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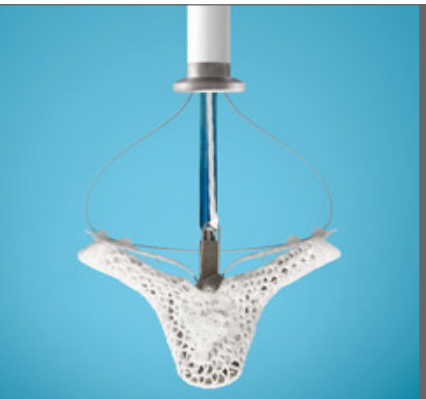

Mitraclip; Abbott Laboratories

Facing rivals for FMR

Favorable registry data from postapproval study unveiled for Abbott's Mitraclip device

By Liz Hollis, Staff Writer

Mitraclip, an alternative to mitral valve regurgitation surgery from Abbott Park, Ill.-based Abbott Laboratories, demonstrated favorable 30-day and one-year outcomes, according to data from a postapproval study evaluating the safety and efficacy of the device. According to the results, 86.8 percent of patients had post-procedural mitral regurgitation of ≤2+ at one year.

See Abbott, page 5

Inside

Mussallem says aortic stenosis coverage should be agnostic

By Mark McCarty, Regulatory Editor

WASHINGTON – Transcatheter aortic valve replacement (TAVR) has made tremendous inroads in the U.S. market, but device makers will press their case where they see gaps. Mike Mussallem, CEO of Edwards Lifesciences Corp. of Irvine, Calif., told *BioWorld MedTech* that the

See TAVR, page 6

Feinstein Institute hopes to decode vagus nerve signals

By Katie Pfaff, Staff Writer

The vagus nerve is vitally important to human function. It runs through the neck and connects to vital organs in the body. The vagus manages signals between the brain and the body, including those that alert the immune system to infection and to regulate the so-called inflammatory

See Vagus, page 7

MRI-guided laser ablation system from CLS for prostate cancer gets a closer look

By David Godkin, Staff Writer

Toronto General Hospital (TGH) is the site for a clinical trial examining the use of a non-cooled, MRI-guided laser ablation system for the focal treatment of localized prostate cancer. Dan Mogren, chief commercial officer of Lund,

See CLS, page 8

China's med-tech companies post banner performances

By Alex Ho, Staff Writer

HONG KONG – 2017 was a rather good year for Chinese device makers, although it remains to be seen whether local manufacturers can step it up enough to compete with foreign conglomerates.

In May, the China Food and Drug Administration (CFDA) published four policy documents aimed at encouraging innovation and the development of medical devices. The policies focused on areas such as strengthening the patent system and supporting clinical applications of new drugs.

However, even with the continued support the government is providing to the industry, China is still far away from successfully competing with

See China, page 9

Miravas raising $3M to develop endovenous technology for varicose vein treatment

By Bernard Banga, Staff Writer

PARIS – Miravas SAS is preparing to raise $3 million to speed up distribution of its technology Hybrid Vbox in Europe. This medical device, which combines two thermic techniques – steam and radiofrequency – within a single medical device to

See Mirivas, page 10

BioWorld MedTech's Neurology Extra

Production Editor Andrea Applegate on one of med-tech's key sectors

Read this week's edition

Other news to note

Foundation Medicine Inc., of Cambridge, Mass., **Roche Holding AG**, of Basel, Switzerland, and **Dian Diagnostics Group Co. Ltd.**, of Hangzhou, China, reported a collaboration to integrate Foundation's comprehensive genomic profiling (CGP) assays into clinical patient care in mainland China. Under the collaboration Dian, developer of Chinese medical diagnostic products and services, becomes the exclusive clinical sequencing partner in China for Foundationone, FoundationACT (Assay for Circulating Tumor DNA) and Foundationoneheme, enabling the delivery of personalized cancer care for patients. Roche maintains commercial exclusivity for Foundation Medicine's molecular information products in China, and in cooperation with Dian continues its current in-county activities to support the broad integration of CGP into clinical care. Financial terms were not disclosed.

Thermo Fisher Scientific, of Waltham, Mass., and **Leica Microsystems**, of Wetzlar, Germany, will develop a cryo-tomography workflow for life sciences. The hardware and software solution is intended to integrate light microscopes from Leica with cryo-electron microscopes from Thermo Fisher.

Regulatory front

The **FDA** published a draft guidance for multiple function device products that defines the term "function" as "a distinct purpose of the product" that could constitute the entirety of the intended use or a subset thereof. The agency said the objective of the draft is to clarify how it will go about assessing the likely impact of non-device functions on the safety and effectiveness of the product's device function. The draft was prompted by section 3060(a) of the 21st Century Cures Act, which directed the FDA to clarify a number of aspects of medical device regulation for software, and introduces the term "device function-under-review" to the regulatory lexicon. The draft says that the device function-under-review should be designed and implemented separately from the other functions so as to reduce or eliminate dependence of the subject function from the product's other functions. The risk analyses for such products should include the potential impact of the non-reviewed functions on the function under review, and mitigations should be characterized for such risks. The agency is taking comment through June 26 at docket number FDA-2018-D-1339.

Daily M&A

Rutherford, N.J.-based **Cancer Genetics Inc.** has completed the sale of Bioserve Biotechnologies (India) Pvt. Ltd. to **Reprocell Inc.**, of Yokohama, Japan, for $1.9 million. Cancer Genetics received an upfront payment of $1.6 million in cash, with the remaining balance slated for payment about six months from closing, subject to Bioserve's revenues for a four-month period post-closing being equivalent to the same four-month period in 2017.

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BioWorld MedTech stock report for public med-tech companies

Company	Symbol	Close 4/20	Close 4/27	Change Week	Change YTD	Vol (000)
Abaxis	ABAX	72.72	66.36	-8.75	34.01	955
Abbott Labs	ABT	59.19	59.56	0.63	4.36	24691
Abiomed	ABMD	305.92	301.74	-1.37	61.01	2381
Accelerate Dx	AXDX	24.50	23.05	-5.92	-12.02	476
Accuray	ARAY	5.05	5.05	0.00	17.44	995
Agilent Tech	A	67.55	66.28	-1.88	-1.03	10573
Align Tech	ALGN	247.07	257.90	4.38	16.07	6466
Allergan	AGN	158.51	162.04	2.23	-0.94	9221
Allied Healthcare	AHPI	2.60	2.53	-2.69	18.78	19
Allscripts	MDRX	12.32	12.14	-1.46	-16.56	5823
Alphatec	ATEC	3.86	3.82	-1.04	43.61	662
Analogic	ALOG	83.45	83.15	-0.36	-0.72	1116
Angiodynamics	ANGO	19.97	19.64	-1.65	18.10	520
Anika Therapeutics	ANIK	45.13	43.95	-2.61	-18.48	789
Antares Pharma	ATRS	2.30	2.38	3.48	19.60	1988
Apollo Endosurg	APEN	5.85	5.90	0.85	5.36	47
Athenahealth	ATHN	146.07	127.45	-12.75	-4.20	3581
Atricure	ATRC	21.21	22.38	5.52	22.70	856
Atrion	ATRI	635.80	627.90	-1.24	-0.43	21
Axogen	AXGN	40.00	40.40	1.00	42.76	1015
Baxter Intl	BAX	67.05	70.21	4.71	8.62	15500
Becton Dickinson	BDX	232.88	234.26	0.59	9.44	3987
Biocept	BIOC	0.24	0.22	-8.33	-68.12	3672
Biolife Solutions	BLFS	7.33	7.22	-1.50	20.33	152
Bio-Rad Labs	BIO	260.68	259.50	-0.45	8.73	357
Bio-Techne	TECH	152.78	152.17	-0.40	17.46	595
Biotelemetry	BEAT	34.50	38.50	11.59	28.76	2839
Boston Scientific	BSX	28.84	29.23	1.35	17.91	37228
Bovie Medical	BVX	3.64	3.50	-3.85	34.62	121
Bruker	BRKR	30.66	29.85	-2.64	-13.02	2499
Cancer Genetics	CGIX	1.10	0.98	-10.91	-47.03	1825
Cantel Medical	CMD	115.84	115.10	-0.64	11.89	401
Cardinal Health	CAH	62.07	65.82	6.04	7.43	10136
Cardiovascular Sys	CSII	22.52	23.16	2.84	-2.24	485
Caredx	CDNA	9.20	9.36	1.74	27.52	564
CAS Medical Sys	CASM	1.14	1.15	0.88	49.35	27
Celcuity	CELC	17.41	18.87	8.39	-0.42	73
Cellectar Biosci	CLRB	1.12	1.15	2.68	-16.06	196
Cerus	CERS	5.49	5.23	-4.74	54.73	2701
Check Cap	CHEK	4.06	9.02	122.17	-13.60	12246
Chembio Dx	CEMI	7.90	8.00	1.27	-2.44	36
CHF Solutions	CHFS	3.12	2.94	-5.77	-15.03	376
Conformis	CFMS	1.79	1.45	-18.99	-39.08	1807
Conmed	CNMD	62.91	65.25	3.72	28.02	1201
Cooper Companies	COO	225.12	230.74	2.50	5.90	1395
Corindus Vascular	CVRS	1.15	1.08	-6.09	6.93	1957
CRH Medical	CRHM	2.70	2.80	3.70	5.66	166
Cryolife	CRY	23.30	22.8	-2.15	19.06	340
Cutera	CUTR	51.30	49.9	-2.73	10.03	581
Cytosorbents	CTSO	7.70	7.55	-1.95	16.15	672
Danaher	DHR	101.34	101.64	0.30	9.50	9106
Dariohealth	DRIO	1.68	1.82	8.33	12.35	795
Daxor	DXR	7.63	7.49	-1.83	63.89	407
Dentsply Intl	XRAY	49.34	50.34	2.03	-23.53	7911
Dexcom	DXCM	72.47	74.25	2.46	29.38	3992
Digirad	DRAD	1.38	1.40	1.45	-45.74	270
Dynatronics	DYNT	2.95	2.95	0.00	0.00	5
Edap Tms	EDAP	2.36	2.28	-3.39	-20.56	77
Edwards Lifesci	EW	137.09	129.29	-5.69	14.71	10799
Ekso Bionics	EKSO	1.62	1.86	14.81	-12.68	872
Electromed	ELMD	5.30	5.36	1.13	-11.70	23
Endologix	ELGX	4.60	4.29	-6.74	-19.81	1428
Enzo Biochem	ENZ	6.15	6.05	-1.63	-25.77	534
Fluidigm	FLDM	6.12	6.02	-1.63	2.21	501

Company	Symbol	Close 4/20	Close 4/27	Change Week	Change YTD	Vol (000)
Fonar	FONR	29.80	28.10	-5.70	15.40	83
Foundation Med	FMI	72.80	78.15	7.35	14.59	686
Fresenius Medical	FMS	52.03	50.75	-2.46	-3.43	912
Genmark Dx	GNMK	6.14	6.49	5.70	55.64	1305
Genomic Health	GHDX	32.23	32.46	0.71	-5.09	464
Glaukos Corp	GKOS	29.75	33.02	10.99	28.73	1217
Globus Medical	GMED	52.09	51.73	-0.69	25.86	4295
Grifols	GRFS	20.76	20.55	-1.01	-10.34	2901
Haemonetics	HAE	76.08	79.01	3.85	36.04	1769
Halyard Health	HYH	47.32	46.83	-1.04	1.41	1382
Henry Schein	HSIC	69.07	76.80	11.19	9.90	8366
Hill-Rom	HRC	87.25	87.18	-0.08	3.43	2590
Hologic	HOLX	38.30	39.36	2.77	-7.93	6540
HTG Molecular Dx	HTGM	3.44	3.65	6.10	79.80	3587
Icad	ICAD	3.39	3.93	15.93	14.24	188
ICU Medical	ICUI	251.25	256.55	2.11	18.77	293
Illumina	ILMN	244.60	244.45	-0.06	11.88	7248
Inogen	INGN	141.08	143.11	1.44	20.18	465
Inovio Pharma	INO	4.64	4.44	-4.31	7.51	3560
Insulet	PODD	86.69	87.34	0.75	26.58	1302
Integer	ITGR	55.35	55.20	-0.27	21.85	744
Integra Lifesci	IART	56.20	61.72	9.82	28.96	4011
Interpace Dx	IDXG	0.91	0.85	-6.59	-16.67	1503
Intersect ENT	XENT	41.75	40.50	-2.99	25.00	732
Intricon	IIN	23.40	23.25	-0.64	17.42	225
Intuitive Surgical	ISRG	456.27	447.03	-2.03	22.49	3174
Invacare	IVC	18.90	18.40	-2.65	9.20	618
Invitae	NVTA	5.71	5.60	-1.93	-38.33	1881
Invivo Therapeut	NVIV	8.51	7.84	-7.87	-59.27	281
Invuity	IVTY	3.80	3.20	-15.79	-48.39	1141
Iradimed	IRMD	15.25	15.85	3.93	4.62	45
Irhythm	IRTC	61.65	58.62	-4.91	4.59	1213
Iridex	IRIX	5.81	5.69	-2.07	-25.33	66
K2M Group	KTWO	19.37	20.05	3.51	11.39	614
Labcorp	LH	165.17	174.52	5.66	9.41	4309
Lantheus Holdings	LNTH	17.55	18.00	2.56	-11.98	1196
Lemaitre Vascular	LMAT	40.48	31.49	-22.21	-1.10	2132
Lianluo Smart	LLIT	2.18	1.78	-18.35	1.71	348
Livanova	LIVN	88.54	89.02	0.54	11.39	1056
Luminex	LMNX	22.20	21.69	-2.30	10.10	459
Masimo	MASI	89.66	91.13	1.64	7.46	1599
Mazor Robotics	MZOR	59.31	54.07	-8.83	4.79	1643
Medigus	MDGS	1.34	1.32	-1.49	0.00	46
Medovex	MDVX	0.45	0.40	-11.11	-29.82	35
Medtronic	MDT	79.90	81.29	1.74	0.67	17485
Meridian Biosci	VIVO	14.55	14.65	0.69	4.64	656
Merit Medical Sys	MMSI	45.95	47.90	4.24	10.88	2521
Mesa Labs	MLAB	169.00	169.10	0.06	36.04	75
Microbot Medical	MBOT	0.80	0.84	5.00	-17.65	2162
Micron Solutions	MICR	3.88	3.73	-3.87	6.57	11
Milestone Scientific	MLSS	0.80	0.73	-8.75	-38.14	130
Mimedx Group	MDXG	7.50	7.82	4.27	-37.99	11089
Misonix	MSON	10.95	11.05	0.91	15.10	23
Myomo	MYO	4.01	3.82	-4.74	1.87	2031
Nanostring Tech	NSTG	9.28	9.47	2.05	26.77	321
Natera	NTRA	10.96	11.08	1.09	23.25	275
Natus Medical	BABY	36.10	33.80	-6.37	-11.52	1476
Neovasc	NVCN	0.05	0.04	-18.37	-93.33	311310
Neurometrix	NURO	1.46	1.40	-4.11	-17.65	423
Nevro	NVRO	90.76	90.82	0.07	31.55	1308
Novocure	NVCR	24.65	26.85	8.92	32.92	5429
Nuvasive	NUVA	52.89	53.91	1.93	-7.83	3138
Nuvectra	NVTR	13.75	13.11	-4.65	68.94	551
Nxstage Medical	NXTM	25.50	26.79	5.06	10.57	1676

Continues on next page

BioWorld MedTech stock report for public med-tech companies

Continued from previous page

Company	Symbol	Close 4/20	Close 4/27	Change Week	Change YTD	Vol (000)
Obalon Therapeutics	OBLN	3.39	3.81	12.39	-42.36	536
Oncocyte	OCX	2.45	2.15	-12.24	-53.76	134
Opko Health	OPK	3.08	3.16	2.60	-35.51	12888
Optinose	OPTN	20.14	21.00	4.27	11.11	318
Orasure Tech	OSUR	17.18	18.08	5.24	-4.14	1865
Orthofix Intl	OFIX	58.86	61.37	4.26	12.19	453
Orthopediatrics	KIDS	19.71	19.12	-2.99	-0.36	304
Oxford Immunotec	OXFD	12.53	12.81	2.23	-8.30	213
Pacific Biosci	PACB	2.59	2.62	1.16	-0.76	1711
Pavmed	PAVM	1.64	1.62	-1.22	-27.03	303
Penumbra	PEN	124.75	126.45	1.36	34.38	684
Perkinelmer	PKI	74.60	74.11	-0.66	1.35	1865
Precision Therapeu	AIPT	0.89	1.01	13.48	-0.98	1012
Presbia	LENS	2.33	2.24	-3.86	-40.74	9
Pro-Dex	PDEX	6.85	6.80	-0.73	-0.73	12
Pulse Biosci	PLSE	18.38	17.64	-4.03	-25.25	826
Quest Dx	DGX	98.16	102.74	4.67	4.32	4021
Quidel	QDEL	55.61	55.95	0.61	29.07	1167
Quotient	QTNT	4.41	4.18	-5.22	-15.56	1481
Radnet	RDNT	13.60	13.15	-3.31	30.20	1805
Reshape Lifesci	RSLS	0.64	0.49	-23.44	-66.89	884
Resmed	RMD	98.80	94.39	-4.46	11.45	3135
Restoration Robotics	HAIR	5.08	4.25	-16.34	-7.61	347
Retractable Tech	RVP	0.88	0.87	-1.14	27.94	642
Rewalk Robotics	RWLK	1.10	1.10	0.00	0.00	347
Royal Philips NV	PHG	40.59	42.75	5.32	13.10	4016
RTI Surgical	RTIX	4.60	4.40	-4.35	7.32	251
Seaspine	SPNE	11.71	11.46	-2.13	13.24	71
Second Sight	EYES	1.67	1.68	0.60	-12.04	564
Senseonics	SENS	3.37	3.15	-6.53	18.42	1991
Sensus Healthcare	SRTS	5.97	6.04	1.17	15.93	33
Sientra	SIEN	12.84	13.52	5.30	-3.84	1918
Smith & Nephew	SNN	38.53	39.10	1.48	11.68	2295
Staar Surgical	STAA	16.75	16.45	-1.79	6.13	457
Steris	STE	96.04	95.41	-0.66	9.08	1452
Strata Skin Sci	SSKN	1.20	1.24	3.33	0.00	239
Stryker	SYK	164.25	170.67	3.91	10.22	5355
Surmodics	SRDX	38.70	37.45	-3.23	33.75	122
T2 Biosystems	TTOO	6.97	6.46	-7.32	56.80	558
Tactile Systems	TCMD	34.94	34.44	-1.43	18.84	413
Tandem Diabetes	TNDM	7.44	7.80	4.84	230.51	7774
Tearlab	TEAR	0.26	0.25	-3.85	-34.21	65
Teladoc	TDOC	42.75	43.00	0.58	23.39	2771
Teleflex	TFX	271.03	270.72	-0.11	8.80	1001
Thermo Fisher Sci	TMO	215.89	212.84	-1.41	12.09	7390
Transenterix	TRXC	1.90	1.720	-9.47	-10.88	6658
Trinity Biotech	TRIB	5.00	4.48	-10.40	-12.33	146
Utah Medical	UTMD	106.50	103.00	-3.29	26.54	43
Valeritas	VLRX	3.12	1.78	-42.95	-37.54	7153
Varian Medical Sys	VAR	126.50	118.18	-6.58	6.32	5160
Veracyte	VCYT	6.12	6.09	-0.49	-6.74	270
Vericel	VCEL	11.80	12.85	8.90	135.78	3151
Vermillion	VRML	1.23	1.34	8.94	-30.57	720
Viewray	VRAY	7.73	7.49	-3.10	-19.11	1704
Viveve Medical	VIVE	3.12	3.41	9.29	-31.39	633
Vocera Comm	VCRA	25.39	25.17	-0.87	-16.71	619
Volitionrx	VNRX	2.18	2.08	-4.59	-29.25	211
West Pharma	WST	91.02	88.94	-2.29	-9.86	3220
Wright Medical	WMGI	19.29	20.00	3.68	-9.91	2030
Xtant Medical	XTNT	7.80	7.05	-9.62	3.07	61
Zimmer Biomet	ZBH	110.32	116.92	5.98	-3.11	7151

Notes

Trading volumes for Nasdaq, Amex and NYSE are recorded as the total number of shares traded (in thousands) on a weekly basis (cumulative Monday through Friday); the weekly and YTD changes are from IPO completion, where applicable.

Average percent change week: -0.25
Range: -42.95 to +122.17; Number of companies: 189 (not market weighted)

Average percent change year-to-date: +5.64
Range: -91.83 to +230.51; Number of companies: 189 (not market weighted)

10 biggest U.S. gainers for the week

Share price by percent		Share price by dollars	
Check Cap	122.17	Align Tech	10.83
Icad	15.93	Labcorp	9.35
Ekso Bionics	14.81	Henry Schein	7.73
Obalon Therapeutics	12.39	Zimmer Biomet	6.60
Biotelemetry	11.59	Stryker	6.42
Henry Schein	11.19	Cooper Companies	5.62
Glaukos Corp	10.99	Integra Lifesci	5.52
Integra Lifesci	9.82	Foundation Med	5.35
Viveve Medical	9.29	ICU Medical	5.30
Novocure	8.92	Check Cap	4.96

10 biggest U.S. losers for the week

Share price by percent		Share price by dollars	
Valeritas	-42.95	Athenahealth	-18.62
Lemaitre Vascular	-22.21	Intuitive Surgical	-9.24
Lianluo Smart	-18.35	Lemaitre Vascular	-8.99
Restoration Robotics	-16.34	Varian Medical Sys	-8.32
Invuity	-15.79	Atrion	-7.90
Athenahealth	-12.75	Edwards Lifesci	-7.80
Oncocyte	-12.24	Abaxis	-6.36
Trinity Biotech	-10.40	Mazor Robotics	-5.24
Xtant Medical	-9.62	Resmed	-4.41
Mazor Robotics	-8.83	Abiomed	-4.18

Abbott

Continued from page 1

Mitral regurgitation is leakage of blood backward through the mitral valve each time the left ventricle contracts. About 10 percent of people aged 75 years and older experience mitral valve regurgitation.

"This is a rigorous, real-world study that includes more data than we've seen before. For the first time, we evaluated results of an echocardiogram and walk test, and assessed the patient's quality of life to further evaluate the effectiveness of Mitraclip therapy," said lead author James Hermiller, interventional cardiologist, St. Vincent Heart Center of Indiana, Indianapolis.

The data came from the first 2,000 Mitraclip patients consecutively entered into the National Transcatheter Valve Therapy Registry (TVT Registry), which is housed jointly by the American College of Cardiology Foundation (ACCF) and the Society for Thoracic Surgeons (STS). They were presented at the Society for Cardiovascular Angiography and Interventions 2018 Scientific Sessions. Additional data demonstrated an 81.7 percent freedom from all-cause mortality at one year and 83.4 percent improvement with New York Heart Association I/II at the one-year mark. In addition, there was mean improvement of 37.9 meters in the six-minute walk test with Mitraclip.

The STS/ACC TVT Registry is designed to monitor the safety and efficacy of new technologies for the treatment of valve disease.

Mitraclip received FDA approval in 2013. It is indicated for patients who experience degenerative mitral valve regurgitation, caused by a leaking heart valve that allows blood to flow backward in the heart. If left untreated, the condition can lead to heart failure.

Last November, Abbott received approval from Japan's Ministry of Health, Labour and Welfare (MHLW) for Mitraclip to treat patients with mitral regurgitation. (See *BioWorld MedTech,* Nov. 13, 2017.) MHLW granted national reimbursement for the device in March.

Expanding field

A randomized study is evaluating Mitraclip in symptomatic functional mitral valve regurgitation (FMR) patients with heart failure. The Cardiovascular Outcomes Assessment of the Mitraclip Percutaneous Therapy for Heart Failure Patients with Functional Mitral Regurgitation (COAPT) trial (NCT01626079) is slated to involve 610 subjects, with about 305 targeted to receive the study device. Abbott said that primary results are expected this year. Positive data could help the company garner the FMR indication. FMR occurs when the left ventricle of the heart dilates, leading to incomplete coaptation of the mitral valve.

Rival Edwards Lifesciences Corp. is enrolling patients for its Annular Reduction for Transcatheter Treatment of Insufficient Mitral Valve (ACTIVE) trial (NCT03016975) with Cardioband. The study will randomize patients with clinically significant FMR to receive either transcatheter mitral valve repair with the system plus guideline directed medical therapy (GDMT) or GDMT alone. Follow-up visits will occur at discharge, 30 days, six months and annually through five years. It currently has CE mark for the device and expects to see sales of about $15 million this year, Michael Mussallem, chairman and CEO, Edwards, said during in a Feb. 1 earnings call. (See *BioWorld MedTech*, Feb. 5, 2018.)

> *"For the first time, we evaluated results of an echocardiogram and walk test, and assessed the patient's quality of life to further evaluate the effectiveness of Mitraclip therapy.*
>
> James Hermiller
> Interventional cardiologist, St. Vincent Heart Center

Separately, Cardiac Dimensions Inc. reported April 26 that it had closed $39 million in series B financing. The money is slated for gaining clinical evidence back the company's Carillon Mitral Contour System for the treatment of FMR in patients with heart failure. New investor Hostplus joined the round, along M. H. Carnegie & Co., Arboretum Ventures, Lumira Capital, LSP Health Economics Fund and Aperture Venture Partners.

In March, Mardil Medical Inc. completed first-in-human implants of its combination therapy Ventouch Triad device at Sanitorio Italiano in Asunción, Paraguay, among patients with type IIIb FMR. (See *BioWorld MedTech*, March 21, 2018.)

Quarterly results

News of the data came about a week after Abbott released first quarter results. Jefferies analysts noted that the medical devices unit saw sales up 9.4 percent. However, results from structural heart and certain other units did not impress. "The results were blamed on tougher comps, though they also feed questions on whether ABT can run ahead of the challenges in the more commoditized segments of medtech," the analysts wrote.

During a call on the results, Chairman and CEO Miles White said the company's earnings per share guidance of $2.80 to $2.90 remained unchanged. William Blair analysts noted that revenue of $7.39 billion was $136 million above their $7.25 billion target. ♦

Appointments and advancements

Franklin Lakes, N.J.-based **BD** (Becton, Dickinson and Co.) named Alberto Mas as president of the medical segment, effective May 29. For the past two years, Mas has held the role of president of the life sciences segment for BD. Patrick Kaltenbach has been named president of the life sciences segment. Kaltenbach has served as senior vice president of Agilent and president of the life sciences and applied markets group since 2014. In addition, the company named Bill Tozzi as interim president of the interventional segment, effective May 1. Tozzi has served as the integration leader for the C. R. Bard transaction since April 2017.

John Groetelaars, who has served as the president of the interventional segment for BD (Becton, Dickinson and Co.) since the completion of the Bard transaction, has been appointed president and CEO of Chicago-based **Hill-Rom Holdings Inc.**, effective May 14. He succeeds John Greisch, who is retiring. Groetelaars also will join the company's board.

TAVR

Continued from page 1

number of clinical sites that provide TAVR are roughly only half the sites that practice surgical valve replacement thanks in part to the terms of Medicare coverage, a predicament he says is a disservice to patients.

Mussallem sat down briefly with *BioWorld MedTech* on a trip to Washington shortly following the company's financial report for the first quarter of 2018. Rates for the company's surgical AVR offerings took a hit in the Medicare draft inpatient prospective payment system for fiscal 2019, thanks to the expiry of the new technology add-on period for the Intuity Elite valve, but the Centers for Medicare & Medicaid Services also took a margin off rates for TAVR via an adjustment to the relative weights for the device/procedure, which on the surface might seem to suggest damage to the company's revenues associated with the Sapien 3 balloon-expandable TAVR device.

Still, Mussallem said the news was no surprise because length of stay associated with TAVR continues to fall.

"We've seen this consistently happen" in the past, Mussallem said, adding that the rates paid for TAVR are about $2,000 below the rates paid for codes associated with surgical aortic valve replacement (SAVR). He said the trimming of rates proposed in the inpatient draft for fiscal 2019 was driven entirely by claims data and was not the result of any recommendations by the American Medical Association's relative value update committee, but he also said the rates for surgical AVR have been consistently going up recently as well, hence the differential between the two device/procedures.

CMS to revisit coverage memo

"The bigger thing is the potential reconsideration of the national coverage determination" for TAVR, Mussallem said, explaining that CMS had intended all along to revisit the TAVR NCD within five or so years of initiation. He pointed to some of the guardrails associated with the NCD, which went into force in January 2013, such as institutional and operator experience along with the team medicine mandate. The requirement that a patient consult with multiple physicians is "one of the biggest objections we hear from coordinators at the various sites," Mussallem said, because the need to consult with multiple physicians often means another trip for patients who are not in particularly robust health.

Mussallem said there is some discussion among clinicians as to whether a coverage determination should be tailored to the diagnosis rather than a particular device, adding, "I do think it would be a good thing for patients if it was a broader look" at the patient's needs. He said institutions and clinicians still tend to default to the service they have to offer rather than step back and consider alternative approaches not offered by that hospital or physician.

Medicare coverage might better serve patients if reimbursement were neutral for treatment, but Mussallem cautioned, "I don't think CMS wants to put itself in a position of biasing the system toward one direction or the other." The situation is difficult to resolve in the absence of a shift toward bundled payments or other alternatives to fee-for-service care, however, and the NCD process is technology-driven rather than pathology-driven, a feature of the program that is unlikely to change in the near term.

> *"The bigger thing is the potential reconsideration of the national coverage determination [for TAVR].*
>
> Mike Mussallem
> CEO, Edwards Lifesciences Corp.

Mussallem said CMS has not been specific as to timelines for a review of the TAVR coverage memo, but he said the medical societies are working on a consensus document regarding the approach to determining the optimal treatment for aortic stenosis patients as well. The timing of the release of that document is not clear, either, however.

"When we went into the NCD process, we had our concerns" about the way the program works, Mussallem said, although he added, "most of us around the system would say it's been pretty effective." The TAVR memo allowed coverage of newer technologies in a fairly streamlined fashion, but the problem is that fewer than one in four with symptomatic severe aortic stenosis are treated for the condition. Mussallem said the blame for this does not necessarily fall on the NCD approach to coverage determination, although one of the more conspicuous elements in the aortic stenosis conversation is highlighted by the fact that Edwards sells valves for SAVR to as many as 1,200 centers in the U.S., but only about half that number of centers currently practice TAVR.

Mussallem said more than 50 percent of the company's revenues are drawn from U.S. sales, and despite the recent success of the Centera self-expanding TAVR device, Edwards will continue to push its developments in the balloon-expandable category with the Sapien 3 Ultra and beyond. The Sapien 3 draws substantially higher rates than the current suite of self-expanding valves in most nations in the European market, so the question for Edwards is how much of the sales of self-expanding units in the EU are driven by price, how much by brand preference, and how much by a preference for the features of self-expanding valves. He said Centera, which bears a CE mark as of February 2018, is priced slightly higher than the Sapien 3 in the EU, and thus sales of the Centera may lend a little clarity on this question. ♦

Vagus

Continued from page 1

reflex to combat diseases or other conditions. Yet the actual mechanism that drives the vagus nerve is not well understood.

Research scientists at the Feinstein Institute for Medical Research, of Manhasset, N.Y., are seeking to standardize an experimental protocol in order to record signals given off by the nerve. Harold Silverman, Sangeeta Chavan, and their colleagues worked to standardize the protocol in mice as a way of recording and better understanding the signals sent within the nerve.

Vagus nerve research

Chavan, associate professor at the Feinstein Institute and associate professor of molecular medicine at Zucker School of Medicine at Hofstra/Northwell, and her colleagues have been studying the nerve for the last decade, she told *BioWorld MedTech*. The connection between the vagus nerve and its role in stemming inflammation has been established, she said.

"That pathway has been identified. The question we are asking now is does the vagus nerve have a role in suppressing inflammation or in sensing inflammation," Chavan said.

"We know from our previous studies that electrically stimulating the vagus nerve inhibits immune responses associated with different diseases," she said. "In this study, we establish methods to record these signals transmitted in the vagus nerve."

The team has been able to record signals from the nerve since 2016, and decipher cytokine 1 and 2.

Signal decoding

Feinstein's team hopes to gain further insight on the signals being sent between the body and brain, and unravel the messages inside.

"The question we are trying to answer, is can we decode the signal transmitted in the vagus nerve," Chavan said. The team hopes to better understand the neuroactivity across the nerve and "decode" those signals for use as a diagnostic or treatment.

The research itself is conducted using a standardized procedure to record signals from a mouse vagus nerve which measures less than 10 microns wide. The study, "Standardization of methods to record Vagus nerve activity in mice," was published March 15, 2018, in *Bioelectronic Medicine* and reports on the institute's electrophysiological recorder, which is able to pick up compound action potentials of mouse vagus nerves.

"Our new methodology allows us to begin developing ways to decode the nervous system in such a way that we better understand how to detect and regulate inflammation," said Silverman. "We can use this new understanding to develop devices that simultaneously diagnose and treat disease."

Device approaches to vagus regulation

Vagus nerve approach to inflammatory disease or metabolism has wide ranging applications, including IBS, obesity and multiple sclerosis (MS). Livanova plc, of London, reported its vagus nerve stimulation therapy system won CE mark for epilepsy treatment. The system includes a generator and programmer, and lets a physician administer treatment. (See *BioWorld MedTech*, April 8, 2018.)

> *"The question we are asking now is does the vagus nerve have a role in suppressing inflammation or in sensing inflammation.*
>
> Sangeeta Chavan
> Associate professor, Feinstein Institute

An implantable device for resistant epilepsy, developed by Synergia Medical SA, garnered $10 million in series A financing to fund a clinical trial. (See *BioWorld MedTech*, Feb. 27, 2018.)

Researchers from Emory University School of Medicine, based in Atlanta, reported in a small-sized study that freezing one of the vagus nerve's two trunks can spur weight loss among mild to moderately obese patients. (See *BioWorld MedTech*, March 22, 2018.)

Enteromedics Inc. also developed a minimally invasive Vbloc device to block vagus nerve signals to treat obesity. (See *BioWorld MedTech*, Jan. 30, 2018.)

Setpoint Medical Corp. has created several vagal-based treatment devices, one of which has been preclinically studied to impact MS. Early data on the VNS device's bioelectronic treatment demonstrated vagus stimulation can impede demyelination and increase remyelination. (See *BioWorld MedTech*, Oct. 31, 2017.) ♦

Product briefs

Biocept Inc., of San Diego, reported the publication of a case report demonstrating the clinical utility of its Target Selector ALK gene rearrangement test. The circulating tumor cell based assay detected the ALK gene translocation in a patient diagnosed with non-small-cell lung cancer who subsequently received sequential ALK inhibitor therapies and exhibited excellent clinical response to treatment. The article, "Detecting an ALK Rearrangement via Liquid Biopsy Enabled a Targeted Therapy-Based Approach for Treating a Patient with Advanced NSCLC," was published in the Spring 2018 issue of the journal *Oncology & Hematology Review*.

Electromed Inc., of New Prague, Minn., reported the results of a longitudinal outcome-based study published in *Respiratory Therapy: The Journal of Pulmonary Technique*. The longitudinal study shows that high frequency chest wall oscillation (HFCWO) therapy with the Smartvest airway clearance system significantly reduces bronchiectasis-related exacerbations including the need for antibiotics, emergency department visits and hospitalizations, and that this effectiveness was maintained for 2.5 years after the initiation of treatment. The study also found that 68 percent of the patients reported a significant increase in their quality of life. The Smartvest system uses HFCWO to rapidly compresses and releases the chest wall, resulting in an oscillation in airflow within the airways that acts to loosen, thin, and propel mucus toward the major airways where it can be expectorated.

CLS

Continued from page 1

Sweden's Clinical Laserthermia Systems AB (CLS) told *BioWorld MedTech*, the Tranberg thermal system's non-cooled system will streamline workflow and procedure times associated with external cooling and that TGH radiologist Sangeet Ghai is just the person to test its effectiveness.

"Dr. Ghai is an opinion-leading doctor in this field. He and his team have previous experience with focal therapies using different technologies, including laser," said Mogren. "So that made us confident this would not only give us good results in terms of the quality of his work, but also a person dedicated to this field of treatment."

Should I cut or should I wait?

Unlike the transrectal approach in which the Tranberg system's laser applicator enters the rectum to treat cancerous prostate tissue, the TGH Tranberg system will employ the transperineal approach, entering the prostate through skin between the scrotum and rectum. As Mogren explained, both approaches reduce morbidities associated with the surveillance of a cancerous prostate gland and more radical prostatectomy or radiation therapy.

"Surgery produces a relatively high percentage of erectile dysfunction, for example. Numbers are above 50 percent at two years," said Mogren. "So you can imagine this factor makes a lot of men with localized prostate cancer think twice before they accept a prostatectomy."

Another problem in stage I and stage II prostate cancer patients: urinary incontinence, which occurs in 10 to 20 percent of patients. Also, the uncertainty patients feel when their doctors suggest just monitoring the extent of their prostate cancers. "You simply don't know whether your cancer will be progressing quickly or whether the doctors will be able to detect that," said Mogren.

Go local, go focal

The Tranberg thermal therapy system, Sangeet Ghai explained, uses the "localizing power of MRI" to identify where a cancer lesion within the prostate gland is located, particularly those lesions that sometimes "hide" at the front of the gland and that transrectal biopsies may miss because they are focussed on the gland's posterior side. "Most of the cancers can be identified if they're clinically significant on MRI," Ghai told *BioWorld MedTech*.

Localizing the cancer using MRI, said Ghai, then raises the question, "Can we focally treat the cancer rather than treat the entire gland?" Again, Ghai said, what you can do is affected by what you can see. Because the visual capability of ultrasound is severely limited "you end up ablating a larger area of the gland in the hope that you've treated the tumor."

By contrast, MRI enables the radiologist to "see the tumor in real time during the treatment," Ghai said. "You can place the Tranberg system's laser fiber right in the center of the tumor and actually control the size of the ablation." Meanwhile, MRI tomography tells clinicians if they're ablating at the intended site.

Tranberg thermal system non-cooled laser applicator; Clinical Laserthermia Systems AB

"And secondly, I can know if I've attained the right temperature at the site, a temperature of around 65 degrees C and how close or how far I am from any sensitive structure and avoid causing any harm to the patient."

Non-cooled, so cool

CLS has also replaced externally cooled laser fibers such as those used in Medtronic's laser applicator system with non-cooled, diffusing laser fiber technology. "A non-cooled system, I think, becomes a little easier on the day of the treatment because there is one less thing to think about," said Ghai. This, in turn, improves work flow and lowers procedure time, he said.

The litmus test for all this: the clinical trial underway at the TGH. Three weeks ago, Ghai treated the first two of 25 patients using the Tranberg system. At different points over the next two years those patients will complete a questionnaire to better understand their quality of life and undergo MRI visualization and numerous biopsies "to know if there's even a tiny, residual amount of tumor left behind," said Ghai.

Publicly traded, CLS's initial IPO came into being in 2009 and continues to finance its development of Tranberg systems through private investment. The laser system in the U.S. lists at $85,000, in addition to disposable laser applicators listed at $3,250. "So that means our system will be less expensive to hospitals compared to our competitors on both items," said Mogren. ♦

China

Continued from page 1

international conglomerates when it comes to high-end medical devices.

"I think China is trying hard to narrow the gap in the R&D amount between itself and international conglomerates, but they are still some way behind," Jackie Tsui from Life Impact Medical, a Hong Kong-based medical device and pharmaceutical products distributor, told *Bioworld MedTech*.

"Foreign manufacturers still dominate high-end medical device market in China, so devices like CT scanners and MRI machines are still largely imported, while local manufacturers continue to focus on lower end devices. So the big picture is still pretty much the same, China's high-end medical device markets relies heavily on imports," Tsui added.

A report published by export.gov, a database, in July 2017 echoed Tsui's comments. According to the report, 80 percent of domestic Chinese manufacturers are low to mid-range devices makers, while high-end products used locally are supplied by large foreign companies like General Electric, Johnson & Johnson, Philips and Siemens.

Still, for China's listed device makers, the last year was a good one.

Shenzhen-listed medical devices maker Lepu Medical Technology was the biggest gainer in the sector in 2017, with its shares surging around 38 percent.

In terms of profitability, the company posted a 32.4 percent increase in net profit last year, the fastest in seven years, on increased sales. Operating income on the other hand jumped 30.9 percent year-on-year.

And first-quarter earnings in 2018 are likely to come in 30 to 40 percent higher than in the same period last year, Lepu said in its full year earnings report.

The company's cardiovascular medical devices sector remained its core business and accounted for 56 percent of total revenue, despite Lepu's recent expansion to the pharmaceutical and the diagnostic product sectors.

The cardiovascular medical devices sector recorded a 20 percent jump in operating revenue in 2017, while its pharmaceutical sector, which accounted for 38.4 percent of the company's total income, saw its operating revenue jump 51 percent year-on-year.

Lepu further added in its earnings report that it plans to utilize more AI technologies in the next three to five years.

Hong Kong-listed Microport Scientific Corp. also reported revenue growth, with an increase of 13.9 percent for the year ended Dec. 31. The company continued its globalization strategy and saw 50.8 percent of its revenue generated from overseas markets in 2017.

The company derived half of its revenue from the orthopedics segment, which jumped 7.3 percent year-on-year. The cardiovascular segment, which accounted for 37.3 percent of the company's total revenue, surged 21.5 percent.

The endovascular segment, neurovascular, EP segment and the neurovascular segment, represented 5.6 percent, 2.1 percent and 3 percent of total income respectively, and their revenue jumped more than 30 percent.

Microport's capital structure also improved, with its gearing ratio dropping to 57.2 percent from 85.5 percent a year earlier while cash and cash equivalents increased to $160.2 million from $123.7 million.

The company noted that tightened supervision over the circulation field and the bidding process will continues to pose challenges to the medical device industry while an increasingly standardized market will likely lead to consolidation in the market.

Shanghai-listed Shinva Medical Instrument Co. Ltd. raised some eyebrows in January as the company said it expected full year net profit to jump between 74 and 124 percent year-on-year, citing an increase in non-operating and investment income from M&A activities as the main reasons for the surge in profit.

The positive profit alert came after Shinva reported in October that its third quarter net profit plunged 91 percent to ¥12.5 million (US$1.98 million). Meanwhile, non-operating income jumped 116.1 percent due to government subsidies, the statement noted.

Operating income on the other hand climbed 20.1 percent to ¥7.1 billion, the company reported.

While the company's Q3 earnings were largely disappointing, analysts and insiders generally believed instead of a hiccup in operations, the plunge in profitability was mainly down to goodwill impairment in Shinva-Uniwin and Yingde Biology, two subsidiaries of the company, as their earnings unexpectedly underperformed. ♦

Product briefs

Establishment Labs SA, of Alajuela, Costa Rica, reported the enrollment and successful completion of implant surgery on the first patient in its U.S. IDE clinical trial of its Motiva silicone breast implants. The Motiva implants IDE clinical trial is a single-arm, multicenter trial, designed to measure the safety and effectiveness of the Motiva Smoothsilk and Ergonomix implants in female patients who are undergoing primary breast augmentation, primary breast reconstruction or revision surgery. With a population size of approximately 750 patients over 22 years of age, at up to 40 study sites in the U.S., Canada, Sweden and Germany, the primary safety endpoint is based on the incidence, severity, method of resolution, and duration of all complications on a per-implant and per-subject basis. The use of 3D imaging systems, performed pre-operatively and at 1-10 year visits, will supplement the data and corroborate the manual measurements performed. An MRI sub-study will be done in parallel to determine the percentage of ruptures, with a subset of the treated population selected to obtain MRIs at one, two, four, six, eight and 10 years.

Miravas

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treat varicose veins, obtained CE marking at the end of last year.

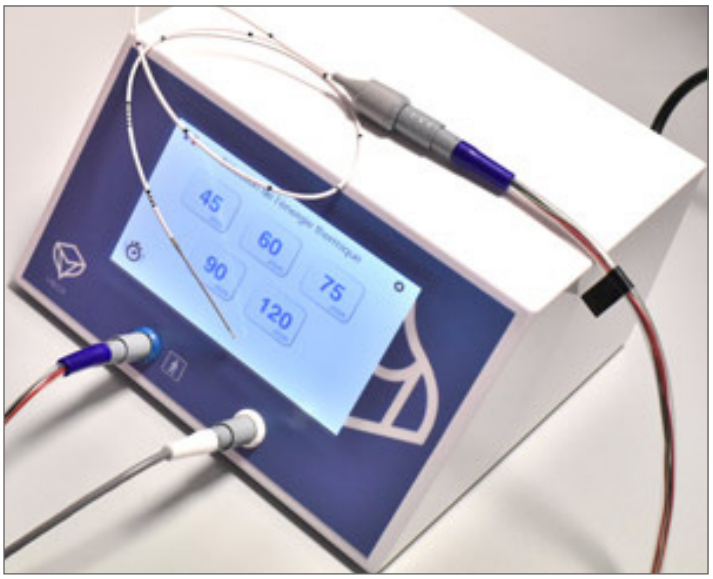
"Our technology allows all types of varicose veins to be treated in just one sitting," Nicolas Rauber, Miravas CEO and an engineer specializing in both microtechnology and medical engineering, told *BioWorld MedTech*.

In France, 10 million patients suffer from varicose veins. Surgical treatments to remove veins by intussusception and stripping have given way to less severe, minimally invasive techniques. Nowadays, most outpatient treatments are based around two medical technologies: radiofrequency and endovenous laser. In radiofrequency treatment, thermal energy is controlled by a generator which heats the venous wall through a dedicated catheter. The laser applied percutaneously in turn burns the vein through the action of the light, which turns into heat at a given wavelength (810, 940, 980 nanometers).

"While laser and radiofrequency techniques are suitable for treating great veins, for sinuous superficial veins like tributary veins and perforating veins it's another story," said Rauber. Hence the idea of combining the two techniques within a single medical device to treat varicose veins. Rauber joined up with René Milleret, who is the founding member and board member of the European Venus forum and the chair of the Congress of the French Society of Phlebology. Since 1995, Milleret has combined his private practice in vascular surgery with developing new medical technologies. He has invented cryo–sclerosis, cryo-stripping of varicose veins, a resorbable braid for colluding veins, a high intensity focused ultrasound device for non invasive vein repair and a method of sclerosing varicose veins by superheated steam. According to Milleret, steam treatment helps to reduce hematomas and inflammations

1 box, 2 techniques

Since its creation in 2015, Besançon, France-based Miravas has invested $615,000 per year to develop this new medical device for the thermic treatment of varicose veins. The hybrid technology is protected by two families of patents, one relating to endovascular treatment by steam, the other to the coexistence of the radiofrequency and steam modes within the same piece of equipment. Hybrid Vbox comprises two components: a box and two different handpieces. The non-sterile and reusable box supplies the electrical energy required for the device to operate and performs the security checks during the treatment. It includes a screen, which serves as an interface displaying the



Hybrid Vbox; Miravas SAS

machine settings. A pedal linked to the box by a connecting cable must be activated in order to give the command for the steam injection. Measuring 250 mm in length, 230 mm in width and 135 mm in height, the box weighs 3 kg. It contains the electronics and software that allows thermic use to be managed alternately; steam mode or radiofrequency mode.

In the "steam treatment" mode reserved for small varicose veins, a single-use sterile handpiece generates the steam, which will be injected into the vein at 120°C at the low pressure of 2 bars. This handpiece, obtained by an industrial injection technique, will convert the sterile water into steam and inject the steam into the catheter and then the vein. In the radiofrequency mode, the handpiece is equipped with a 6F catheter 2 mm in diameter and 65 cm in length. "This very flexible small-diameter catheter is introduced and guided in the vein with no risk of perforating it," said Rauber. This catheter will deliver the thermal energy to the vein walls. Its distal part is heated to a temperature of 120°C over a length of 5 cm for 20 seconds. Then the angiologist or the vascular surgeon moves it along the inside of the vein containing the varix in order to subject this vein to the thermic effect of the radiofrequency along its whole length.

The Hybrid Vbox was designed so that the medical procedure was identical to the procedure of the techniques currently used, with the aim of making its handling easier for medical practice by angiologists or vascular surgeons. "The treatment procedure is very quick. A session will only last around 10 minutes," said Rauber. It comprises four steps: marking the vein under Doppler ultrasound, introducing a catheter to a vein, local anesthetic by tumescence and sending thermal energy in one of the two modes

The Besançon-based med-tech company is developing two medical devices. The first generation, dedicated solely to steam treatment (Vbox steam), received CE marking in July 2016. The

> *"We will put the $3 million towards marketing the first treatment technique for varicose veins to use steam and radiofrequency throughout the European Union.*
>
> Nicolas Raube
> CEO, Miravas

See Mirivas, page 11

Miravas

Continued from page 10

second generation, which was CE certified in December 2017 (Hybrid Vbox), combines radiofrequency and steam treatment. The first generation of the medical device was the object of a post-market clinical follow-up on 15 patients who were monitored at the Aleris Colosseum-Nobel in Oslo in Norway. In April, the French startup company launched a second post-market clinical study with around 60 patients distributed between three French hospital centers. "This is about verifying the safety and clinical reliability of the Hybrid Vbox," said Rauber.

A European market worth $386M

Miravas wishes to acquire a dominant position in the endovenous treatment of varicose veins. This is a $36.2 million market in France, which is expected to reach $65.6 million. According to "Varicose vein treatment devices market analysis and segment forecasts to 2025," the latest study by Grand View Research, a California-based market research and consulting company, the European market, which was worth $211.5 million two years ago, will experience a 9 percent annual growth, reaching $386 million in 2025.

However, the French medical technology will have to vie with half a dozen direct competitors, including Medtronic and its Closurefast device; Angiodynamics Inc. and its Venacure EVLT laser; Biolitec Biomedical Technology GmbH and its technology Elves Radial laser therapy; as well as F Care Systems Srl and its endovenous radiofrequency system. None of these med-tech companies, however, provides steam treatment of varicose veins. This gives a technological lead to Miravas, which has already sold around 40 Hybrid Vboxes through one distributor network in France and another in the U.K. at a unit cost of $12,000 for the box and $250 for the consumables (handpieces). "We are expecting to accelerate distribution in Europe," said Rauber.

The company started raising funds with $430,000 in April 2016 with Invest PME, a private equity firm which supports SMEs from the Bourgogne Franche-Comté region. "We are now launching a second round of fundraising for $3 million with three objectives in mind: to finance a new clinical study on a large cohort of European patients with a three-year follow-up, to expand our distribution contracts in Germany, Spain, Italy and Portugal, and at the same time to prepare the marketing of the technology in the North American market," said Rauber. ♦

Product briefs

Hesperos Inc., of Orlando, Fla., said it has increased its pioneering human-on-a-chip drug testing capabilities by adding a new in vitro, human-human neuromuscular model to its patented multi-organ microfluidic device systems. The new technology is described in a recent *Biomaterials* paper titled "Stem cell derived phenotypic human neuromuscular junction model for dose response evaluation of therapeutics." The technology is now licensed to Hesperos and is available as a fee-for-service assay. Unlike other tests that examine neuromuscular function in co-cultures or using biomarker activity and protein analysis, the new model is a functioning platform that recreates human neuronal connections to skeletal muscle. The compartmentalized, serum-free microfluidic device is made with thin silicone membrane with tiny tunnels. Drugs can be applied to the model – in single doses or in several doses over an extended period of time, mimicking real drug evaluation conditions – to measure how the muscle system reacts. In the paper, researchers describe dose response curves generated curare toxin, alpha bungarotoxin and botulinum toxin (Botox). The results closely matched in vivo data at all four stimulation frequencies tested, suggesting the model provides an accurate replica of live human systems. The technology could help inform the design of future clinical trials, and accelerate drug development timelines.

Medtronic plc, of Dublin, reported two-year outcomes for the Harmony transcatheter pulmonary valve (TPV) from its early feasibility study. Presented at the Society for Cardiovascular Angiography and Interventions 41st Annual Scientific Sessions, data from 18 patients revealed the Harmony TPV showed solid valve function and no paravalvular leak. Designed to offer a treatment alternative for patients with congenital heart disease (CHD), the Harmony TPV is being studied in CHD patients born with right ventricular outflow tract (RVOT) anomalies who undergo a surgical repair early in life. For these patients, who account for approximately 80 percent of CHD patients born with RVOT anomalies, the Harmony TPV provides a less invasive option to help restore normal valve function later in life. Patients enrolled in the Harmony TPV early feasibility study who have now been followed out to two years continued to experience strong hemodynamics, with 86.7 percent of patients having no/trace pulmonary regurgitation at two years. Two patients experienced tissue growth within the stent frame and were treated successfully with a transcatheter valve-in-valve procedure with the Melody TPV. The Harmony Pivotal IDE Study is treating up to 40 patients at approximately 15 sites in the U.S., Canada and Japan.

Mobius Imaging LLC, of Shirley, Mass., received 510(k) clearance for its Airo Mobile CT imaging system for pediatric applications. The system previously received 510(k) clearance in 2013 for non-pediatric imaging Primarily used for intraoperative, image guided procedures in neuro-spine surgery, Airo diagnostic images are also used for supporting applications in brachytherapy, radiation therapy and surgical imaging. Pediatric patients can now receive the clinical benefits of Airo CT imaging for diagnostic and intraoperative procedures.

Neurology Extra

Keeping you up to date on recent developments in neurology

By Andrea Applegate, Production Editor

New transcranial magnetic stimulation able to treat depression in three-minute sessions

In recent study a three-minute version of a brain stimulation treatment was shown to be just as effective as the standard 37-minute version for hard-to-treat depression. The Canadian study looked at repetitive transcranial magnetic stimulation (rTMS), which is a form of treatment that uses magnetic field pulses to noninvasively stimulate the dorsolateral prefrontal cortex, which is associated with mood regulation. Researchers from the Center for Addiction and Mental Health, the University Health Network's Krembil Research Institute and the University of British Columbia compared standard rTMS treatment, which uses high frequency (10 Hz) brain stimulation for 37.5 minutes per session, with a newer form of rTMS called intermittent theta burst stimulation (iTBS), that mimics the brain's natural rhythms and takes just over three minutes per treatment. In the study, 414 participants with treatment-resistant depression were randomly allocated to receive either the standard form of rTMS treatment or the shorter iTBS treatment for five days a week for up to six weeks. For 49 percent of study participants who had the iTBS treatment, depression symptoms reduced significantly, with 32 percent reporting a remission of depression symptoms. Those who received standard rTMS had a remission rate of 27 percent. The results are consistent with previous large-scale studies and meta-analyses over the past 20 years that have confirmed the efficacy and safety of the standard form of rTMS. The study findings were published in the April 28 issue of *The Lancet* in the article "Effectiveness of theta burst versus high-frequency repetitive transcranial magnetic stimulation in patients with depression (THREE-D): a randomised non-inferiority trial."

Brain folding provides researchers with an accurate marker to predict psychosis

Detecting psychosis early increases the chances of effective treatment. Despite advances in diagnosis, however, it has previously not been possible to examine young people with initial psychotic symptoms and reliably say who will develop acute psychosis and who will not. By using images of the brain to look at how its outer surface is folded on itself, researchers found they can predict which high-risk patients will develop psychosis with more than 80 percent accuracy. Researchers from Western University and Lawson Health Research Institute in London, Ontario, collaborated with scientists at the University of Basel in Switzerland to develop an approach using magnetic resonance imaging (MRI) of the brain that can identify which patients with pre-psychotic symptoms will go on to develop full-blown psychosis. For their study, the researchers examined 44 healthy control subjects, 38 patients with first-episode psychosis (characterized by brief hallucinations or delusions) and 79 people with an increased risk of psychosis (with mean ages ranging from 24.0 to 25.9 years). The researchers followed the participants for four years to determine which of those patients developed psychotic disorders like schizophrenia, and which did not. Of the 161 participants, 16 later developed fully-formed psychosis. They reconstructed the brain's nerve pathways using MRI and methods from mathematical graph theory, with which they described a network of nodes. The results show that in comparison to the healthy control group, the folding in individual regions of the brain in patients with an initial psychotic episode and those with a later psychosis transition showed reduced integration and increased segregation. The research article, published April 25, 2018, in *JAMA Psychiatry*, is titled "Disorganized gyrification network properties during the transition to psychosis."

New technology for measuring brain blood flow with light

Biomedical engineers at the University of California, Davis (UC Davis) have developed a new technique for measuring blood flow in the human brain, which could be used in patients with stroke or traumatic brain injury, for example. The new technique, based on conventional digital camera technology, could be significantly cheaper and more robust than prior methods. The work is described in the paper "Highly parallel, interferometric diffusing wave spectroscopy for monitoring cerebral blood flow dynamics" published April 26, 2018, in the journal *Optica*. If you shine a light into a cloudy solution, light particles will be scattered in different directions. An experimental technique called diffuse correlation spectroscopy, or DCS, uses essentially this approach to look inside someone's skull. Laser light is shined on the head; as photons from the laser pass through the skull and brain, they are scattered by blood and tissue. A detector placed elsewhere on the head, where the photons make their way out again, picks up the light fluctuations due to blood motion. These fluctuations provide information about blood flow. The light signal, however, is very weak, and the further it passes through the skull and brain tissue, the weaker it gets. So DCS requires a number of very sensitive, expensive single photon counting detectors. Boosting the light going in risks burning the patient's skin. The researchers took a different approach, based on the fact that overlapping light waves will reinforce or cancel each other out, like overlapping ripples on a pond. They first split the light beam into "sample" and "reference" paths. The sample beam goes into the patient's head and another, stronger, reference beam is routed so that it reconnects with the sample beam before going to the detector. This boosts the signal, meaning that instead of needing about 20 photon-counting detectors that cost a few thousand dollars each, the researchers could use a single CMOS-based digital camera chip for a fraction of the price. They call the method interferometric diffusing wave spectroscopy, or iDWS. So far, the team has tested their device by making brain recordings from volunteers in the laboratory. They are working to validate and adapt the technology for eventual use in neurocritical care. UC Davis has applied for a provisional patent on the technology.