We Claim:

1. A heart pump assembly comprising:

an elongate catheter having a proximal portion and a distal portion;

a rotor disposed at the distal portion of the elongate catheter, the rotor having an impeller blade, wherein the impeller blade is shaped to induce fluid flow in a first axial direction when the rotor is rotated in a first rotational direction;

a drive shaft coupled to the rotor, the drive shaft including a pump element formed on a surface of the drive shaft at the distal portion of the elongate catheter; and

a bearing disposed at the distal portion of the elongate catheter and having a bore into which the drive shaft extends;

wherein, when the distal portion of the elongate catheter is inserted into a patient and the rotor is rotated in the first rotational direction, the pump element is shaped to induce fluid flow through the bore and into the patient in a second axial direction.

2. The heart pump assembly of claim 1, wherein the second axial direction is opposite to the first axial direction.

3. The heart pump assembly of claim 1, wherein the second axial direction is substantially the same as the first axial direction.

4. The heart pump assembly of any of the preceding claims, wherein a fluid supply line is in fluid communication with the bore, and wherein the pump element is configured to draw fluid from the fluid supply line through the bore.

5. The heart pump assembly of any of the preceding claims, wherein the bearing is a sleeve bearing, and the pump element is disposed in a bearing gap between the drive shaft and the bearing.

6. The heart pump assembly of claim 5, wherein the bearing gap between the drive shaft and the bearing is in a range of 5-15 microns.

7. The heart pump assembly of any of the preceding claims, wherein the pump element is shaped as a groove on the surface of the drive shaft.

8. The heart pump assembly of claim 7, wherein the groove on the surface of the drive shaft is angled with respect to a longitudinal axis of the drive shaft.

9. The heart pump assembly of claims 1-6, wherein the pump element is shaped as a protrusion on the surface of the drive shaft.

10. The heart pump assembly of any of the preceding claims, wherein the heart pump assembly is configured such that a ratio of a flow rate of the fluid flow in the second axial direction to a flow rate of the fluid flow in the first axial direction is about 0.002% or less.

11. The heart pump assembly of any of the preceding claims, wherein the heart pump assembly is configured such that a flow rate of the fluid flow in the first axial direction is 2-5 liters per minute (lpm).

12. The heart pump assembly of any of the preceding claims, wherein the heart pump assembly is configured such that a flow rate of the fluid flow in the second axial direction is 2-30 cc/hr.

13. The heart pump assembly of any of the preceding claims, wherein the drive shaft is coupled to a motor.

14. The heart pump assembly of any of the preceding claims, further comprising a pump housing enclosing the rotor and bearing.

15. The heart pump assembly of claim 14, wherein the pump assembly is sized for percutaneous insertion.

16. The heart pump assembly of claim 15, further comprising:

a blood outlet positioned proximal to a proximal end of the pump housing; and

a blood inlet positioned at a distal end portion of a cannula of the pump assembly.

17. The heart pump assembly of claim 15, further comprising:

a blood outlet positioned at a distal end portion of a cannula of the pump assembly; and

a blood inlet positioned proximal to a proximal end of the pump housing.

18. A method for operating a heart pump, the method comprising:

positioning a heart pump in a patient's vasculature, wherein the heart pump comprises an elongate catheter having a proximal portion and a distal portion, a rotor assembly disposed at the distal portion of the elongate catheter and having a drive shaft coupled to a rotor, a bearing disposed at the distal portion of the elongate catheter and having a bore into which the drive shaft extends, and wherein the rotor has a first pump element, the drive shaft has a second pump element, formed on a surface of the drive shaft at the distal portion of the elongate catheter, and the first and second pump elements rotate together;

rotating the rotor assembly to induce a blood flow in a first axial direction with the first pump element while concurrently inducing fluid flow in a second axial direction through the bore and into the patient with the second pump element,

wherein the rate of fluid flow induced by the second pump element is less than 1% the rate of blood flow induced by the first pump element.

19. The method of claim 18, wherein the second axial direction is opposite to the first axial direction.

20. The method of claim 18, wherein the second axial direction is substantially the same as the first axial direction.

21. The method of any of claims 18-20, wherein the fluid flow induced by the second pump element is drawn through a fluid supply line.

22. The method of claim 21, wherein the fluid flow induced by the second pump element is through a bearing gap between the drive shaft and the bearing.

23. The method of claim 22, wherein the bearing gap is about 5 microns or less.

24. The method of any of claims 18-23, wherein the fluid flow in the first axial direction surrounds the fluid flow in the second axial direction.

25. The method of any of claims 18-24, wherein a ratio of a flow rate of the fluid flow in the second axial direction to a flow rate of the fluid flow in the first axial direction is 0.001-0.03%.

26. The method of any of claims 18-25, wherein the flow rate of the fluid flow in the first axial direction is 2-5 lpm.

27. The method of any of claims 18-26, wherein the flow rate of the fluid flow in the second axial direction is 2-30 cc/hr.

28. The method of claim any of claims 18-27, wherein the second pump element is shaped as a groove on a surface of the rotor assembly.

29. The method of claim any of claims 18-27, wherein the second pump element is shaped as a protrusion on a surface of the rotor assembly.

30. The method of claim any of claims 18-29, wherein positioning a heart pump in a patient's vasculature comprises percutaneous implantation of the pump into the heart.