

We claim:

1. An implantable prosthetic valve comprising:
 - an annular frame having an inflow end, an outflow end and a central longitudinal axis extending from the inflow end to the outflow end;
 - a valvular structure including two or more leaflets, each of the two or more leaflets having a leaflet inflow edge positioned at least partially outside of the frame and a leaflet outflow edge positioned within the frame, wherein at least a portion of each of the leaflet inflow edges is unsupported by the frame;
 - an inner skirt having a first portion that extends circumferentially around the central longitudinal axis along an inner surface of the frame and is supported by the frame and a second portion that extends circumferentially around the central longitudinal axis outside of the frame and is not supported by the frame; and
 - an outer sealing member secured on both an outer surface of the frame and an outer surface of the second portion of the inner skirt
 - wherein the portion of the leaflet inflow edges unsupported by the frame is connected to the second portion of the inner skirt; and
 - wherein the frame includes at least two rows of cells extending circumferentially around the central longitudinal axis and the at least two rows of cells define openings having a length in an axial direction and a length of the portion of the leaflet inflow edges unsupported by the frame is equal to or greater than the length of the openings.
2. The valve of claim 1, wherein the inner skirt includes a first set of fibers that are sufficiently stiff to impede inward bending of the second portion due to systolic pressure gradient and blood flowing from the left ventricle to the aorta.
3. The valve of claim 2, wherein the first set of fibers run parallel to the central longitudinal axis.
4. The valve of any of claims 2-3, wherein the inner skirt includes a

second set of fibers that run perpendicular to the first set of fibers, wherein the first set of fibers are stiffer than the second set of fibers.

5. The valve of any of claims 2-4, wherein the first set of fibers include monofilaments.

6. The valve of any of claims 1-5, wherein the portions of the leaflet inflow edges unsupported by the frame each include an apex portion of each leaflet.

7. An implantable prosthetic valve, the prosthetic valve comprising:
an annular frame having an inflow end, an outflow end and a central longitudinal axis extending from the inflow end to the outflow end;

an inner skirt, wherein a first portion of the inner skirt extends circumferentially around the central longitudinal axis along an inner surface of the frame and a second portion of the inner skirt extends circumferentially around the central longitudinal axis outside of the frame; and

a valvular structure including two or more leaflets, each of the two or more leaflets having a leaflet inflow edge positioned at least partially outside of the frame and a leaflet outflow edge positioned within the frame, wherein at least a portion of each of the leaflet inflow edges are connected to the second portion of the inner skirt;

wherein the inner skirt includes a first set of fibers and a second set of fibers that runs perpendicular to the first set of fibers, wherein the first set of fibers is stiffer than the second set of fibers.

8. The valve of claim 7, wherein the frame includes a row of cells defining openings having a length in an axial direction and wherein a length of the second portion is equal to or greater than the length of the openings.

9. The valve of any of claims 7-8, further comprising an outer skirt connected to the second portion of the inner skirt.

10. The valve of any of claims 7-9, wherein the portions of the leaflet inflow edges connected to the second portion of the inner skirt unsupported by the frame include an apex portion of each leaflet.

11. An implantable prosthetic valve comprising:
an annular frame having an inflow end, an outflow end and a central longitudinal axis extending from the inflow end to the outflow end;
a valvular structure including two or more leaflets, each of the two or more leaflets having a leaflet inflow edge positioned at least partially outside of the frame and a leaflet outflow edge positioned within the frame, wherein at least a portion of each of the leaflet inflow edges is unsupported by the frame;
an inner skirt, having a first portion that extends circumferentially around the central longitudinal axis along an inner surface of the frame and is supported by the frame and a second portion that extends circumferentially around the central longitudinal axis outside of the frame and is not supported by the frame;
an outer sealing member mounted on the outside of the frame; and
a support layer, wherein a first portion of the support layer extends circumferentially around the central longitudinal axis along an outer surface of the frame and a second portion of the support layer extends circumferentially around the central longitudinal axis axially beyond the inflow end of the frame;
wherein the portions of the leaflet inflow edges unsupported by the frame are connected to both the second portion of the inner skirt and the second portion of the support layer.

12. The valve of claim 11, wherein the outer sealing member is connected to the second portion of the support layer at an inflow end of the outer skirt.

13. The valve of any of claims 11-12, wherein the support layer includes a first set of fibers and a second set of fibers that runs perpendicular to the first set of

fibers, wherein the first set of fibers is stiffer than the second set of fibers.

14. The valve of claim 13, wherein the first set of fibers includes monofilaments.

15. The valve of any of claims 11-14, wherein the valvular structure comprises a plurality of leaflets and the at least a portion of the valvular structure unsupported by the frame includes an apex portion of each leaflet.