These and other features and advantages of the present invention will become apparent upon reading the following detailed description when taken in conjunction with the drawings.

## BRIEF DESCRIPTION OF THE DRAWINGS

## CLAIMS

We claim:

1. A scaffold for engineering tissues comprising:

a vascular tube defining a first diameter and suitable for receiving vascular system seed cells;

a non-vascular tube formed adjacent to the vascular tube along a length of the scaffold device, thereby forming an interface between the vascular tube and the non-vascular tube, wherein the non-vascular tube defines a second diameter and is suitable for receiving organ system seed cells; and

a barrier formed at the interface of the vascular tube and the non-vascular tube, wherein the barrier defines a width of the interface.

2. The scaffold of claim 1, wherein the barrier consists of a space.

3. The scaffold of claim 1, wherein the barrier includes a space.

4. The scaffold of claim 1, wherein the barrier provides communication of oxygen and nutrients between the vascular tube and the non-vascular tube and inhibits the movement of vascular system seed cells and organ system seed cells.

5. The scaffold of claim 1, wherein the width defined by the barrier is less than the first diameter.

6. The scaffold of claim 1, wherein the width defined by the barrier is less than the second diameter.

7. The scaffold of claim 1, wherein the barrier includes hydrogel.

8. The scaffold of claim 1, wherein the non-vascular tube is suitable for receiving hepatocytes.

9. The scaffold of claim 1, wherein the non-vascular tube is suitable for receiving biliocytes.

10. The scaffold of claim 1, wherein the first diameter is different from the second diameter.

11. The scaffold of claim 1, wherein the first diameter changes over the length of the scaffold.

12. The scaffold of claim 1, wherein the second diameter changes over the length of the scaffold.

13. The scaffold of claim 1, wherein the barrier provides communication between the vascular tube and the non-vascular tube.

14. The scaffold of claim 1, wherein the barrier is a semi-permeable membrane.

15. The scaffold of claim 1, wherein the vascular tube is suitable for supporting blood flow in a first direction, and the non-vascular tube is suitable for supporting fluid flow in a second direction.

16. The scaffold of claim 15, wherein the first direction is opposite the second direction.

17. The scaffold of claim 1, wherein the width defined by the barrier is less than a minimum dimension of one of a seeded vascular cell and a seeded non-vascular cell.