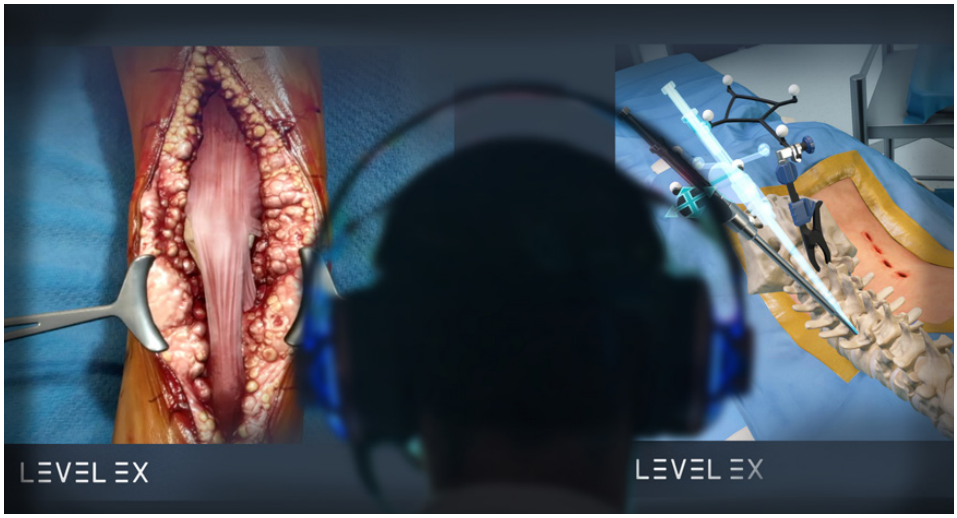
VOLUME 19, ISSUE 29 | OCTOBER 10, 2023

Orthopedics This Week

WEEK IN REVIEW



BREAKING NEWS

For all news that is ortho, read on.

CLICK HERE TO DOWNLOAD A PDF VERSION OF THIS WEEK'S NEWSLETTER

Orthopedic Power Rankings

Robin Young's Entirely Subjective Ordering of Public Orthopedic Companies

THIS WEEK: The attack on Israel added a layer of complex geopolitical risk to the Wall of Worry that traders are already dealiing with—higher interest rates, unexpectedly high job growth, unemployement rate at 3.8%, well below historic 5.7% average. A war in Israel triggers secondary worries over oil prices and even a widening war with other players jumping in. Ortho valuations are moving down. Sales and earnings for the September quarter should be strong, but that is unlikely to change valuation trends. Keep in mind—in this kind of ortho equity market—scale builds wealth.

RANK	LAST WEEK	COMPANY	TTM OP MARGIN	30-DAY PRICE CHANGE	COMMENT
1	4	Integra LifeSciences	17.32%	(7.71%)	3rd cheapest company, 5th best stock performance. Q3 looks like $387mm, up 2%, $0.78 EPS. After its recent operational woes, IART is in rebound mode. Upside possible.
2	1	Johnson & Johnson	24.97	(0.23)	JNJ's equity, as you can see, barely budges in this bear market. Best dividend yield in ortho. Improving performance at DePuy Synthes. Every portfolio needs JNJ.
3	NR	Globus Medical	22.59	(1.86)	Now that the NUVA deal is done, what's GMED doing? Oh, just buying back $350 milliion of stock and launching its own augmented reality platform. Scale builds wealth. GMED is the poster child.
4	2	ConMed	7.42	(10.07)	Perenial ortho value stock. For Q3, Wall Street is looking for 7% sales growth and 8% earnings growth. Note: CNMD has made a habit of beating Wall Street's estimate by, on average, 5-10%.
5	3	Zimmer Biomet	19.88	(9.59)	In addition to new CEO, 44-year old Ivan Tornos, ZBH makes other key changes to executive management. New energy at 96-year-old ZBH? Should be an interesting Q3 Wall Street call.
6	6	Medtronic	18.65	(5.69)	The #1 meeting for spine and neursurgeons—North American Spine Society—opens in about 10 days. MDT should have an outstanding NASS.
7	7	Bioventus	(5.33)	(8.480	Wall Street's patience with reclamation projects like BVS is thin these days. But at these prices, with this outstanding product portfolio and this management, BVS #7 again on the Power Rankings.
8	5	Pacira Biosciences	23.50	(14.64)	PCRX just keeps getting cheaper and cheaper. One year ago, it was $52/share, today it is $29/share. At these prices, with these profit margins, it is the cheapest equity in ortho.
9	NR	Anika Therapeutics	(20.94)	6.52	The top stock performer is Anika Therapeutics. Market leader in HA knee care, since expanded into implants. Latest is a novel shoulder system. Investors like what they see.
10	9	ZimVie	(5.96)	(21.01)	While down over the past 30 days, ZIMV is up 7% from a year ago and at these prices, is the 5th cheapest equity in ortho. For Q3, look for flattish sales but continued EBITDA growth.

Robin Young's Orthopedic Universe

TOP PERFORMERS LAST 30 DAYS

	COMPANY	SYMBOL	PRICE	MKT CAP	30-DAY CHG
1	Anika Therapeutics	ANIK	$18.47	$270	6.52%
2	Johnson & Johnson	JNJ	$157.64	$378,570	-0.23%
3	Globus Medical	GMED	$52.81	$7,382	-1.86%
4	Aurora Spine	ASG.V	$0.25	$16	-5.62%
5	Medtronic	MDT	$76.12	$101,280	-5.69%
6	SI-BONE, Inc	SIBN	$20.76	$834	-6.15%
7	Integra LifeSciences	IART	$38.21	$3,110	-7.71%
8	Stryker	SYK	$265.85	$100,964	-8.04%
9	Dynatronics Corp	DYNT	$0.69	$3	-8.29%
10	Bioventus	BVS	$3.13	$246	-8.48%

WORST PERFORMERS LAST 30 DAYS

	COMPANY	SYMBOL	PRICE	MKT CAP	30-DAY CHG
1	Orthofix	OFIX	$11.57	$425	-40.82%
2	Alphatec Holdings	ATEC	$11.31	$1,361	-28.37%
3	AxoGen	AXGN	$4.58	$197	-25.53%
4	OrthoPediatrics Corp	KIDS	$29.29	$684	-21.16%
5	ZimVie	ZIMV	$9.10	$241	-21.01%
6	SINTX Technologies	SINT	$0.76	$3	-20.15%
7	Pacira Biosciences	PCRX	$29.80	$1,383	-14.64%
8	MicroPort Scientific	0853	$1.45	$2,651	-10.87%
9	Xtant Medical Hldgs	XTNT	$1.15	$148	-10.85%
10	ConMed	CNMD	$97.93	$3,010	-10.07%

LOWEST PRICE / EARNINGS RATIO (TTM)

	COMPANY	SYMBOL	PRICE	MKT CAP	P/E
1	Integra LifeSciences	IART	$38.21	$3,110	17.23
2	Medtronic	MDT	$76.12	$101,280	17.97
3	Johnson & Johnson	JNJ	$157.64	$378,570	19.27
4	Globus Medical	GMED	$52.81	$7,382	24.93
5	Zimmer Biomet	ZBH	$110.91	$23,176	26.21

HIGHEST PRICE / EARNINGS RATIO (TTM)

	COMPANY	SYMBOL	PRICE	MKT CAP	P/E
1	Pacira Biosciences	PCRX	$29.80	$1,383	59.95
2	Medacta	MOVE	$125.70	$2,514	48.06
3	Smith & Nephew	SNN	$23.70	$10,350	46.41
4	ConMed	CNMD	$97.93	$3,010	36.22
5	Stryker	SYK	$265.85	$100,964	31.34

LOWEST P/E TO GROWTH RATIO (EARNINGS ESTIMATES)

	COMPANY	SYMBOL	PRICE	MKT CAP	PEG
1	Smith & Nephew	SNN	$23.70	$10,350	-5.80
2	ConMed	CNMD	$97.93	$3,010	1.30
3	Medacta	MOVE	$125.70	$2,514	1.70
4	Globus Medical	GMED	$52.81	$7,382	2.04
5	Stryker	SYK	$265.85	$100,964	3.11

HIGHEST P/E TO GROWTH RATIO (EARNINGS ESTIMATES)

	COMPANY	SYMBOL	PRICE	MKT CAP	PEG
1	Medtronic	MDT	$76.12	$101,280	5.18
2	Integra LifeSciences	IART	$38.21	$3,110	4.66
3	Zimmer Biomet	ZBH	$110.91	$23,176	3.62
4	Johnson & Johnson	JNJ	$157.64	$378,570	3.35
5	Pacira Biosciences	PCRX	$29.80	$1,383	3.33

LOWEST PRICE TO SALES RATIO (TTM)

	COMPANY	SYMBOL	PRICE	MKT CAP	PSR
1	Dynatronics Corp	DYNT	$0.69	$3	0.07
2	ZimVie	ZIMV	$9.10	$241	0.26
3	Bioventus	BVS	$3.13	$246	0.48
4	Aurora Spine	ASG.V	$0.25	$16	0.81
5	Orthofix	OFIX	$11.57	$425	0.92

HIGHEST PRICE TO SALES RATIO (TTM)

	COMPANY	SYMBOL	PRICE	MKT CAP	PSR
1	SI-BONE, Inc	SIBN	$20.76	$834	7.84
2	Globus Medical	GMED	$52.81	$7,382	7.22
3	Medacta	MOVE	$125.70	$2,514	5.75
4	OrthoPediatrics Corp	KIDS	$29.29	$684	5.59
5	Stryker	SYK	$265.85	$100,964	5.47

PSR: Aggregate current market capitalization divided by aggregate sales and the calculation excluded the companies for which sales figures are not available.

Wanna Play? Learn Surgery on a Video Game

BY KIM DELMONICO

Images from the Level Ex Virtual Technique Guides / Source: Level Ex and Shuttlerstock

Level Ex, a medical video game studio based in Chicago, Illinois, is expanding the world of video games to include surgery and, the game they have launched (which you can try out—read to the end of this article) is sophisticated enough to be an education and training tool for physicians.

The Level Ex team has designed a suite of intriguing video games which are available across several platforms (mobile devices, for example) and incorporate simulation technology and a cloud-based gaming platform.

Level Ex has designed their "games" for medical and healthcare companies, surgeons, and others who may want to develop or advance their surgical skills, complete continuing medical education all while also learning about new medical devices, drug therapies, and clinical best practices.

The guiding principle behind Level Ex is that "play can advance the practice of medicine" by making the learning process more interactive, engaging and, ultimately, effective.

According to the company, "Hands-on experience through video games has helped physicians learn better and faster, leading to a 28% improvement in device competency."

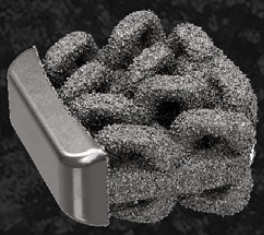
Furthermore, according to Level Ex, companies who employ this gaming style of education have increased their surgeon conversion rates 65%, increased sales 6% and, on average, booked a $5 million increase in revenue.

Level Ex gave *OTW* the opportunity to try out its Virtual Technique Guides. The game options provided to *OTW* included knee replacement, ultrasound simulator, and spine displacement challenge.

During the knee replacement game, *OTW* went through the steps of knee replacement surgery. The steps included the following: placing the retractors on either side of the incision, pulling the retractors to open the incision, bending the knee into position for further preparation, positioning the IM rod near the distal femur, inserting the IM rod into the femoral canal, turning the valgus angle dial to the highlighted position, advancing the cut guide toward the distal femur, and turning the cut level dial until the guide is flush with the distal femur.

Try out the Level Ex Virtual Technique Guides for yourself. ♦

CERVICAL



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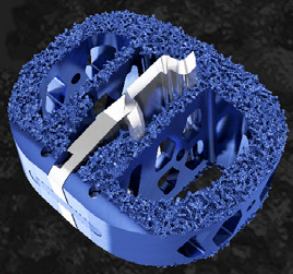

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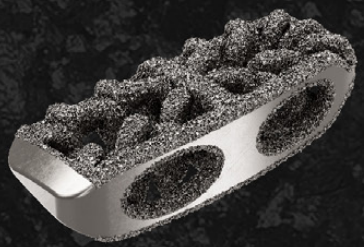

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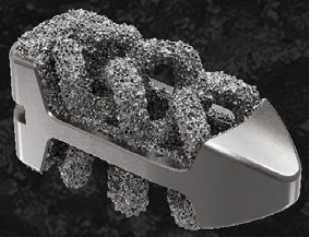

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Are We There Yet? AI in Ortho – An Early Assessment

BY ROBIN YOUNG

Can the supply of physicians, surgeons, or physical therapists meet future demand for musculoskeletal (MSK) care? Probably not.

To make matters worse, the entire MSK system, which relies on about a quarter million highly trained, artisanal, craft-based caregivers, is not easily scalable.

Artificial intelligence (AI) and machine learning (ML) tools, however, could represent a possible solution.

Source: Shutterstock

Mid-Course Assessment on the Road to an AI Future

Two researchers, one from Strava Corporation in San Francisco, Phani Teja Nallamothu, Senior Cloud Engineer II and one from the University of the Cumberlands, Jasmin Praful Bharadiya, Ph.D., former research assistant and current DevOps engineer, published a mid-course assessment of these intelligent tools in orthopedics and spine.

Their study, "Artificial Intelligence in Orthopedics: A Concise Review" appears in the April 2023 edition of the *Asian Journal of Orthopaedic Research*.

By specialty, here was what they found:

- **Joint Reconstruction:** AI is being employed, on a testing basis, for, "Imaging analysis for automated diagnosis, implant appraisal and clinical outcomes prediction." Other applications, which apply across all specialties, but are found in joint reconstruction include, say the study authors, "improving pre-operative workflow for patient-specific implants and implant R&D." Specific areas of AI testing and development are:
    - o Automated OA Diagnosis
    - o OA grading
    - o Prediction risk of OA progression
    - o Identification of unstable implants
    - o Automated implant identification
    - o Preoperative prediction of hospital length of stay, cost and long-term patient reported outcomes
    - o Preoperative planning assistance
    - o R&D/Implant optimization
- **Spine:** By study volume, spine is one of the most active areas for testing AI and ML tools. According to the study authors, "Predicting postoperative complications and using imaging to diagnose spinal disorders are two of the most

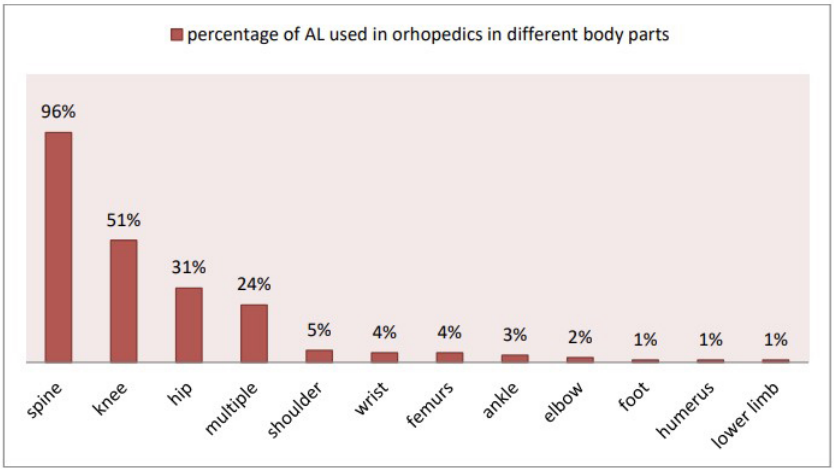
investigated areas." Specific areas of AI testing and development are:

- o Automated vertebral localization
- o Automated pathology diagnosis
- o Disc degeneration severity classified
- o Prediction of postoperative complications

- **Orthopedic Oncology:** "Both primary bone and soft tissue malignancies, as well as metastatic illnesses, have been the focus of AI research." The researchers noted that the use of AI in orthopedic oncology is still in its infancy, but that the outcomes reported in the literature are promising. Specific areas of AI testing and development are:
  - o Automated diagnosis of tumors
  - o Classifying tumors as benign or malignant
  - o Prediction of recurrence, survival, and life-expectancy
  - o Tumor burden analysis
- **Trauma:** For trauma applications, AI image technologies are gaining the most traction. Specifically, "Automated image-based fracture diagnosis is where orthopedic trauma applications now stand." As in other specialties, AI in trauma care is still in its early stages but "research on the use of AI to predict clinical outcomes for victims of trauma is beginning to emerge." Specific areas of AI testing and development are:
  - o Automated fracture detection
- **Sports Medicine:** The study authors found that "Anterior cruciate ligament (ACL) and meniscal tear identification is the most common application in the study of knee injuries." Since sports medicine is, by and large, a soft tissue repair practice, imaging—notably MRI imaging—is especially critical to accurate diagnosis—which, of course, lends itself well to AI tools. Specific areas of AI testing and development are:
  - o Automated detection of soft tissue pathology

Application of AI by Anatomical Region

The authors, as part of their literature review, tracked which anatomic region was most often the target of AI tools. Their conclusions were summarized in the following chart:



Source: Phani Teja Nallamothu and Jasmin Praful Bharadiya, Ph.D.

Here, from the study is a partial list of the musculoskeletal AI clinical studies referenced in their paper:

- Automatic identification of adolescent idiopathic scoliosis through optimization of a three-dimensional spine model vector: *Thong W. et al. Three-dimensional morphology study of surgical adolescent idiopathic scoliosis patient from encoded geometric models. Eur Spine J. 2016;25 (10):3104-3113.*
- Radiographic image analysis for fracture diagnosis: *Olczak J, et al. Artificial intelligence for analyzing orthopedic trauma radiographs. Acta Orthop. 2017;88(6):581-586.*
- In order to make accurate clinical forecasts in the future, ML-based predictions for physician order input have shown that it is preferable to priorities smaller amounts

of more recent data over bigger amounts of older data: *Chen JH, et al. Decaying relevance of clinical data towards future decisions in data-driven inpatient clinical order sets. Int J Med Inform. 2017;102:71-79*

- Dual-energy x-ray absorptiometry for the prediction of hip fractures: *Kruse C, Eiken P, Vestergaard P, Machine learning principles can improve hip fracture prediction. Calcif Tissue Int. 2017;100(4): 348-360.*

- The mechanical performance of a short-stem total hip replacement ban be improved by using machine learning techniques. *Cilla M, et al. Machine learning techniques for the optimization of joint replacements: Application to a short-stem hip implant. Plos One. 2017;12(9):e0183755.*

- New York University uses a value-based care-aligned artificial intelligence system (PersonaCARE) to manage its middle-aged and elderly fracture population. *Karnuta JM, et al. Bundled care for hip fractures: A machine-learning approach to an untenable patient-specific payment model. J Orthop Trauma. 2019;33(7): 324-330.*

- Having concluded that the current value-based bundled care approach to hip fractures is unsustainable. *Ramkumar PN, et al. Preoperative prediction of value metrics and a patientspecific payment model for primary total hip arthroplasty: Development and validation of a deep learning model. J Arthroplasty. 2019;34(10):2228-2234.*

- Joint replacement of the lower extremities: expected hospital expenditures, duration of stay, and patient outcome. *Shah RF, et al. Variation in the thickness of knee cartilage. The use of a novel machine learning algorithm for cartilage segmentation of magnetic resonance images. J Arthroplasty. 2019;34(10): 2210-2215.*

- Articular cartilage thickness in MRI of healthy knees, automatically measured and segmented. *Harris AHS, et al. Can machine learning methods produce accurate and easy-to use prediction models of 30-day complications and mortality after knee or hip arthroplasty? Clin Orthop Relat Res. 2019;477(2):452-460*

- Estimation of Complications and Mortality Rates 30 Days After TJA. *Hamlet WP, Fletcher A, Meals RA. Publication patterns of papers presented at the annual meeting of the American Academy of Orthopaedic Surgeons. JBJS. 1997;79(8):1138-43*

- Predicting in-house SNF utilization after TJA with ANN using internal EMR data. *Fontana MA, et al. Can machine learning algorithms predict which patients will achieve minimally clinically important differences from total joint arthroplasty? Clin Orthop Relat Res. 2019;477(6):1267- 1279 and Thirukumaran CP, et al. Natural language processing for the identification of surgical site infections in orthopaedics. J Bone Joint Surg Am, 2019. 101(24): p. 2167- 2174*

- Using ML before TJA surgery to determine which patients have a good chance of experiencing MCI is a promising area of research. *Thirukumaran CP, et al. Natural language processing for the identification of surgical site infections in orthopaedics. J Bone Joint Surg Am, 2019. 101(24): p. 2167- 2174*

- Infections at orthopedic surgery sites can be detected using natural language processing. *Galbusera F, Casaroli G, Bassani T. Artificial intelligence and machine learning in spine research. JOR Spine. 2019;2(1): e1044.*

- Excellent summary of the use of AI and ML in spine studies. *Myers TG, et al. Artificial intelligence and orthopaedics: An introduction for clinicians. J Bone Joint Surg Am. 2020;102(9):830- 840*

Conclusions

The field of AI and ML in orthopedics is entering its more creative phase, I think, and the range of ideas, particularly in trauma, is very encouraging. Noteworthy, as well, is that the authors, while hailing from academia, are now in industry, in Silicon Valley. From that frame of reference, it is refreshing to see how they see the contours of an AI and ML musculoskeletal future. ◆

Does FDA Have a Handle on the Digital Future of Medicine?

BY ROBIN YOUNG

Source: Shutterstock

The Digital Band is warming up. AI, ML, Big Data—for the FDA, these are going to be complicated beats, for sure.

In mid-September (2023), the FDA released a comprehensive digital strategic plan—an IT roadmap in effect—covering the period from 2024 to 2027.

If you want to read the 11 page report yourself, here is the link: FDA Information Technology Strategy for Fiscal Years 2024 to 2027 (IT Strategy).

Where Is the FDA Heading?

This is the first time the agency has created an actual roadmap for its digital future.

And, where is that road leading to? Technology "maturity," says the agency, in the following four areas…

- Technology
- Data
- Enterprise management
- Cybersecurity

This initiative comes under the FDA's Office of Digital Transformation.

As always, the agency wants input from stakeholders (seriously, who is NOT a stakeholder in the coming world of digital medicine?) and FDA centers.

It's an ambitious vision. Can the FDA meet the diverse needs of its internal and external constituents in an increasingly AI based digital future?

Begin Where You Are

For better or worse, the FDA starts with an existing IT framework—indeed, unavoidably, it is the cornerstone of its IT strategy for the next three years. It's a robust foundation, for sure, but must evolve according to the four bullet points listed above.

FDA's broad objectives? "Foster innovation, enhance public health outcomes, and lead the FDA into a new

era of scientific and technological advancement."

Important to note, incorporated in this plan is a new Office of Regulatory Affairs model.

Six Digital Goals for FY 2024-2027

Despite the rapid evolution of digital technologies and resources, scarcity of technical talent and real concerns over governance in the face of AI and Big Data, the agency does hope to bridge the gap between its current digital capabilities and the coming digital future.

The IT Strategy for Fiscal Years 2024 to 2027, has six key goals:

1. **Create a Shared OneFDA Ecosystem:** Enhance cross-functional collaboration and shift the FDA's culture towards a more integrated approach.
2. **Strengthen IT Infrastructure:** Modernize and secure the underlying IT infrastructure, ensuring adaptability and quick resolution of technology issues.
3. **Modernize Enterprise Services and Capabilities:** Optimize the IT services portfolio to provide stable, resilient, and adaptive solutions that are aligned with mission needs.
4. **Share Data for Mission Outcomes:** Make critical data assets widely available to drive efficiency, excellence, and promote public health innovation.
5. **Adopt AI and Mission-Driven Innovations:** Proactively identify opportunities and risks related to emerging technologies such as AI.
6. **Cultivate Talent and Leadership:** Develop comprehensive technology expertise, leadership, and a robust talent pipeline to keep pace with change.

If, as the agency hopes, it does manage to move into a shared enterprise collaboration frame with stakeholders and cross-sector partners then, it would be a paradigm shift. The key, naturally, is a mix of funding and agency politics.

The digital band has already started playing. Can the elephant learn the new dance? ♦

COMPANY

$23M to Fight PJI With Novel 7-Day Drug Therapy

A seven-day treatment for periprosthetic joint infections (PJI) has just attracted $23 million in series C funding—bringing the total raised to date for this truly novel approach to nearly $65 million.

The investors are among the top venture and private equity firms in the United States—Gideon Strategic Partners, Asteroid Partners and returning investors Johnson and Johnson Development Corp., HM Capital, Prism Ventures and Medvest Capital

The new drug therapy for periprosthetic joint infections is VT-X7 (vancomycin hydrochloride and tobramycin sulfate for irrigation/VT-X7 irrigation system).

It is a drug/device combination product which delivers vancomycin and tobramycin, well-established, broad-spectrum antibiotics, directly to the joint space and surrounding tissue to treat PJI. The drug is delivered by irrigation and is a seven-day therapy.

According to the company bringing VT-X7 through the regulatory gauntlet, Dallas, Texas-based Osteal Therapeutics, Inc., 100% of patients recently treated as part of a clinical study received a new permanent joint prosthesis in seven days with 93% remaining infection free at one year.

FDA Orphan Drug AND Fast Track Status

The U.S. Food and Drug Administration (FDA) granted VT-X7 orphan drug,

Courtesy of Osteal Therapeutics, Inc.

fast track, and qualified infectious disease product designations.

Osteal Therapeutics is nearing full enrollment of its second multicenter, randomized controlled clinical trial of VT-X7. The study, which carries the moniker "APEX-2", builds upon an early Phase 2 study that met its primary endpoint earlier in 2023. Both studies were designed in consultation with the FDA following the agency's decision to designate VT-X7 an orphan drug and qualified infectious disease product.

Osteal will formally apply for New Drug Application (NDA) approval once the full data from APEX-2 is collected and providing that endpoints are met.

"This is a very exciting time at Osteal as we expect to achieve a number of critical value-creating milestones in the coming months," said President and Chief Executive Officer David Thompson. "This capital raise places Osteal in an excellent position to continue our progress with the VT-X7 program, while also leveraging our technical and scientific expertise to strategically expand our pipeline."

Investor Comments

Asteroid Partners, an investor, chimed in.

"Today, hip and knee replacements are extremely common. An aging population that is seeking to stay active will drive a roughly three-fold increase in annual procedures between now and 2040. PJIs, while rare, closely track the number of primary and revision joint replacements. The current standard of care for treatment of PJI is associated with significant morbidity, risk of early death and reduced quality of life, driving both the clinical community and regulators to search for better treatment options. Osteal is addressing this significant unmet medical need with a highly novel approach," said Martin Sands of Asteroid Partners.

"I am impressed with the progress this team has made, especially with their clinical program. What I find the most compelling is that when I speak to clinicians, they universally describe the serious unmet need in PJI treatment and quickly understand the potential value of VT-X7. They recognize this solution affords the possibility to both save and change lives," said Steven Sands, of Asteroid Partners. "I believe Osteal's therapeutic platform will dramatically improve quality of life and outcomes for patients with serious orthopedic infections. I look forward to supporting the team to achieve multiple key milestones over the next 18 months."

Periprosthetic Joint Infection (PJI)

Affecting over 40,000 people in the U.S. annually, PJI is a rare and potentially devastating complication of joint replacement surgery in which pathogenic bacteria colonize the joint prosthesis forming difficult to remove structures called biofilms. Biofilm infections are challenging to resolve, requiring long, invasive and expensive treatments that are often unsuccessful, resulting in high rates of permanent disability and early death. Recent retrospective analyses demonstrate that the current gold standard for treatment of PJI, two-stage exchange arthroplasty, takes an average of 16 weeks and has a success rate under 50% after 12 months, highlighting the unmet need for faster and more efficacious treatment options.

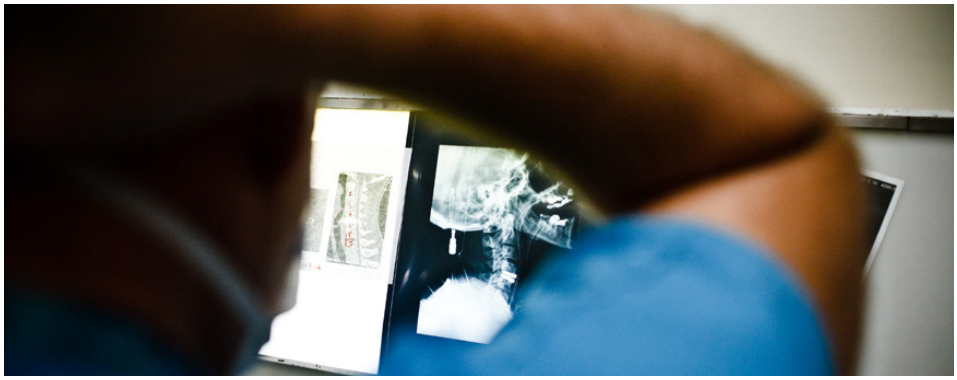
For more information, please visit: www.ostealtx.com — *RRY*

SPINE

32,000 Patient Study Tracks ACDF Revision Rates

A new Yale University study using the PearlDiver MSpine database of 31,952 cervical spine surgery patients collected 5-year revision statistics for single-level anterior cervical discectomy and fusion cases.

The full study, "Single-level Anterior Cervical Discectomy and Fusion Results in Lower Five-year Revisions than Posterior Cervical Foraminotomy in a Large National Cohort," appears in the September 15, 2023, edition of *Spine*.



Source: Andrew Huth and RRY Publications

While there have been numerous retrospective cohorts, randomized control studies, and meta-analyses comparing single-level anterior cervical discectomy and fusion (ACDF) to posterior cervical foraminotomy (PCF), the Yale School of Medicine team wanted to assemble a more statistically significant data set to better understand ACDF outcomes.

Lead author Rahul Jayaram, B.S., a medical student at Yale, told *OTW*, "Cervical radiculopathy is a common issue for which there are different potential surgical approaches. While there is some literature about the outcomes of these different approaches, prior studies have had defined limitations and have reported conflicting conclusions."

"We believed we could approach this topic with large data tools that we had available to add to the literature on this topic."

"Prior literature has been mixed regarding postoperative outcomes and revision surgery rates for anterior cervical discectomy and fusion ACDF and PCF, with some studies maintaining no difference while others demonstrating higher revision rate for posterior cervical foraminotomy (PCF)."

"There have been prior retrospective cohort studies, randomized control studies, and meta-analyses conducted that looked into the risks of anterior versus posterior approaches for cervical procedures, however, these studies are often limited by sample size and lack of adequate follow-up."

"The larger patient numbers in our current analysis of a large national administrative database affords greater statistical power to further examine this question. Of course, this is balanced by limitation of administrative database studies and lack of patient reported outcomes."

Using the Q1 2010 to Q3 2020 PearlDiver MSpine national database, the researchers looked at 31,953 patients who underwent either single-level ACDF (n=29,958) or posterior cervical foraminotomy (PCF) (n=1995).

They found that PCF was associated with significantly greater odds of aggregated serious adverse events, wound dehiscence, surgical site infection, and pulmonary embolism. On the other hand, they determined that PCF was associated with significantly lower odds of readmission, dysphagia, and pneumonia.

At five years, PCF cases had a significantly higher cumulative revision rate compared with ACDF cases (19.0% vs. 14.8%).

"The cumulative rate of revision surgery was significantly higher in PCF than in ACDF," stated Jayaram to *OTW*. "When subsequent surgery was performed following either ACDF or PCF, posterior procedures were most common in both settings."

Jayaram added, "Given the conflicting prior literature, it is likely that the statistical power of our large patient cohort allowed us to identify this observed difference in cumulative revision rates. It can be noted that the Kaplan-Meier curves in this study increasingly separated over time, highlighting the importance of sufficient follow-up time to determine differences between these procedures."

"While the exact mechanism as to why the posterior approach is associated with higher cumulative incidence could not be defined, there are several potential mechanisms. With posterior approaches, it could be that there is less complete decompression of the neural elements, or it may be that the levels addressed are more likely to settle over time."

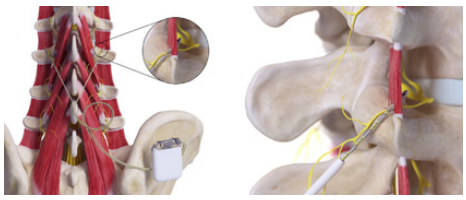
"In cases where anterior or posterior approaches are possible for cervical radiculopathy, the relative incidence of different adverse events should be considered. This should also be put in the context of possible revision procedures over time." — *EH*

ISASS Issues NeuroStim Guidelines

The International Society for the Advancement of Spine Surgery (ISASS) has just issued a comprehensive set of guidelines for treating low back pain patients with restorative neurostimulation therapies.

The new guideline cover:

- The definition of mechanical chronic low back pain



Source: ISASS

- How it presents clinically
- The prevalence and nuance of low back pain
- The critical role muscles play in generating low back pain
- How mechanism of action for restorative neurostimulation
- Patient selection for neurostim treatment
- Clinical evidence for neurostimulation
- Reimbursement landscape including the relevant ICD-10 codes?
- Costs, direct and indirect.

The authors of the study were:

- Morgan Lorio, M.D., FACS with the Orthopedic Laser and Spine Center at LSU,
- Kai-Uwe Lewandrowski, M.D., with the Center for Advanced Spinal Surgery in Tucson,
- Domagoj Coric, M.D., neurosurgeon, Carolina Neurosurgery and Spine Associates,
- Frank Phillips, M.D., Director of Spine Surgery at Rush Medical and
- Christopher I. Shaffrey, M.D., neurosurgeon at the Duke Spine Center

These guidelines come at a most propitious moment. Interventional pain management is, perhaps, the fastest growing sector in the treatment of back pain. Caregivers, notably surgeons and interventional pain specialists, need a comprehensive and authoritative study to help guide the use of these interesting and promising therapies.

For sure, chronic low back pain (LBP) is a diverse and often debilitating experience for a significant proportion of the U.S. population.

Conservative management is step one and remains the predominant care pathway. However, for many patients, conservative care falls too short of symptom relief.

Restorative neurostimulation is a new and promising technique for patients who have exhausted traditional care paradigms.

According to the authors: "Restorative neurostimulation for chronic mechanical LBP is supported by several clinical studies that show robust and durable clinical effects over the pretreatment condition."

"The totality of evidence suggests that in a well-selected patient population

who have exhausted conventional care paradigms, the potential benefits outweigh the risks and costs. These patients tend to be exposed to multiple therapies with limited durability, resulting in a continuous cycle of high-cost health care utilization."

"Restorative neurostimulation should be considered for clinically appropriate patients who have exhausted reasonable conservative approaches."

To read the guidelines yourself, here is a link. —*RRY*

REMEMBRANCES

Arthroscopy Pioneer, Robert Vincent "Bob" Johnson Dies Age 89

Robert Vincent "Bob" Johnson, M.D., a Northern Colorado pioneer in arthroscopy and co-founder of Orthopaedic Center of the Rockies, passed away at home on September 2, at the age of 89.

Johnson served as team doctor for Colorado State University's football and basketball teams and Poudre High School's football team for many years.

In 2000, he was also the team physician for the U.S. National Wrestling Team and traveled with the team to the 2000 Pan American Wrestling Championships in Colombia.

Johnson earned his medical degree from Northwestern University Medical School. He graduated in 1960 with honors and completed his internship at Chicago's Rush-Presbyterian-St. Luke's Hospital in 1961.

Next, he did a four-year orthopedic residency at the University of Illinois Research and Educational Hospitals, and then he enlisted in the United States Air Force.

He served in the Vietnam War from 1965 to 1967 as an orthopedic surgeon at Air Force Academy Hospital.

After his military service, he, Dr. Douglas Murray, Dr. Chuck Collopy. and Dr. Ben Magsamen formed Fort Collins Orthopaedic Associates. They also built a clinic near Poudre Valley Hospital.

In 1990, Fort Collins Orthopaedic Associates was renamed the Orthopaedic Center of the Rockies and the partners built a new surgery/recovery center and therapy center at 2500 East Prospect Road. Johnson continued to work there until he retired in 2002.

Johnson was known as a skilled surgeon who could stay calm under pressure. He was devoted to his patients and staff at the Orthopaedic Center of the Rockies and Poudre Valley Hospital in Fort Collins, Colorado.

Robert Johnson, M.D. / Courtesy of Vessey Funeral Service & Cremation Service

Johnson was born in Lafayette, Indiana, the oldest of a large family of six children. He spent his childhood in nearby Delphi.

His parents owned a small-town newspaper called the *Delphi Citizen* and at first, he thought he would follow in their footsteps.

When he enrolled in DePauw University in Greencastle, Indiana, in 1952 he was a Rector Scholar and English major. It wasn't until he joined the Beta Theta Pi fraternity that he discovered that he enjoyed his fraternity brothers' pre-med classes more than his own.

While he was at DePauw University, he met and fell in love with a classmate Ginny, who would eventually become his wife and the love of his life.

Johnson loved to be active and had many interests including photography, traveling the world, and supporting his favorite sports teams. He loved to ski, bike, and play tennis.

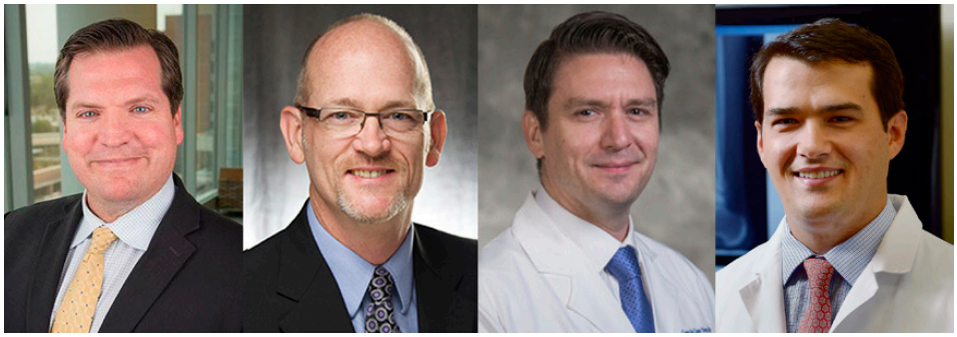
"Bob had an abundance of love for his family. We adored him and treasured our adventures together. Above all, we cherished our time as a large, extended family sitting around the kitchen table, sharing stories and jokes, eating good food, and enjoying each other's company," his family wrote.

Johnson is survived by his wife of 67 years, Ginny; their four sons, Steve, Mike, Tom, and Matt; 13 grandchildren; two great-grandchildren; his siblings Ann Tudor, Mike Johnson, Jerry Johnson, and Mary Johnson.

He was preceded in death by his father, Myron Johnson; his mother, Eileen Rahilly Johnson; and his sister, Sara Adair. — *TR*

PEOPLE

Four Researchers Share AOFAS/AF Award for Ankle Arthritis Research



Kenneth J. Hunt, M.D., Donald D. Anderson, Ph.D., Cesar de Cesar Netto, Ph.D., and Constantine A. Demetracopoulos, M.D. / Courtesy of UC Health, University of Iowa, Duke University, and Hospital for Speical Surgery

The American Orthopaedic Foot and Ankle Society (AOFAS) and the Arthritis Foundation (AF) have jointly announced a first (and hopefully ongoing and permanent) grant to support innovative clinical research that advances knowledge toward treatments to stop or slow ankle osteoarthritis.

The four recipients, who will share this significant $600,000 grant, are University of Colorado-Denver's Kenneth J. Hunt, M.D., University of Iowa's Donald D. Anderson, Ph.D., Duke University's Cesar de Cesar Netto, Ph.D. and Hospital for Special Surgery's Constantine A. Demetracopoulos, M.D.

"This award represents a major step forward for our collaborative effort to understand the unique nature of ankle arthritis. Findings could lead to novel preventative measures and targeted treatments," said Kenneth J. Hunt, M.D., one of the recipients of the award. "We are grateful to the Arthritis Foundation and AOFAS for supporting this work."

Constantine A. Demetracopoulos, M.D., at the Hospital for Special Surgery in New York, said this grant gives his research team the opportunity to study bone quality in ankle arthritis patients in a multidisciplinary and meaningful way.

"Our hope is that our research will lead to better treatment options for patients early on in the disease and improved decision-making and outcomes in our surgical interventions for patients with end-stage ankle arthritis," he said.

Presenting the 2023 AF/AOFAS Ankle Arthritis Think Tank First-Ever Grant Awardees

- **Study Subject:** *Determining the Traumatic Origins of Ankle OA and the Time to Joint Degeneration* Donald D. Anderson, Ph.D., University of Iowa and Cesar de Cesar Netto, M.D., Ph.D., Duke University
- **Study Subject:** *The Impact of Bone Quality and Histopathology in Ankle Osteoarthritis* Constantine A. Demetracopoulos, M.D., and Jensen K. Henry, M.D., Hospital for Special Surgery
- **Study Subject:** *Defining the Unique Synovial Transcriptome and Proteome of Ankle Post-traumatic Osteoarthritis* Kenneth J. Hunt, M.D., and Michael Zuscik, Ph.D., University of Colorado-Denver

"This award means so much to our research team," said Donald D. Anderson, Ph.D. "We are establishing a multisite clinical study group to retrospectively investigate how ankle osteoarthritis develops after different injuries. Our vision is to also position this group to study new interventions as they emerge."

To read the full grant summaries and learn more about the AF/AOFAS Ankle Arthritis Think Tank Research Grants, visit aofas.org/arthritisgrants.

Affecting over 30 million Americans, osteoarthritis is the most common form of arthritis. This month, AF and AOFAS awarded three grants, each totaling almost $200,000 over a two-year period, to AOFAS members dedicated to furthering their ankle osteoarthritis research.

About the AOFAS

The American Orthopaedic Foot and Ankle Society (AOFAS) mobilizes our dynamic community of foot and ankle orthopaedic surgeons to improve patient care through education, research, and advocacy. As the premier global organization for foot and ankle care, AOFAS delivers exceptional events and resources for continuous education, funds and promotes innovative research, and broadens patient understanding of foot and ankle conditions and treatments. By emphasizing collaboration and excellence, AOFAS inspires

ever-increasing levels of professional performance leading to improved patient outcomes. For more information visit the American Orthopaedic Foot and Ankle Society online at aofas.org.

About the Arthritis Foundation

The Arthritis Foundation is fighting for all people who live with arthritis. As a Champion of Yes, it's the Arthritis Foundation's mission to turn the obstacles arthritis causes into opportunities. The Arthritis Foundation champions life-changing solutions and medical advancements, and it also provides ways for people to connect, break down barriers in health care, and join the fight for a cure—uniting hearts, minds, and resources to change the future of arthritis. To join the fight to cure arthritis, visit arthritis.org. — *RRY*

Joseph D. Zuckerman, MD, Receives Lifetime Achievement Award

Someday, buildings will be named for Joseph D. Zuckerman, M.D.

Every once in a long while, a leader emerges in orthopedics—which, this particular specialty, means someone whose core genius is the talent to lead in assists. Having Joe Zuckerman in the building, on the phone or scrubbing in, or teaming up with an engineering

Source: OSET and Dr. Joseph D. Zuckerman

team to solve difficult clinical problems, means that everyone performs better, understands more, creates new standards of care or is simply uplifted.

Kevin Plancher's Orthopaedic Summit-Evolving Technologies conference, gave Dr. Zuckerman its Lifetime Achievement Award at the 13th annual Summit in Boston on September 20, 2023.

In their dedication to him, they pointed out that Joe is The Walter A. L. Thompson Professor of Orthopedic Surgery at the NYU Grossman School of Medicine, Chair of the Department of Orthopedic Surgery at NYU Langone Health and Surgeon-in-Chief of NYU Langone Orthopedic Hospital.

His surgical specialty is shoulder arthroplasty and hip/knee reconstructions. However, over the course of his 39-year career, Joe Zuckerman became known more for his significant contributions and commitment to the field of orthopedics—from patient care, education, clinical research, mentorship, to industry innovation.

Dr. Zuckerman was president of the American Shoulder Elbow Society from 2003 to 2004, then president of the American Academy of Orthopaedic Surgeons from 2009 to 2010. He has trained more than 400 residents and fellows, authored 600+ journal articles and book chapters, and has served as faculty in hundreds of orthopedic courses globally.

"In our 13th year of the Orthopaedic Summit, I couldn't be prouder to present the Lifetime Achievement Award to Joseph D. Zuckerman," said Kevin Plancher, M.D., MPH, FAOA, FAAOS, Founder of the Orthopaedic Summit, Clinical Professor of Orthopaedics at Albert Einstein College of Medicine.

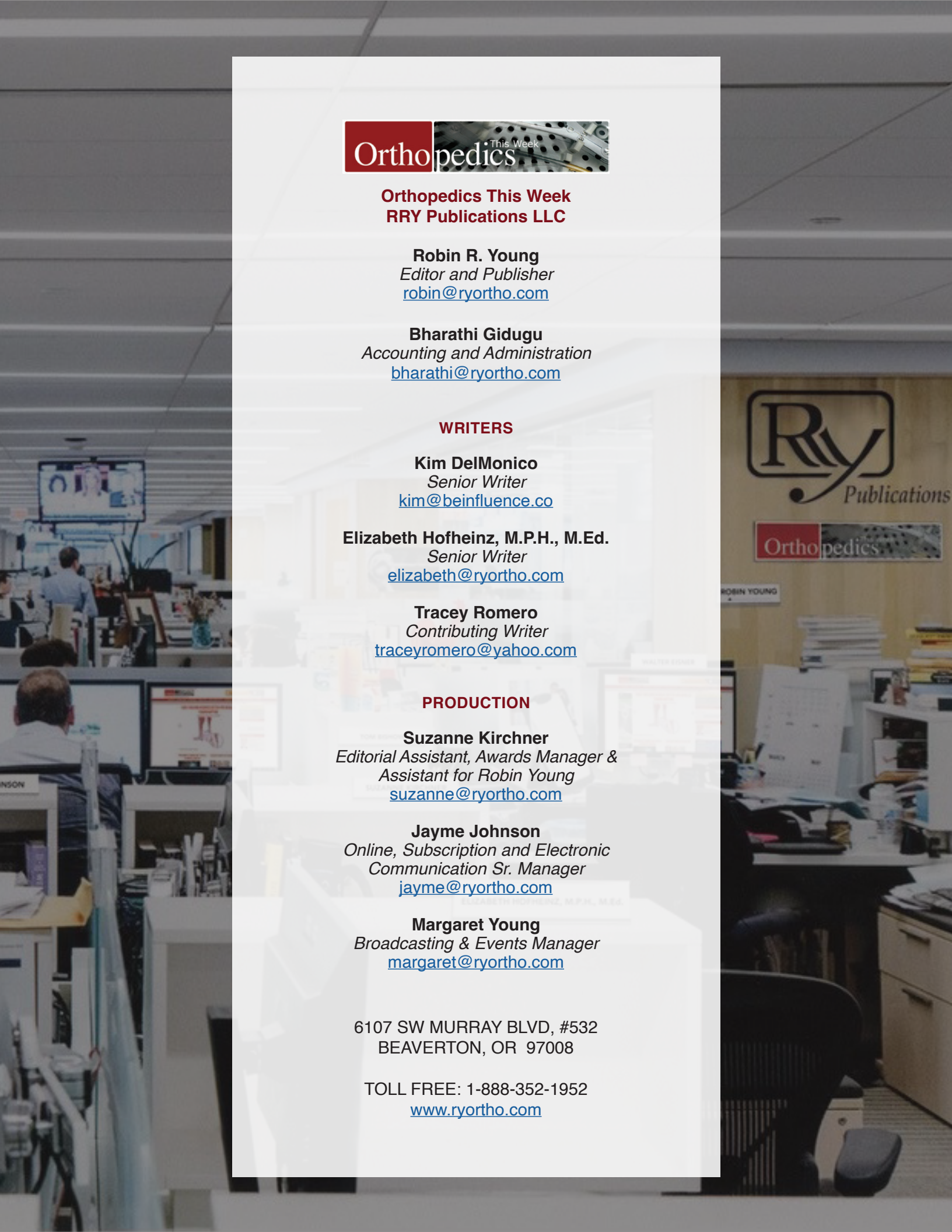
"Joe is an internationally acclaimed giant in the field of orthopaedics. He has mentored so many of us and made countless meaningful and revolutionary contributions in educating surgeons around the globe, changing too numerous to count patients' lives. I couldn't be more honored to have Dr. Zuckerman come to the stage in Boston today at the Orthopaedic Summit."

"I am honored OSET chose to award me the Lifetime Achievement Award," Zuckerman said. "From an early age, I knew I was destined for orthopaedics, and it has been a privilege to have had the opportunity to work with so many wonderful people. I would like to thank my colleagues for their passion and sharing the same vision to advance the field of orthopaedics. I have been fortunate to be able to participate in the evolution of this field to ultimately improve patient care."

Chiming in on behalf of industry was Exactech's Vice President of Extremities Marketing, Emery Patton, who said, "Dr. Zuckerman's extensive knowledge, leadership and professionalism exemplifies why he is a recipient of the Lifetime Achievement Award."

"He has contributed to the development of about 30 Exactech shoulder products over the past 20 years, including many first-to-market solutions, such as our platform humeral stem, augmented glenoids, Equinoxe Humeral Reconstruction Prosthesis and ExactechGPS shoulder navigation."

"These innovations have helped surgeons improve thousands of patients' lives. It has been an honor working alongside Dr. Zuckerman, and it is especially fitting to celebrate this achievement as we approach the 20th anniversary of the flagship Equinoxe® Shoulder System." — *RRY*



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