

The registrant hereby amends this registration statement on such date or dates as may be necessary to delay its effective date until the registrant shall file a further amendment which specifically states that this registration statement shall thereafter become effective in accordance with Section 8(a) of the Securities Act of 1933 or until the registration statement shall become effective on such date as the Securities and Exchange Commission, acting pursuant to said Section 8(a), may determine.

EXPLANATORY NOTE: We are filing this Amendment No. 3 (this "Amendment") to our Registration Statement on Form S-1, which was originally filed with the Securities and Exchange Commission on March 20, 2017 and has been previously amended by Amendment Nos. 1 and 2 thereto (as so amended, the "Registration Statement"), solely to include an updated Exhibit 5.1. No other information in the Registration Statement, including the prospectus that forms a part thereof, is being modified. Accordingly, this Amendment consists only of the facing page, this explanatory note, Part II of the Registration Statement, the signature page to the Registration Statement, the Exhibit Index, and Exhibit 5.1 filed herewith. The prospectus that forms a part of the Registration Statement is unchanged and has therefore been omitted from this filing.

PART II

INFORMATION NOT REQUIRED IN PROSPECTUS

Item 13. Other Expenses of Issuance and Distribution.

The following table sets forth the estimated costs and expenses to be incurred in connection with the issuance and distribution of the securities registered under this Registration Statement. All amounts are estimates except the Securities and Exchange Commission registration fee.

	<u>Amount to be Paid</u>
SEC registration fee	\$ 1,910
FINRA filing fee	\$ 3,000
Legal fees and expenses	\$ 100,000
Printing expenses	\$ 15,000
Accountant's fees and expenses	\$ 50,000
Transfer agent and registrar fees	\$ 5,000
Miscellaneous expenses	\$ 10,090
Total	\$ 185,000

Item 14. Indemnification of Directors and Officers.

Our certificate of incorporation and bylaws provide that each person who was or is made a party or is threatened to be made a party to or is otherwise involved (including, without limitation, as a witness) in any action, suit or proceeding, whether civil, criminal, administrative or investigative, by reason of the fact that he or she is or was a director or an officer of Sunshine Heart, Inc. or is or was serving at our request as a director, officer, or trustee of another corporation, or of a partnership, joint venture, trust or other enterprise, including service with respect to an employee benefit plan, whether the basis of such proceeding is alleged action in an official capacity as a director, officer or trustee or in any other capacity while serving as a director, officer or trustee, shall be indemnified and held harmless by us to the fullest extent authorized by the Delaware General Corporation Law, as amended (the "DGCL"), against all expense, liability and loss (including attorneys' fees, judgments, fines, ERISA excise taxes or penalties and amounts paid in settlement) reasonably incurred or suffered by such.

Section 145 of the DGCL permits a corporation to indemnify any director or officer of the corporation against expenses (including attorney's fees), judgments, fines and amounts paid in settlement actually and reasonably incurred in connection with any action, suit or proceeding brought by reason of the fact that such person is or was a director or officer of the corporation, if such person acted in good faith and in a manner that he or she reasonably believed to be in, or not opposed to, the best interests of the corporation, and, with respect to any criminal action or proceeding, if he or she had no reason to believe his or her conduct was unlawful. In a derivative action, (i.e., one brought by or on behalf of the corporation), indemnification may be provided only for expenses actually and reasonably incurred by any director or officer in connection with the defense or settlement of such an action or suit if such person acted in good faith and in a manner that he or she reasonably believed to be in, or not opposed to, the best interests of the corporation, except that no indemnification shall be provided if such person shall have been adjudged to be liable to the corporation, unless and only to the

extent that the court in which the action or suit was brought shall determine that the defendant is fairly and reasonably entitled to indemnity for such expenses despite such adjudication of liability.

Pursuant to Section 102(b)(7) of the DGCL, our certificate of incorporation eliminates the liability of a director to us or our stockholders for monetary damages for such a breach of fiduciary duty as a director, except for liabilities arising:

- from any breach of the director's duty of loyalty to us or our stockholders;
- from acts or omissions not in good faith or which involve intentional misconduct or a knowing violation of law;
- under Section 174 of the DGCL; and
- from any transaction from which the director derived an improper personal benefit.

We carry insurance policies insuring our directors and officers against certain liabilities that they may incur in their capacities as directors and officers.

The Company has entered into indemnification agreements with each of its directors and executive officers. Pursuant to the indemnification agreements, the Company agrees to hold harmless and indemnify its directors and executive officers to the fullest extent authorized or permitted by the provisions of the Company's certificate of incorporation and bylaws and the DGCL, including for any amounts that such director or officer becomes obligated to pay because of any claim to which such director or officer is made or threatened to be made a party, witness or participant, by reason of such director's or officer's service as a director, officer, employee or other agent of the Company.

There are certain exceptions from the Company's obligation to indemnify its directors and executive officers pursuant to the indemnification agreements, including for "short-swing" profit claims under Section 16(b) of the Exchange Act, losses that result from conduct that is established by a final judgment as knowingly fraudulent or deliberately dishonest or that constituted willful misconduct, or that constituted a breach of the duty of loyalty to the Company or resulted in any improper personal profit or advantage, where payment is actually made to a director or officer under an insurance policy, indemnity clause, bylaw or agreement, except in respect of any excess beyond payment under such insurance, clause, bylaw or agreement, for indemnification which is not lawful, or in connection with any proceeding initiated by such director or officer, or any proceeding against the Company or its directors, officers, employees or other agents, unless (i) such indemnification is expressly required to be made by law, (ii) the proceeding was authorized by the board of directors of the Company, (iii) such indemnification is provided by the Company, in its sole discretion, pursuant to the powers vested in the Company under the DGCL, or (iv) the proceeding is initiated to enforce a claim for indemnification pursuant to the indemnification agreement.

All agreements and obligations of the Company contained in the indemnification agreements shall continue during the period when the director or officer who is a party to an indemnification agreement is a director, officer, employee or other agent of the Company (or is or is serving at the request of the Company as a director, officer, employee or other agent of another corporation, partnership, joint venture, trust, employee benefit plan or other enterprise) and shall continue thereafter so long as such director or officer shall be subject to any possible claim or threatened, pending or completed action, suit or proceeding, whether civil, criminal, arbitrational, administrative or investigative. In addition, the indemnification agreements provide for partial indemnification and advance of expenses.

Insofar as indemnification for liabilities arising under the Securities Act of 1933 may be permitted to our directors, officers or controlling persons pursuant to the foregoing provisions, or otherwise, we have been advised that in the opinion of the Securities and Exchange Commission this indemnification is against public policy as expressed in the Securities Act, and is, therefore, unenforceable.

Item 15. Recent Sales of Unregistered Securities.

The following sets forth information regarding all unregistered securities sold by the registrant in the three years preceding the date of this registration statement. This information has been retroactively adjusted to reflect the reverse stock split for all periods presented.

- On February 18, 2015, the registrant entered into a loan agreement with Silicon Valley Bank under which the registrant issued to Silicon Valley Bank and its affiliate, Life Science Loans, LLC, warrants to purchase shares of its common stock equal to 6% of a \$6.0 million term loan divided by the lower of (i) the closing price for a share of the registrant's common stock as reported on the Nasdaq Capital Market for the date on which such term loan advance was made to the registrant, and (ii) the average of the closing prices for a share of the registrant's common stock reported for the ten trading days ending on the date of such term loan advance. The warrants were exercisable immediately with a term of ten years. Additionally, upon Silicon Valley Bank funding the \$2.0 million term loan available until June 30, 2015, the warrants automatically became exercisable for an additional number of shares equal to 6% of such term loan divided by the lower of (i) the closing price for a share of the registrant's common stock as reported on the Nasdaq Capital Market for the date such term loan advance, and (ii) the average of the closing prices for a share of the registrant's common stock reported or the ten trading date ending on the date of such term loan advance. The warrants were issued under an exemption from the registration requirements of the Securities Act provided in Section 4(a)(2) of the Securities Act and/or Regulation D.
 - On July 20, 2016, the registrant entered into a securities purchase agreement with Sabby Healthcare Master Fund Ltd. and Sabby Volatility Warrant Master Fund Ltd. (collectively, Sabby) under which the registrant issued and sold, on July 26, 2016, 3,468 shares of Series B Convertible Preferred Stock at \$1,000 per share directly to Sabby in a registered direct offering. In a concurrent private placement, the registrant issued warrants to purchase an aggregate of 122,977 shares of its common stock to Sabby. Each warrant was exercisable beginning on the six month anniversary of the date of issuance at an exercise price of \$3.77 per share (as adjusted), subject to further adjustment as provided therein and for 36 months from the initial exercise date, but not thereafter. Northland Securities, Inc. acted as placement agent and the registrant issued Northland Securities, Inc. and its designees warrants to purchase an aggregate of 7,379 shares of common stock. The Northland warrants were exercisable beginning immediately upon the closing at an exercise price of \$40.50 per share, subject to adjustment as provided there in, and for 5 years thereafter. Subject to limited exceptions, a holder will not have the right to exercise any portion of its warrant if the holder, together with its affiliates, would beneficially own over 4.99% of the number of shares of the registrant's common stock outstanding immediately after giving effect to such exercise; provided, however, that upon not less than 61 days' prior notice, the holder may increase the limitation, provided that in no event will the limitation exceed 9.99%. The warrants were issued under an exemption from the registration requirements of the Securities Act provided in Section 4(a)(2) of the Securities Act and/or Regulation D.
 - On August 5, 2016, the registrant entered into and consummated the transactions contemplated by an asset purchase agreement with Gambro UF Solutions, Inc. (the "Seller"), pursuant to which the registrant acquired certain assets exclusively related to the production and sale of Seller's Aquadex™ FlexFlow product for consideration consisting of \$4.0 million paid in cash and 33,333 shares of the registrant's common stock. The shares of common stock were issued to Seller under an exemption from the registration requirement of the Securities Act provided in Section 4(a)(2) of the Securities Act and/or Regulation D.
 - On October 30, 2016, the registrant entered into a securities exchange agreement with Sabby, as holder of the registrant's Series B Convertible Preferred Stock pursuant to which the registrant agreed to issue Sabby 2,227.2 shares of Series B-1 Convertible Preferred Stock in exchange for the cancellation of all shares of Series B Convertible Preferred Stock held by Sabby in reliance
-

on an exemption from registration provided by Section 3(a)(9) of the Securities Act, and consummated such exchange on November 3, 2016.

- On October 30, 2016, the registrant entered into securities purchase agreements with Sabby under which it agreed to issue and sell 2,900 shares of Series C Convertible Preferred Stock at \$1,000 per share directly to Sabby in a registered direct offering. In a concurrent private placement, the registrant agreed to issue and sell 900 shares of Series D Convertible Preferred Stock at \$1,000 per share directly to Sabby and warrants to purchase an aggregate of 745,097 shares of common stock to Sabby. The registered direct offering closed on November 3, 2016, and the registrant concurrently sold 700 shares of the Series D Convertible Preferred Stock and warrants to purchase 705,882 shares of common stock. The remaining 200 shares of Series D Convertible Preferred Stock and warrants to purchase 39,215 shares of common stock were issued and sold at a second closing on January 11, 2017. The Series D Convertible Preferred Stock has a stated value of \$1,000 per share and a conversion price of \$3.77 (as adjusted) subject to further adjustment and may be converted to shares of common stock at any time following the receipt of stockholder approval of such issuance upon conversion. Each warrant will be exercisable beginning on the day that is the later of the date stockholder approval of the issuance of common stock underlying such warrants is obtained or the six month anniversary of the date of issuance at an exercise price of \$3.77 per share (as adjusted), subject to further adjustment as provided therein, and terminate five years thereafter. Northland Securities, Inc. acted as placement agent and the registrant issued Northland Securities, Inc. and its designees warrants to purchase an aggregate of 42,352 shares of common stock at the second closing, with an exercise price of \$6.30 per share. Subject to limited exceptions, a holder of Series D Convertible Preferred Stock or warrants will not have the right to convert or exercise if the holder, together with its affiliates, would beneficially own over 4.99% of the number of shares of the registrant's common stock outstanding immediately after giving effect to such exercise; provided, however, that upon not less than 61 days' prior notice, the holder may increase the limitation, provided that in no event will the limitation exceed 9.99%. The Series D Convertible Preferred Stock and the warrants were issued pursuant to an exemption from the registration requirement of the Securities Act provided in Section 4(a)(2) of the Securities Act and/or Regulation D.
 - On February 15, 2017, the registrant entered into a letter agreement with Sabby, to incent the cash exercise of the warrants held by Sabby on or before March 31, 2017 (the "Exercise Period"). In exchange for any such exercise, the registrant agreed to provide Sabby replacement warrants (the "Replacement Warrants") to purchase the same number of shares of common stock as were issued upon exercise of the exercised warrants, with an exercise price equal to the consolidated closing bid price of the registrant's common stock on the date of issuance. The agreement also (i) amends the definition of "Beneficial Ownership Limitation" in the existing warrants to mean, solely for purposes of any exercises of warrants that occur during the Exercise Period, "9.99%" and (ii) amends the Initial Exercise Date of the existing warrants issued on November 3, 2016 and January 11, 2017 so that such warrants are exercisable on or after the receipt of stockholder approval. Since such stockholder approval was received on January 9, 2017, such warrants were immediately exercisable as of the date of the agreement. The Replacement Warrants will be in the same form as the exercised warrants except the exercise price will not be subject to reduction for subsequent equity issuances and (ii) the Replacement Warrants will not allow Sabby to demand that the registrant purchase the Replacement Warrants in the event of a fundamental transaction involving the registrant. Concurrent with the signing of the agreement, Sabby exercised warrants to purchase 104,419 shares of common stock for cash proceeds of approximately \$564,000, and the registrant issued Replacement Warrants to purchase 104,419 shares of common stock at an exercise price of \$4.99 per share. From March 10, 2017 to March 28, 2017, Sabby exercised warrants to purchase 763,498 shares of common stock for cash proceeds of approximately \$1.4 million, and the registrant issued Replacement Warrants to purchase 763,498 shares of common stock with exercise prices equal to the closing consolidated bid price of our common stock available on the date of issuance (ranging from \$1.73 to \$3.77 per share). The Replacement Warrants are issued pursuant to an exemption from the registration requirement of the Securities Act provided in Section 4(a)(2) of the Securities Act and/or Regulation D.
-

Item 16. Exhibits and Financial Statement Schedules.

The following exhibits are included as part of this Form S-1.

EXHIBIT INDEX

<u>Exhibit Number</u>	<u>Exhibit Description</u>	<u>Incorporated By Reference</u>			<u>Exhibit Number</u>	<u>Filed Herewith</u>	<u>Furnished Herewith</u>
		<u>Form</u>	<u>File Number</u>	<u>Date of First Filing</u>			
1.1	Form of Underwriting Agreement.	S-1	333- 216841	April 4, 2017	1.1		
2.1	Asset Purchase Agreement between Sunshine Heart, Inc. and Gambro UF Solutions, Inc. dated August 5, 2016.	8-K	001- 35312	August 8, 2016	2.1		
3.1	Fourth Amended and Restated Certificate of Incorporation	10	001- 35312	February 1, 2012	3.1		
3.2	Certificate of Amendment to the Fourth Amended and Restated Certificate of Incorporation	8-K	001- 35312	January 13, 2017	3.1		
3.3	Amended and Restated Bylaws	10	001- 35312	September 30, 2011	3.2		
3.4	Form of Certificate of Designation of Series A Junior Participating Preferred Stock	8-K	001- 35312	June 14,2013	3.1		
3.5	Certificate of Designation of Preferences, Rights and Limitations of Series B Convertible Preferred Stock.	8-K	001- 35312	July 25, 2016	3.1		
3.6	Certificate of Designation of Preferences, Rights and Limitations of Series B-1 Convertible Preferred Stock.	8-K	001- 35312	November 3, 2016	3.1		
3.7	Certificate of Designation of Preferences, Rights and Limitations of Series C Convertible Preferred Stock.	8-K	001- 35312	November 3, 2016	3.2		
3.8	Certificate of Designation of Preferences, Rights and Limitations of Series D Convertible Preferred Stock.	8-K	001- 35312	November 3, 2016	3.3		
3.9	Form of Certificate of Designation of Preferences, Rights and Limitations of Series E Convertible Preferred Stock.	S-1	333- 216841	April 4, 2017	3.9		
4.1	Warrant to Purchase Stock, dated February 18, 2015, issued to Silicon Valley Bank	8-K	001- 35312	February 19, 2015	4.1		

<u>Exhibit Number</u>	<u>Exhibit Description</u>	<u>Incorporated By Reference</u>			<u>Exhibit Number</u>	<u>Filed Herewith</u>	<u>Furnished Herewith</u>
		<u>Form</u>	<u>File Number</u>	<u>Date of First Filing</u>			
4.2	Warrant to Purchase Stock, dated February 18, 2015, issued to Life Science Loans, LLC	8-K	001-35312	February 19, 2015	4.2		
4.3	Form of common stock Purchase Warrant issued pursuant to the Securities Purchase Agreement, dated July 20, 2016, among the Company and the purchasers signatory thereto.	8-K	001-35312	July 22, 2016	4.3		
4.4	Form of common stock Purchase Warrant issued to Northland Securities, Inc.	8-K	001-35312	July 22, 2016	4.3		
4.5	Registration Rights Agreement between Sunshine Heart, Inc. and Gambro UF Solutions, Inc. dated August 5, 2016	8-K	001-35312	August 8, 2016	4.1		
4.6	Form of common stock Purchase Warrant issued pursuant to the Securities Purchase Agreement, dated October 30, 2016, among the Company and the purchasers signatory thereto.	8-K	001-35312	October 31, 2016	4.1		
4.7	Form of Common Stock Purchase Warrant issued pursuant to the Letter Agreement between the Company and the purchasers signatory thereto, dated February 15, 2017.	8-K	001-35312	February 16, 2017	4.1		
4.8	Form of Warrant to purchase shares of common stock.	S-1	333-216841	April 4, 2017	4.8		
5.1	Opinion of Honigman Miller Schwartz and Cohn LLP.					X	
10.1	Securities Purchase Agreement, dated July 20, 2016 among the Company and the purchasers signatory thereto.	8-K	001-35312	July 22, 2016	10.1		
10.2	Patent License Agreement between Sunshine Heart, Inc. and Gambro UF Solutions, Inc. dated August 5, 2016.	8-K	001-35312	August 8, 2016	10.1		
10.3	Loan and Security Agreement between Sunshine Heart, Inc. and Silicon Valley Bank dated August 5, 2016.	8-K	001-35312	August 8, 2016	10.2		

Exhibit Number	Exhibit Description	Incorporated By Reference			Exhibit Number	Filed Herewith	Furnished Herewith
		Form	File Number	Date of First Filing			
10.4	Amended and Restated 2002 Stock Plan†	10	001- 35312	December 16, 2011	10.2		
10.5	Form of Notice of Stock Option Grant and Option Agreement for Amended and Restated 2002 Stock Plan†	10	001- 35312	September 30, 2011	10.3		
10.6	Second Amended and Restated 2011 Equity Incentive Plan, as amended†	14A	001- 35312	July 27, 2012	App. A		
10.7	Form of Stock Option Grant Notice and Option Agreement for 2011 Equity Incentive Plan†	10	001- 35312	September 30, 2011	10.5		
10.8	Form of Stock Option Grant Notice and Option Agreement (Senior Management) for 2011 Equity Incentive Plan†	10	001- 35312	September 30, 2011	10.6		
10.9	Form of Stock Option Grant Notice and Option Agreement (Director) for 2011 Equity Incentive Plan†	8-K	001- 35312	September 18, 2012	10.1		
10.10	Form of Stock Grant Notice and Award Agreement for 2011 Equity Incentive Plan†	8-K	001- 35312	September 10, 2013	10.1		
10.11	Form of Restricted Stock Unit Grant Notice and Agreement for 2011 Equity Incentive Plan†	8-K	001- 35312	September 10, 2013	10.2		
10.12	2013 Non-Employee Directors' Equity Incentive Plan†	14A	001- 35312	April 5, 2013	App. A		
10.13	Form of Stock Option Grant Notice and Option Agreement for 2013 Non-Employee Directors' Equity Incentive Plan†	10-K	001- 35312	March 20, 2014	10.10		
10.14	Form of Restricted Stock Unit Award Grant Notice and Agreement for 2013 Non-Employee Directors' Equity Incentive Plan†	10-K	001- 35312	March 20, 2014	10.11		
10.15	New-Hire Equity Incentive Plan†	10-Q	001- 35312	August 8, 2013	10.1		
10.16	First Amendment to New-Hire Equity Incentive Plan†	10-Q	001- 35312	November 12, 2013	10.1		
10.17	Second Amendment to New-Hire Equity Incentive Plan†	10-Q	333- 202904	March 20, 2015	10.1		

Exhibit Number	Exhibit Description	Incorporated By Reference			Exhibit Number	Filed Herewith	Furnished Herewith
		Form	File Number	Date of First Filing			
10.18	Form of Stock Option Grant Notice and Option Agreement for New-Hire Equity Incentive Plan†	10-K	001-35312	March 20, 2014	10.14		
10.19	Form of Indemnity Agreement for the Company's executive officers and directors†	10	001-35312	September 30, 2011	10.1		
10.20	Form of Change in Control Agreement for the Company's executive officers†	10-K	001-35312	March 20, 2015	10.16		
10.21	Non-Employee Director Compensation Policy†	10-Q	001-35312	August 8, 2013	10.2		
10.22	Executive Employment Agreement dated February 6, 2013 by and between the Company and David A. Rosa†	8-K	001-35312	February 6, 2013	10.1		
10.23	Lease Agreement dated October 21, 2011 by and between the Company and Silver Prairie Crossroads, LLC	10	001-35312	December 16, 2011	10.18		
10.24	Sales Agreement dated March 21, 2014 by and between the Company and Cowen and Company, LLC	S-3	333-194731	March 21, 2014	1.2		
10.25	Loan and Security Agreement between the Company and Silicon Valley Bank dated February 18, 2015	8-K	001-35312	February 19, 2015	10.1		
10.26	First Amendment to Loan and Security Agreement between the Company and Silicon Valley Bank dated December 8, 2015	8-K	001-35312	December 9, 2015	99.1		
10.27	Second Amendment to Lease, dated as of April 20, 2015, by and between the Company and Capital Partners Industrial Fund I, LLLP dba Prairie Crossroads Business Center	8-K	001-35312	April 23, 2015	10.1		
10.28	Termination and Release Agreement dated January 1, 2015 by and between the Company and William S. Peters†	10-Q	001-35312	May 7, 2015	10.2		

Exhibit Number	Exhibit Description	Incorporated By Reference			Exhibit Number	Filed Herewith	Furnished Herewith
		Form	File Number	Date of First Filing			
10.29	Separation and Release Agreement dated June 19, 2015 by and between the Company and Kimberly A. Oleson†	10-Q	001-35312	August 5, 2015	10.2		
10.30	Separation and Release Agreement between the Company and David A. Rosa, dated November 30, 2015†	8-K	001-35312	November 30, 2015	99.1		
10.31	Executive Employment Agreement between Sunshine Heart, Inc. and John L. Erb, dated March 1, 2016†	8-K	001-35312	March 2, 2016	10.1		
10.32	Separation and Release Agreement by and between Sunshine Heart, Inc. and Brian J. Brown, dated February 3, 2016†	10-Q	001-35312	May 5, 2015	10.2		
10.33	Separation and Release Agreement by and between Sunshine Heart, Inc. and Debra Kridner, dated January 24, 2016†	10-Q	001-35312	May 5, 2016	10.3		
10.34	Third Amendment to the Sunshine Heart, Inc. New-Hire Equity Incentive Plan†	S-8	333-210215	March 15, 2016	99.1		
10.35	Claudia Drayton Retention Bonus Letter, dated as of December 12, 2016†	8-K	001-35312	December 16, 2016	10.1		
10.36	Molly Wade Retention Bonus Letter, dated as of December 12, 2016†	10-K	001-35312	March 8, 2017	10.33		
10.37	Letter Agreement dated February 15, 2017 among the Company, Sabby Volatility Warrant Master Fund, Ltd. and Sabby Healthcare Master Fund, Ltd.	8-K	003-35312	February 16, 2017	10.1		
21	List of Subsidiaries	10-K	001-35312	March 8, 2017	21		
23.1	Consent of Independent Registered Public Accounting Firm	S-1	333-216841	April 4, 2017	23.1		
23.2	Consent of Honigman Miller Schwartz & Cohn LLP						Included in Exhibit 5.1
24.1	Power of Attorney	S-1	333-216841	March 20, 2017	24.1		

† Indicates management compensatory plan, contract or arrangement.

Item 17. Undertakings.

The undersigned registrant hereby undertakes that, for the purpose of determining any liability under the Securities Act of 1933, as amended, each such post-effective amendment shall be deemed to be a new registration statement relating to the securities offered therein, and the offering of such securities at that time shall be deemed to be the initial bona fide offering thereof.

The undersigned registrant hereby undertakes to remove from registration by means of a post-effective amendment any of the securities being registered that remain unsold at the termination of the offering.

The undersigned registrant hereby undertakes that, for the purposes of determining liability to any purchaser, if the registrant is subject to Rule 430C, each prospectus filed pursuant to Rule 424(b) as part of a registration statement relating to an offering, other than registration statements relying on Rule 430B or other than prospectuses filed in reliance on Rule 430A, shall be deemed to be part of and included in the registration statement as of the date it is first used after effectiveness. Provided, however, that no statement made in a registration statement or prospectus that is part of the registration statement or made in a document incorporated or deemed incorporated by reference into the registration statement or prospectus that is part of the registration statement will, as to a purchaser with a time of contract of sale prior to such first use, supersede or modify any statement that was made in the registration statement or prospectus that was part of the registration statement or made in any such document immediately prior to such date of first use.

The undersigned registrant hereby undertakes that, for the purpose of determining liability of the registrant under the Securities Act of 1933 to any purchaser in the initial distribution of the securities:

The undersigned registrant undertakes that in a primary offering of securities of the undersigned registrant pursuant to this registration statement, regardless of the underwriting method used to sell the securities to the purchaser, if the securities are offered or sold to such purchaser by means of any of the following communications, the undersigned registrant will be a seller to the purchaser and will be considered to offer or sell such securities to such purchaser:

- (i) Any preliminary prospectus or prospectus of the undersigned registrant relating to the offering required to be filed pursuant to Rule 424;
- (ii) Any free writing prospectus relating to the offering prepared by or on behalf of the undersigned registrant or used or referred to by the undersigned registrant;
- (iii) The portion of any other free writing prospectus relating to the offering containing material information about the undersigned registrant or its securities provided by or on behalf of the undersigned registrant; and
- (iv) Any other communication that is an offer in the offering made by the undersigned registrant to the purchaser.

Insofar as indemnification for liabilities arising under the Securities Act of 1933, as amended, may be permitted to directors, officers and controlling persons of the undersigned registrant according to the foregoing provisions, or otherwise, the undersigned registrant has been advised that in the opinion of the Securities and Exchange Commission such indemnification is against public policy as expressed in the Act and is, therefore, unenforceable. In the event that a claim for indemnification against such liabilities (other than the payment by the Registrant of expenses incurred or paid by a director, officer or controlling person of the registrant in the successful defense of any action, suit or proceeding) is asserted by such director, officer or controlling person in connection with the securities being registered, the registrant will, unless in the opinion of its counsel the matter has been settled by controlling precedent, submit to a court of appropriate jurisdiction the question whether such indemnification by it is against public policy as expressed in the Securities Act of 1933, as amended, and will be governed by the final adjudication of such issue.

The undersigned registrant hereby undertakes that, for purposes of determining any liability under the Securities Act of 1933, each filing of the registrant's annual report pursuant to section 13(a) or section 15(d) of the Securities Exchange Act of 1934 (and, where applicable, each filing of an employee benefit plan's annual report pursuant to section 15(d) of the Securities Exchange Act of 1934) that is incorporated by reference in the registration statement shall be deemed to be a new registration statement relating to the securities offered therein, and the offering of such securities at that time shall be deemed to be the initial bona fide offering thereof.

EXHIBIT INDEX

<u>Exhibit Number</u>	<u>Exhibit Description</u>	<u>Incorporated By Reference</u>			<u>Exhibit Number</u>	<u>Filed Herewith</u>	<u>Furnished Herewith</u>
		<u>Form</u>	<u>File Number</u>	<u>Date of First Filing</u>			
1.1	Form of Underwriting Agreement.	S-1	333- 216841	April 4, 2017	1.1		
2.1	Asset Purchase Agreement between Sunshine Heart, Inc. and Gambro UF Solutions, Inc. dated August 5, 2016.	8-K	001- 35312	August 8, 2016	2.1		
3.1	Fourth Amended and Restated Certificate of Incorporation	10	001- 35312	February 1, 2012	3.1		
3.2	Certificate of Amendment to the Fourth Amended and Restated Certificate of Incorporation	8-K	001- 35312	January 13, 2017	3.1		
3.3	Amended and Restated Bylaws	10	001- 35312	September 30, 2011	3.2		
3.4	Form of Certificate of Designation of Series A Junior Participating Preferred Stock	8-K	001- 35312	June 14,2013	3.1		
3.5	Certificate of Designation of Preferences, Rights and Limitations of Series B Convertible Preferred Stock.	8-K	001- 35312	July 25, 2016	3.1		
3.6	Certificate of Designation of Preferences, Rights and Limitations of Series B-1 Convertible Preferred Stock.	8-K	001- 35312	November 3, 2016	3.1		
3.7	Certificate of Designation of Preferences, Rights and Limitations of Series C Convertible Preferred Stock.	8-K	001- 35312	November 3, 2016	3.2		
3.8	Certificate of Designation of Preferences, Rights and Limitations of Series D Convertible Preferred Stock.	8-K	001- 35312	November 3, 2016	3.3		
3.9	Form of Certificate of Designation of Preferences, Rights and Limitations of Series E Convertible Preferred Stock.	S-1	333- 216841	April 4, 2017	3.9		
4.1	Warrant to Purchase Stock, dated February 18, 2015, issued to Silicon Valley Bank	8-K	001- 35312	February 19, 2015	4.1		
4.2	Warrant to Purchase Stock, dated February 18, 2015, issued to Life Science Loans, LLC	8-K	001- 35312	February 19, 2015	4.2		

Exhibit Number	Exhibit Description	Incorporated By Reference			Exhibit Number	Filed Herewith	Furnished Herewith
		Form	File Number	Date of First Filing			
4.3	Form of common stock Purchase Warrant issued pursuant to the Securities Purchase Agreement, dated July 20, 2016, among the Company and the purchasers signatory thereto.	8-K	001-35312	July 22, 2016	4.3		
4.4	Form of common stock Purchase Warrant issued to Northland Securities, Inc.	8-K	001-35312	July 22, 2016	4.3		
4.5	Registration Rights Agreement between Sunshine Heart, Inc. and Gambro UF Solutions, Inc. dated August 5, 2016	8-K	001-35312	August 8, 2016	4.1		
4.6	Form of common stock Purchase Warrant issued pursuant to the Securities Purchase Agreement, dated October 30, 2016, among the Company and the purchasers signatory thereto.	8-K	001-35312	October 31, 2016	4.1		
4.7	Form of Common Stock Purchase Warrant issued pursuant to the Letter Agreement between the Company and the purchasers signatory thereto, dated February 15, 2017.	8-K	001-35312	February 16, 2017	4.1		
4.8	Form of Warrant to purchase shares of common stock.	S-1	333-216841	April 4, 2017	4.8		
5.1	Opinion of Honigman Miller Schwartz and Cohn LLP.					X	
10.1	Securities Purchase Agreement, dated July 20, 2016 among the Company and the purchasers signatory thereto.	8-K	001-35312	July 22, 2016	10.1		
10.2	Patent License Agreement between Sunshine Heart, Inc. and Gambro UF Solutions, Inc. dated August 5, 2016.	8-K	001-35312	August 8, 2016	10.1		
10.3	Loan and Security Agreement between Sunshine Heart, Inc. and Silicon Valley Bank dated August 5, 2016.	8-K	001-35312	August 8, 2016	10.2		
10.4	Amended and Restated 2002 Stock Plan†	10	001-35312	December 16, 2011	10.2		
10.5	Form of Notice of Stock Option Grant and Option Agreement for Amended and Restated 2002 Stock Plan†	10	001-35312	September 30, 2011	10.3		

Exhibit Number	Exhibit Description	Incorporated By Reference			Exhibit Number	Filed Herewith	Furnished Herewith
		Form	File Number	Date of First Filing			
10.6	Second Amended and Restated 2011 Equity Incentive Plan, as amended†	14A	001-35312	July 27, 2012	App. A		
10.7	Form of Stock Option Grant Notice and Option Agreement for 2011 Equity Incentive Plan †	10	001-35312	September 30, 2011	10.5		
10.8	Form of Stock Option Grant Notice and Option Agreement (Senior Management) for 2011 Equity Incentive Plan†	10	001-35312	September 30, 2011	10.6		
10.9	Form of Stock Option Grant Notice and Option Agreement (Director) for 2011 Equity Incentive Plan†	8-K	001-35312	September 18, 2012	10.1		
10.10	Form of Stock Grant Notice and Award Agreement for 2011 Equity Incentive Plan†	8-K	001-35312	September 10, 2013	10.1		
10.11	Form of Restricted Stock Unit Grant Notice and Agreement for 2011 Equity Incentive Plan†	8-K	001-35312	September 10, 2013	10.2		
10.12	2013 Non-Employee Directors' Equity Incentive Plan†	14A	001-35312	April 5, 2013	App. A		
10.13	Form of Stock Option Grant Notice and Option Agreement for 2013 Non-Employee Directors' Equity Incentive Plan†	10-K	001-35312	March 20, 2014	10.10		
10.14	Form of Restricted Stock Unit Award Grant Notice and Agreement for 2013 Non-Employee Directors' Equity Incentive Plan†	10-K	001-35312	March 20, 2014	10.11		
10.15	New-Hire Equity Incentive Plan†	10-Q	001-35312	August 8, 2013	10.1		
10.16	First Amendment to New-Hire Equity Incentive Plan†	10-Q	001-35312	November 12, 2013	10.1		
10.17	Second Amendment to New-Hire Equity Incentive Plan†	10-Q	333-202904	March 20, 2015	10.1		
10.18	Form of Stock Option Grant Notice and Option Agreement for New-Hire Equity Incentive Plan†	10-K	001-35312	March 20, 2014	10.14		
10.19	Form of Indemnity Agreement for the Company's executive officers and directors†	10	001-35312	September 30, 2011	10.1		

Exhibit Number	Exhibit Description	Incorporated By Reference			Exhibit Number	Filed Herewith	Furnished Herewith
		Form	File Number	Date of First Filing			
10.20	Form of Change in Control Agreement for the Company's executive officers†	10-K	001-35312	March 20, 2015	10.16		
10.21	Non-Employee Director Compensation Policy†	10-Q	001-35312	August 8, 2013	10.2		
10.22	Executive Employment Agreement dated February 6, 2013 by and between the Company and David A. Rosa†	8-K	001-35312	February 6, 2013	10.1		
10.23	Lease Agreement dated October 21, 2011 by and between the Company and Silver Prairie Crossroads, LLC	10	001-35312	December 16, 2011	10.18		
10.24	Sales Agreement dated March 21, 2014 by and between the Company and Cowen and Company, LLC	S-3	333-194731	March 21, 2014	1.2		
10.25	Loan and Security Agreement between the Company and Silicon Valley Bank dated February 18, 2015	8-K	001-35312	February 19, 2015	10.1		
10.26	First Amendment to Loan and Security Agreement between the Company and Silicon Valley Bank dated December 8, 2015	8-K	001-35312	December 9, 2015	99.1		
10.27	Second Amendment to Lease, dated as of April 20, 2015, by and between the Company and Capital Partners Industrial Fund I, LLLP dba Prairie Crossroads Business Center	8-K	001-35312	April 23, 2015	10.1		
10.28	Termination and Release Agreement dated January 1, 2015 by and between the Company and William S. Peters†	10-Q	001-35312	May 7, 2015	10.2		
10.29	Separation and Release Agreement dated June 19, 2015 by and between the Company and Kimberly A. Oleson†	10-Q	001-35312	August 5, 2015	10.2		
10.30	Separation and Release Agreement between the Company and David A. Rosa, dated November 30, 2015†	8-K	001-35312	November 30, 2015	99.1		

Exhibit Number	Exhibit Description	Incorporated By Reference			Exhibit Number	Filed Herewith	Furnished Herewith
		Form	File Number	Date of First Filing			
10.31	Executive Employment Agreement between Sunshine Heart, Inc. and John L. Erb, dated March 1, 2016†	8-K	001-35312	March 2, 2016	10.1		
10.32	Separation and Release Agreement by and between Sunshine Heart, Inc. and Brian J. Brown, dated February 3, 2016†	10-Q	001-35312	May 5, 2015	10.2		
10.33	Separation and Release Agreement by and between Sunshine Heart, Inc. and Debra Kridner, dated January 24, 2016†	10-Q	001-35312	May 5, 2016	10.3		
10.34	Third Amendment to the Sunshine Heart, Inc. New-Hire Equity Incentive Plan †	S-8	333-210215	March 15, 2016	99.1		
10.35	Claudia Drayton Retention Bonus Letter, dated as of December 12, 2016†	8-K	001-35312	December 16, 2016	10.1		
10.36	Molly Wade Retention Bonus Letter, dated as of December 12, 2016†	10-K	001-35312	March 8, 2017	10.33		
10.37	Letter Agreement dated February 15, 2017 among the Company, Sabby Volatility Warrant Master Fund, Ltd. and Sabby Healthcare Master Fund, Ltd.	8-K	003-35312	February 16, 2017	10.1		
21	List of Subsidiaries	10-K	001-35312	March 8, 2017	21		
23.1	Consent of Independent Registered Public Accounting Firm	S-1	333-216841	April 4, 2017	23.1		
23.2	Consent of Honigman Miller Schwartz & Cohn LLP						Included in Exhibit 5.1
24.1	Power of Attorney	S-1	333-216841	March 20, 2017	24.1		

† Indicates management compensatory plan, contract or arrangement.

QuickLinks

PART II

INFORMATION NOT REQUIRED IN PROSPECTUS

[Item 13. Other Expenses of Issuance and Distribution.](#)

[Item 14. Indemnification of Directors and Officers.](#)

[Item 15. Recent Sales of Unregistered Securities.](#)

[Item 16. Exhibits and Financial Statement Schedules.](#)

EXHIBIT INDEX

[Item 17. Undertakings.](#)

SIGNATURES

EXHIBIT INDEX

[Letterhead of Honigman Miller Schwartz & Cohn LLP]

April 6, 2017

Sunshine Heart, Inc.
 12988 Valley View Road
 Eden Prairie, Minnesota 55344

Re: Registration Statement on Form S-1

Ladies and Gentlemen:

We have acted as counsel to Sunshine Heart, Inc., a Delaware corporation (the "**Company**"), in connection with the preparation and filing with the Securities and Exchange Commission (the "**Commission**") pursuant to the Securities Act of 1933, as amended (the "**Securities Act**"), of a Registration Statement on Form S-1 (such registration statement as amended or supplemented from time to time, the "**Registration Statement**"), relating to the offer and sale by the Company of up to \$9,200,000 in the aggregate of (i) units consisting of one share of the Company's common stock, par value \$0.0001 per share (the "**Common Stock**") and one warrant to purchase one share of Common Stock (the "**Class A Units**") and (ii) units consisting of one share of Series E Convertible Preferred Stock, par value \$0.0001 per share (the "**Preferred Stock**") and warrants to purchase a number of shares of Common Stock equal to \$1,000 divided by the conversion price of the Preferred Stock (the "**Class B Units**" and, together with the Class A Units, the "**Units**"). The Units are to be sold to the underwriters for resale to the public as described in the Registration Statement and pursuant to the underwriting agreement referred to in the Registration Statement (the "**Underwriting Agreement**"). Pursuant to the Certificate of Designation (the "**Certificate of Designation**") establishing the powers, designations, preferences and rights of the Preferred Stock to be filed in connection with the offering contemplated by the Registration Statement and the Company's Fourth Amended and Restated Certificate of Incorporation, as amended (the "**Certificate of Incorporation**"), the shares of the Preferred Stock will be convertible into shares of Common Stock.

For the purpose of rendering the opinions herein, we examined originals or copies of such documents as we deemed relevant. In conducting our examination, we assumed, without investigation, the genuineness of all signatures, the correctness of all certificates, the authenticity of all documents submitted to us as originals, the conformity to original documents of all documents submitted as certified or photostatic copies, the authenticity of the originals of such copies, and the accuracy and completeness of all records made available to us by the Company. As to certain factual matters, we have relied upon a certificate of officers of the Company and have not independently sought to verify such matters.

Sunshine Heart, Inc.
 April 6, 2017
 Page 2

Our opinions are limited solely to matters set forth herein. The law covered by the opinions expressed herein is limited to the federal law of the United States, New York law applicable to contracts and Delaware corporate law.

Based on our examination of such documents and other matters as we deem relevant, we are of the opinion that:

1. The shares of Common Stock (a) offered by the Registration Statement, to be issued and sold by the Company as described in the Registration Statement and in the manner set forth in the Underwriting Agreement, against payment therefor, (b) issuable upon the valid exercise of the warrants in accordance with their terms, including without limitation, payment of the consideration therefor as described therein, and (c) issuable upon the valid conversion of the shares of Preferred Stock in accordance with the Certificate of Designation, in each case, have been duly authorized by the Company and when issued and delivered will be validly issued, fully paid and non-assessable.
2. The shares of Preferred Stock have been duly authorized by the Company and, upon issuance and delivery against payment of the consideration therefor specified in the Underwriting Agreement and in accordance with the Certificate of Designation, will be validly issued, fully paid and non-assessable.
3. When the warrants have been duly executed and delivered by the Company against payment of the consideration therefor specified in the Underwriting Agreement, such warrants will constitute binding obligations of the Company, enforceable against the Company in accordance with their terms.
4. The Units, when issued against payment therefor as set forth in the Registration Statement and the underwriting Agreement, will be validly issued, fully paid and non-assessable.

Our opinions set forth in paragraph 3 above are subject to the effect of any applicable bankruptcy, insolvency, reorganization, moratorium or similar law relating to or affecting creditors' rights generally (including, without limitation, fraudulent conveyance laws), general principles of equity, including, without limitation, concepts of materiality, reasonableness, good faith and fair dealing and the possible unavailability of specific performance or injunctive relief, regardless of whether considered in a proceeding in equity or at law and limitations regarding the availability of indemnification and contribution where such indemnification or contribution may be limited by applicable law or the application of principles of public policy.

We express no opinion as to the enforceability of (i) provisions that relate to choice of law, forum selection or submission to jurisdiction (including, without limitation, any express or implied waiver of any objection to venue in any court or of any objection that a court is an inconvenient forum) to the extent that the validity, binding effect or enforceability of any such provision is to be determined by any court other than a state court of the State of New York, (ii) waivers by the Company of any statutory or constitutional rights or remedies, (iii) terms which excuse any person or entity from liability for, or require the Company to indemnify such person or entity against, such person's or entity's negligence or willful misconduct or (iv) obligations to pay any prepayment premium, default interest rate, early termination fee or other form of liquidated damages, if the payment of such premium, interest rate, fee or damages may be

Sunshine Heart, Inc.
April 6, 2017
Page 3

construed as unreasonable in relation to actual damages or disproportionate to actual damages suffered as a result of such prepayment, default or termination.

We draw your attention to the fact that, under certain circumstances, the enforceability of terms to the effect that provisions may not be waived or modified except in writing may be limited.

We hereby consent to the filing of this opinion as Exhibit 5.1 to the Registration Statement and to the reference to our firm under the caption "Legal Matters" in the Registration Statement. In giving such consent, we do not admit that we are within the category of persons whose consent is required by Section 7 of the Securities Act or the rules and regulations promulgated thereunder by the Commission.

Very truly yours,

/s/ HONIGMAN MILLER SCHWARTZ AND COHN LLP
HONIGMAN MILLER SCHWARTZ AND COHN LLP

PDT/MZE/JQW/REW
