



Q3 2022 LS Tools / Dx Sector Recap

November 18, 2022

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Q3 2022 Earnings Summary

Q3 Earnings Sentiment

Leading into earnings...

Analysts were generally not expecting large beats in the quarter given continued macroeconomic challenges and geopolitical pressures. Specifically, recession risks, continued lockdowns due to COVID, and varying exposure to foreign exchange were expected to negatively impact earnings and lead to cash deployment conservatism. Early color on 2023 was largely in focus.

Key takeaways

- **While perception of results was mixed**, results were mostly in-line or beat street expectations
 - Significant number of notable events:
 - **9 M&A transactions, 13 C-suite and BOD Chairman changes, 5 cost saving initiatives, and 20 announced capital raises and shelf offerings¹**
- Management commentary was conservative when assessing the macro situation
 - Many companies observed significant FX headwinds, as international currencies weakened compared to US dollar
 - Companies are seeing a high cost of labor for hospitals and a shortage of labor
- Ark investments shifting more of their portfolio away from LST/Dx

Key Themes

Macro environment continues to be a concern

- Most companies assuming macroeconomic challenges including FX and inflation to persist into 2023
- Inflation and FX headwinds expected across the board for the first half of 2023
- Continued trend of companies strengthening their supply and manufacturing infrastructure to prevent significant impact

Increasingly crowded earnings cycle

- **31 companies are recently public** since the beginning of 2020 and 18 companies since 2021, making the reporting space much more crowded
- Like last quarter, larger / more mature companies reported later in the earnings cycle and overlapped with smaller and/or newly public companies

22 rating downgrades and 3 upgrades across the LS Tools/Dx sector

Valuation multiple contraction for growth companies continued throughout the summer

- Average growth **tools multiple down ~41%** since beginning of 2022, and **down ~6%** since the end of the Q2 earnings cycle
- Average growth **Dx multiple down ~45%** since beginning of 2022, and **up ~3%** since the end of the Q2 earnings cycle

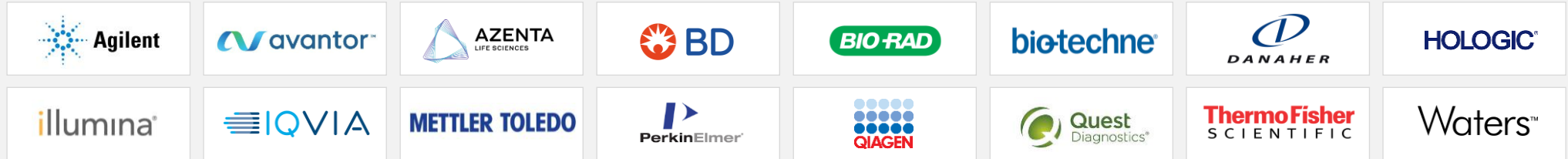


Reporting Landscape

Tracked Companies

Large Caps

>\$10 billion



16 companies

Small / Mid Caps

\$300 mn - \$10 bn



36 companies






















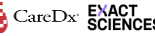












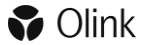































Micro Caps

<\$300 million



18 companies

Q3 Earnings Calendar

	Monday	Tuesday	Wednesday	Thursday	Friday
BM				  20	 21
AM					
BM	24	25	  26	27	 28
AM					
BM	 31	  1	2	  3	4
AM			     	         	
BM	7	    8	9	    10	11
AM	     	           			
BM	   14	15	 16	17	 18
AM	    				

*Genetron & Quotient have not announced earnings yet, Agilent reporting on 11/21/2022

Key Trends & Takeaways

- **31 companies are recently public** since the beginning of 2020 and 18 companies since 2021, making the reporting space much more crowded
- **Larger companies are continuing to report later** in the cycle
- **Mornings** continue to be meaningfully **less crowded** than afternoons
- **Mondays** are becoming **increasingly popular** for companies to report earnings



Q3 2022 Performance

Pre-announcements

Company (Ticker)	Date	Revenue	Y/Y Growth	Guidance	Y/Y Growth (at midpoint)	Stock Reaction (next close)
T2 Biosystems (TTOO)	Oct 12	Miss (22%)	(51%)	Lowered	(20%)	(9%)
QuidelOrtho (QDEL)	Oct 12	Beat 9%	(22% cc)	Raised	6%-8% cc	11%
Perkin Elmer (PKI)	Oct 17	Beat 2%	(7%)	Initiated	--	5%

Large Caps

Company (Ticker)	Date	Revenue	Y/Y Growth	Guidance	Y/Y Growth (at midpoint)	FX Headwind	Stock Reaction (next close)	Stock Reaction (through Nov. 15)
Agilent (A)	Nov 21							
Avantor (AVTR)	Oct 28	In-line	1%	Lowered	2.5%-3%	5.8%	(6%)	3%
Azenta (AZTA)	Nov 14	Beat 3%	Flat	Initiated	--	4%	22%	22%
Becton, Dickinson & Co (BDX)	Nov 10	Beat 2%	(7%)	Initiated	--	--	34%	2%
Bio-Rad (BIO)	Oct 27	In-line	(9%)	Lowered	1%-2%	--	(8%)	7%
Bio-Techne (TECH)	Nov 1	Miss 4%	4%	-	-	3%	4%	19%
Danaher (DHR)	Oct 20	Beat 7%	6%	Raised	-	5.5%	(6%)	5%
Hologic (HOLX)	Oct 31	Beat 10%	(28%)	Initiated	-	\$27M	9%	10%
Illumina (ILMN)	Nov 3	In-line	1%	Lowered	0%-1%	--	6%	13%
IQVIA (IQV)	Oct 26	In-line	5%	Lowered	4%	\$500M in 2022	2%	13%
Mettler-Toledo (MTD)	Nov 3	Beat 1%	4%	Raised	10%	4\$ in 2023	5%	15%
PerkinElmer (PKI)*	Nov 8	Beat 1%	(12%)	Lowered	(9%)	6%	(2%)	10%
Qiagen (QGEN)	Nov 8	Beat 4%	(7%)	Raised	0%	6%	6%	14%
Quest Diagnostics (DGX)	Oct 20	Beat 6%	(10.4%)	Raised	(9%)	--	6%	17%
Thermo Fischer Sci. (TMO)	Oct 26	Beat 8%	14%	Raised	12%	\$1.46B in 2022	(2%)	6%
Waters (WAT)	Nov 1	Beat 4%	8%	Raised	11.5%-12%	13%	3%	10%

Small / Mid Caps

Company (Ticker)	Date	Revenue	Y/Y Growth	Guidance	Y/Y Growth (at midpoint)	FX Headwind	Stock Reaction (next close)	Stock Reaction (through Nov. 15)
10x Genomics (TXG)	Nov 2	Beat 2%	5%	Reiterated	4%	--	18%	50%
908 Devices (MASS)	Nov 14	Beat 1%	26%	Lowered	13%	--	(22%)	(34%)
AbCellera (ABCL)	Nov 8	Beat 35%	1741%	--	--	--	(4%)	18%
Adaptive (ADPT)	Nov 3	In-line	21%	Lowered	22%	--	14%	17%
Akoya (AKYA)	Nov 7	Beat 7%	40%	Raised	35%	--	(10%)	0%
Bruker (BRKR)	Nov 3	Beat 5%	5%	Lowered	1.5%-3.5%	6.9%	5%	13%
CareDx (CDNA)	Nov 3	Miss 4%	5%	Lowered	8%-10%	--	(14%)	(26%)
Castle Biosciences (CSTL)	Nov 2	Beat 7%	5%	--	--	--	(2%)	(7%)
Codexis (CDXS)	Nov 3	Beat 12%	(6%)	Reiterated	32%	--	11%	19%
Cue Health (HLTH)	Nov 9	Beat 20%	(69%)	Initiated	--	--	8%	(7%)
Cytek Bio (CTKB)	Nov 9	Miss 7%	18%	Reiterated	25%-31%	--	5%	8%
Exact Sciences (EXAS)	Nov 3	Beat 4%	15%	Raised	15%	\$2.9M	16%	37%
Fulgent (FLGT)	Nov 7	Beat 16%	(54%)	Lowered	(38%)	--	(2%)	4%
Guardant Health (GH)	Nov 3	In-line	24%	Lowered	19%	--	5%	14%
Invitae (NVTX)	Nov 8	Beat 2%	17%	Reiterated	--	--	(3%)	50%
Maravai (MRVI)	Nov 2	Miss 2%	(7%)	Lowered	10%-11%	--	(6%)	(2%)
MaxCyte (MXCT)	Nov 9	Beat 2%	4%	Reiterated	+30% core	--	16%	12%
Myriad Genetics (MYGN)	Nov 1	Miss 8%	(7%)	Lowered	(2%)	\$7M YTD	(7%)	19%

Small / Mid Caps (cont.)

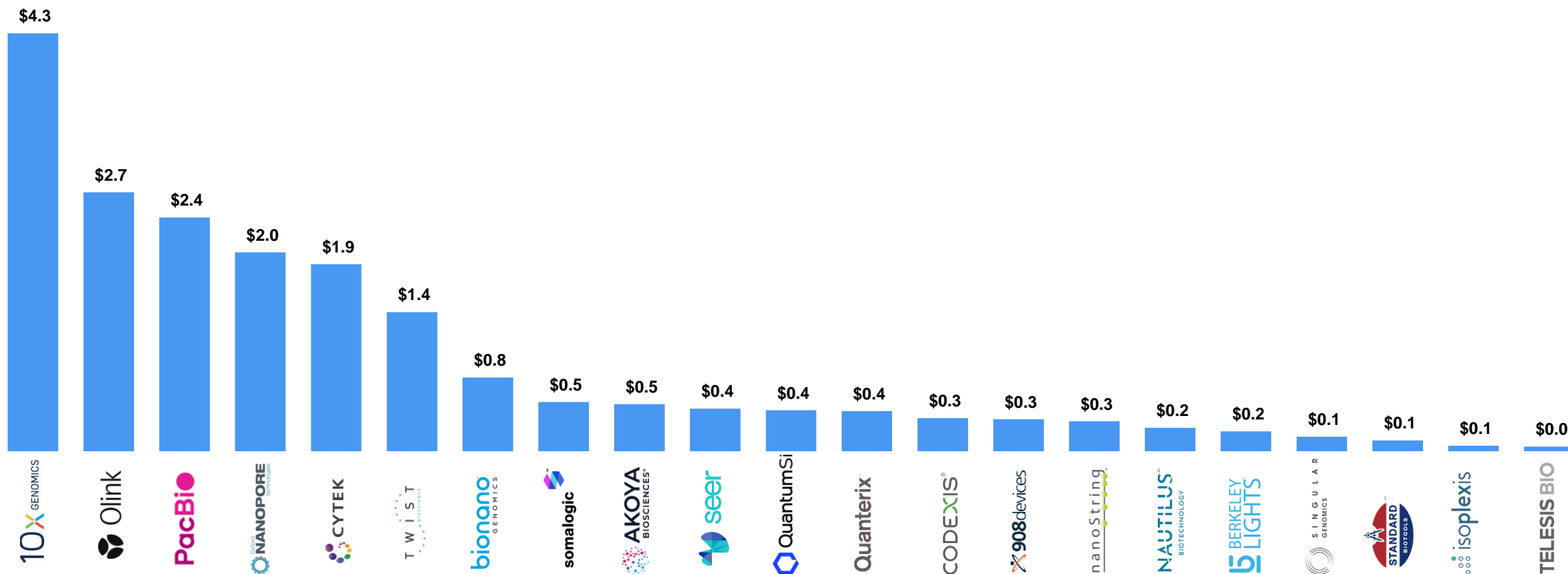
Company (Ticker)	Date	Revenue	Y/Y Growth	Guidance	Y/Y Growth (at midpoint)	FX Headwind	Stock Reaction (next close)	Stock Reaction (through Nov. 15)
NanoString (NSTG)	Nov 7	Miss 17%	(21%)	Lowered	(13%)	--	(33%)	(18%)
Natera (NTRA)	Nov 8	Beat 2%	33%	Raised	31%	--	(13%)	(19%)
NeoGenomics (NEO)	Nov 8	Beat 6%	6%	--	--	--	25%	59%
Olink (OLK)	Nov 10	Beat 10%	59%	Lowered	47%	--	21%	33%
Orasure (OSUR)	Nov 8	Beat 27%	116%	--	--	--	4%	24%
PacBio (PACB)	Nov 7	Miss 9%	(7%)	Withdrawn	--	10%	7%	33%
Quanterix (QTRX)	Nov 8	Beat 11%	(5%)	Reiterated	(5%)	--	1%	30%
Quantum Si (QSI)	Nov 7	Beat 11%	(5%)	Reiterated	(5%)	--	2%	24%
QuidelOrtho (QDEL)*	Nov 2	Beat 9%	22% cc	Raised	6%-8% cc	EPS 230bps	(1%)	3%
Schrodinger (SDGR)	Nov 3	Beat 20%	24%	--	--	--	(15%)	(10%)
Seer (SEER)	Nov 8	Beat 13%	84%	Reiterated	127%	--	6%	28%
Sema4 (SMFR)	Nov 14	Beat 23%	93%	Reiterated	18%	--	(14%)	(14%)
Somalogic (SLGC)	Nov 14	Beat 108%	109%	Raised	17%	--	(11%)	(11%)
Standard Tools (LAB)	Nov 8	--	(8%)	--	--	--	(5%)	55%
Twist (TWST)	Nov 18	In-line	51%	Initiated 2023	30%	--	--	--
Veracyte (VCYT)	Nov 2	Beat 14%	25%	Raised	32%	10%	24%	48%

Micro Caps

Company (Ticker)	Date	Revenue	YY Growth	Guidance	YY Growth (at midpoint)	FX Headwind	Stock Reaction (next close)	Stock Reaction (through Nov. 15)
Accelerate Dx (AXDX)	Nov 14	Miss 22%	(5%)	--	--	--	(19%)	(19%)
Berkeley Lights (BLI)	Nov 8	In-line	(12%)	Reiterated	Flat	--	20%	26%
Biodesix (BDSX)	Nov 3	Beat 9%	70%	Reiterated	(29%)	--	3%	4%
Biora Therapeutics (BIOR)	Nov 14	In-line	(56%)	--	--	--	(4%)	(4%)
Chembio Dx (CEMI)	Nov 3	--	(7%)	--	--	--	(9%)	(20%)
Exagen (XGN)	Nov 14	Beat 64%	(37%)	Raised	(14%)	--	42%	42%
Genetron (GTH)								
Isoplexis (ISO)	Nov 10	Beat 1%	7%	Lowered	11%-15%	--	(15%)	(17%)
Lucira Health (LHDX)	Nov 14	Beat 3%	130%	--	--	--	(40%)	(40%)
Nautilus (NAUT)	Nov 1	--	--	--	--	--	(4%)	(19%)
Personalis (PSNL)	Nov 2	Beat 9%	(33%)	Lowered	(26%)	--	0%	4%
Quotient (QTNT)								
Rapid Micro (RPID)	Nov 10	Beat 19%	(31%)	Reiterated	(27%)	--	4%	8%
Renalytix (RNLX)	Oct 31	In-line	99%	--	--	--	17%	(14%)
Singular Genomics (OMIC)	Nov 7	--	--	--	--	--	(6%)	7%
SOPHiA Genetics (SOPH)	Nov 8	Beat 1%	29%	Reiterated	30%-35% cc	\$6M in 2022	(5%)	6%
T2 Biosystems (TTOO)*	Nov 10	Miss 22%	(51%)	Lowered	(20%)	--	3%	10%
Talis (TLIS)	Nov 3	Beat 99%	365%	--	--	--	(9%)	(28%)
Telesis Bio (DNAY)	Nov 8	Beat 26%	140%	Raised	117%	--	(13%)	0%

Growth Life Science Tools Q3 Performance

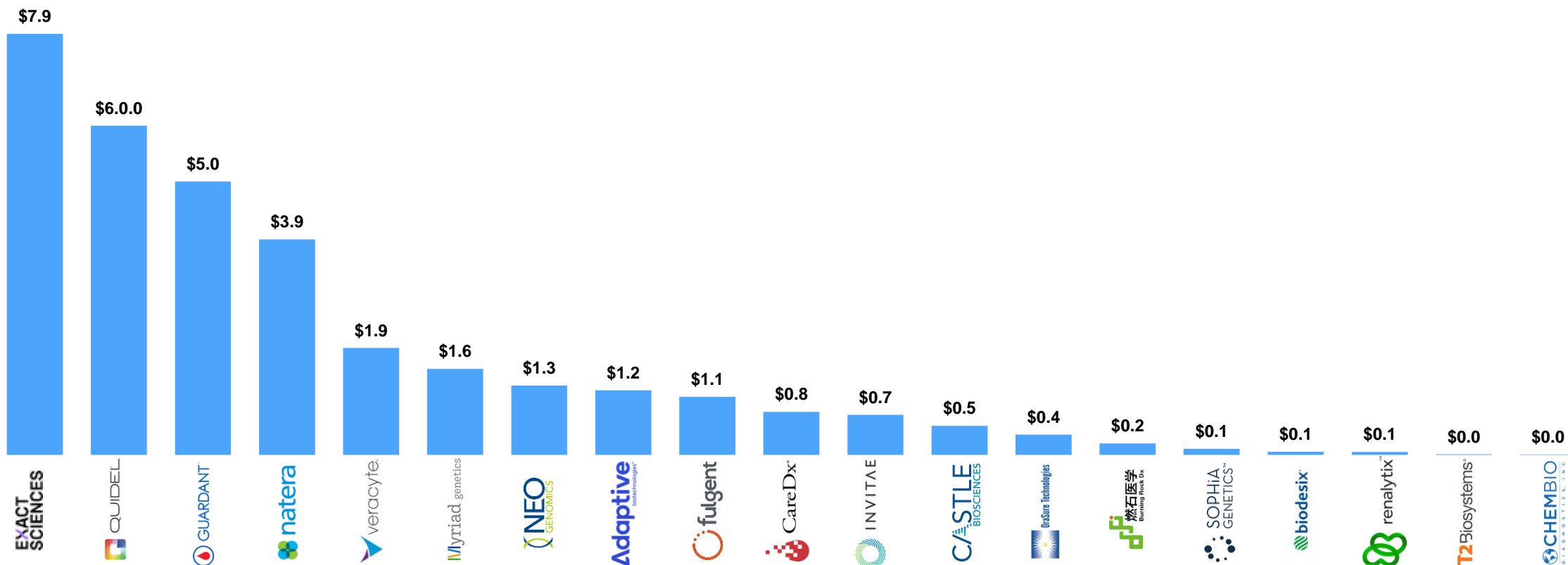
Market Cap (\$B)¹



Revenue (\$mn)	131.1	31.8	32.3		40.5	57.3	7.2	41.7	18.9	4.0	--	26.6	34.5	15.8	29.5	--	21.4	--	25.6	4.5	6.7
Y/Y Growth (%)	5%	60%	(7%)		18%	51%	55%	109%	40%	84%	--	(5%)	(6%)	26%	(21%)	--	(12%)	--	(8%)	7%	140%
OpEx	140.7	30.0	88.2		26	82.6	34.0	82.4	27.6	27.0	27.7	47.5	35.3	16.5	50.8	15.8	36.5	24.7	38.2	19.2	14.9
Cash (\$mn)	452.4	77.1	834.3		341.5	378.7	180.2	566.3	82.0	441.0	372.1	343.7	108.7	193.7	230.5	323.6	120.6	263.8	185.2	53.1	49.9

Growth Diagnostic Q3 Performance









Market Cap (\$B) ¹





Revenue (\$mn)	523.1	783.8	117.4	210.6	75.6	156.4	128.8	47.8	105.7	79.4	133.5	37.0	116.5	21.7	11.6	11.1	0.8	3.7	11.2
Y/Y Growth (%)	15%	22% cc	24%	33%	25%	(7%)	6%	21%	(54%)	5%	17%	5%	116		12%	70%	99%	(51%)	(7%)
OpEx (\$mn)	500.0	350.7	221.5	213.2	54.6	151.0	88.4	78.4	45.7	46.1	306.5	49.7	45.3		30.9	10.6		13.4	7.5
Cash (\$mn)	669.1	212.2	1100	521.2	170.1	259.2	444	527.8	918.0	291.3	736.8	134.2	101.6	142.0	152.8	15.2	41.3	21.5	21.1

Rating Changes

Rating Changes - Downgrades

Bank	Analyst	Company (Ticker)	New Rating	Previous Rating
 ARGUS	David Toung	Catalent (CTLT)	Hold	Buy
 BofA SECURITIES	Derik de Bruin, Michael Ryskin	Catalent (CTLT)	Neutral	Buy
	Michael Ryskin	Maravai (MRVI)	Neutral	Buy
 BARCLAYS	Luke Sergott	Sotera Health Company (SHC)	Underweight	Equal-weight
 BENCHMARK	Robert Wasserman	ThermoFisher (TMO)	Hold	Buy
	Robert Wasserman	Danaher (DHR)	Hold	Buy
 BTIG	Ryan Zimmerman	Organogenesis Holdings (ORGO)	Neutral	Buy
	Ryan Zimmerman	Vericel (VCEL)	Neutral	Buy
EVERCORE	Elizabeth Anderson	Syenos Health (SYNH)	In-line	Buy
 citi	Patrick Donnelly	IQVIA (IQV)	Buy	Neutral
	Patrick Donnelly	Quest Diagnostics (DGX)	Neutral	Sell
 Goldman Sachs	Salveen Richter	Acadia Pharmaceuticals (ACAD)	Sell	Neutral
	Salveen Richter	Lyell Immunopharma (LYEL)	Neutral	Buy
	Salveen Richter	Taysha Gene Therapies (TSHA)	Neutral	Buy
J.P.Morgan	Rachel Vatnsdal	Amyris (AMRS)	Underweight	Neutral
 nephron <small>HEALTHCARE INVESTMENT RESEARCH</small>	Jack Meehan	Avantor (AVTR)	Buy	Hold
	Jack Meehan	Catalent (CTLT)	Hold	Sell
	Jack Meehan	Danaher (DHR)	Buy	Hold
 OPPENHEIMER	Colin Rusch	Amyris (AMRS)	Perform	Outperform
	Colin Rusch	Velodyne Lidar (VLDR)	Perform	Outperform
PIPER SANDLER	David Westenberg	Oncocyte (OCX)	Overweight	Neutral
<i>William Blair</i>	Andrew Brackmann	Derm-tech (DMTK)	Market perform	Outperform

Rating Changes - Upgrades

Bank	Analyst	Company (Ticker)	New Rating	Previous Rating
 BofA SECURITIES	Derik de Bruin	Icon Plc (ICLR)	Buy	Neutral
 Goldman Sachs	Salveen Richter	4D Molecular Therapeutics (FDMT)	Buy	Neutral
	Salveen Richter	Mettler Toledo (MTD)	Neutral	Sell



Sector Multiples, Short Interest & Other Trends

Blended Sector Multiples Have Contracted Since Early 2021



Growth LS Tools EV/Sales 2022 Multiples

Company (Ticker)	January 2022 (as of 1/07/2022)	November 2022 (as of 11/15/2022)	Change
10x Genomics (TXG)	21.4x	8.5x	(60%)
908 Devices (MASS)	6.8x	3.1x	(54%)
AbCellera (ABCL)	12.9x	5.5x	(57%)
Absci (ABSI)	38.0x	20.1x	(47%)
Akoya (AKYA)	6.1x	6.9x	(12%)
Bruker (BRKR)	4.7x	4.3x	(9%)
Codexis (CDXS)	13.8x	2.9x	(79%)
Maravai (MRVI)	10.4x	2.5x	(76%)
MaxCyte (MXCT)	14.4x	11.4x	(21%)
NanoString (NSTG)	8.8x	2.8x	(69%)
Olink (OLK)	8.8x	22.4x	155%
PacBio (PACB)	20.2x	19.3x	(4%)
Quanterix (QTRX)	7.4x	1.4x	(82%)
Schrodinger (SDGR)	11.5x	7.1x	(39%)
Seer (SEER)	72.7x	7.8x	(89%)
Sema4 (SMFR)	2.3x	1.0x	(57%)
Somalogic (SLGC)	11.9x	(0.2x)	(102%)
Twist (TWST)	16.3x	6.9x	(58%)
Average	15.9x	7.4x	(41%)

Growth LS Tools Stock Performance

Company Name (Ticker)	Price	IPO Date	IPO Price	Price chg vs IPO	30D ADV shrs (mm)	30 Day VWAP Price	30D VWAP \$ Vol (mm)	Market Value	Enterprise Value	1-Day	1-week	MTD	3-month	6-month	YTD	1 YR
Genomic																
Bionano Genomics (BNGO)	\$2.29	09/21/2018	\$6.13	(54.4%)	8.14	\$2.23	\$18.29	\$828	\$620	4.9%	16.2%	13.7%	(21.3%)	117.1%	(11.0%)	(47.8%)
Standard BioTools (LAB)	\$1.37	02/10/2011	\$13.50	(89.2%)	0.21	\$1.10	\$0.22	\$116	\$310	9.0%	19.6%	13.6%	(23.0%)	(35.1%)	(65.8%)	(71.5%)
Illumina (ILMN)	\$96.33	07/28/2000	\$16.00	1366.1%	1.52	\$217.79	\$216.74	\$36,898	\$39,708	(3.4%)	8.2%	6.1%	6.7%	13.9%	(36.2%)	(37.0%)
Oxford Nanopore (ONT-GB)	\$3.25	09/30/2021	\$5.73	(43.1%)	1.07	\$2.68	\$1.73	\$2,290	\$1,810	(4.1%)	1.0%	10.5%	(16.5%)	5.6%	(63.9%)	(51.0%)
PacBio (PACB)	\$5.63	10/27/2010	\$16.00	(36.7%)	6.70	\$7.81	\$48.09	\$2,290	\$2,443	(1.7%)	24.8%	22.0%	29.7%	120.8%	(49.7%)	(61.8%)
Personalis (PSNL)	\$3.19	06/20/2019	\$16.00	(83.5%)	0.38	\$2.56	\$0.85	\$121	-\$17	(4.3%)	9.1%	3.4%	(42.6%)	(31.7%)	(80.7%)	(85.5%)
Singular Genomics (OMIC)	\$2.49	05/27/2021	\$22.00	(89.3%)	0.17	\$2.41	\$0.34	\$168	-\$28	(5.2%)	7.8%	(6.8%)	(37.5%)	(21.0%)	(78.5%)	(85.3%)
Proteomic																
908 Devices (MASS)	\$19.08	12/18/2020	\$20.00	(37.6%)	0.22	\$15.13	\$2.35	\$394	\$313	(22.0%)	15.3%	0.1%	(18.7%)	18.2%	(38.1%)	(50.0%)
Nautilus (NAUT)	\$2.14	08/07/2020	\$10.00	(80.2%)	0.14	\$2.12	\$0.25	\$247	-\$10	(4.8%)	0.0%	(15.8%)	(29.3%)	(35.6%)	(59.8%)	(60.0%)
Olink (OLK)	\$14.80	03/25/2021	\$20.00	3.4%	0.13	\$17.38	\$1.79	\$2,461	\$2,437	(2.6%)	13.3%	15.9%	23.7%	103.8%	16.7%	(11.7%)
Quanterix (QTRX)	\$8.94	12/07/2017	\$15.00	(14.4%)	0.46	\$9.92	\$3.40	\$476	\$169	1.3%	26.7%	14.5%	24.8%	(17.8%)	(70.1%)	(76.9%)
Quantum-Si (QSI)	\$3.04	10/26/2020	\$10.00	(69.1%)	0.67	\$2.76	\$1.64	\$432	\$88	(2.5%)	26.8%	4.6%	(20.9%)	3.6%	(59.7%)	(59.7%)
Seer (SEER)	\$9.88	12/04/2020	\$19.00	(58.8%)	0.34	\$7.14	\$1.89	\$490	\$131	(8.9%)	12.2%	9.6%	(19.7%)	22.2%	(62.4%)	(70.7%)
IsoPlexis (ISO)	\$1.89	10/08/2021	\$15.00	(90.2%)	0.02	\$1.80	\$0.02	\$58	\$41	(5.2%)	(9.9%)	(14.4%)	(27.9%)	(25.1%)	(83.1%)	(89.8%)
SomaLogic (SLGC)	\$3.55	04/15/2021	\$10.00	(68.5%)	1.16	\$2.97	\$3.16	\$578	-\$12	(4.3%)	9.3%	(5.2%)	(25.4%)	(23.0%)	(71.7%)	(74.6%)
Spatial																
10X Genomics (TXG)	\$31.30	09/12/2019	\$39.00	(0.2%)	1.60	\$28.60	\$36.23	\$4,457	\$4,371	(5.7%)	29.4%	51.9%	(14.5%)	4.2%	(72.3%)	(75.4%)
Akoya (AKYA)	\$11.21	04/16/2021	\$20.00	(34.7%)	0.08	\$12.82	\$0.69	\$496	\$488	(1.7%)	(3.8%)	(3.3%)	(13.0%)	40.2%	(13.2%)	(0.3%)
Nanostring (NSTG)	\$13.22	06/26/2013	\$10.00	(23.3%)	1.53	\$9.64	\$10.30	\$358	\$408	(7.5%)	(13.8%)	(20.7%)	(52.2%)	(40.7%)	(80.4%)	(83.0%)
Mean				27.6%						(3.8%)	10.7%	5.5%	(15.4%)	12.2%	(54.4%)	(60.7%)
Median				(48.8%)						(4.2%)	10.7%	5.4%	(20.3%)	3.9%	(63.1%)	(66.3%)

Short Interest Trends (% of float) - Growth LS Tools

Company (Ticker)	January 2022 (as of 1/3/2022)	October 2022 (as of 10/1/2022)	November 2022 (as of 11/15/2022)
PacBio (PACB)	9.4	12.4	11.4
Twist (TWST)	11	10.5	11.2
Akoya (AKYA)	3.3	11.3	10.6
908 Devices (MASS)	9.4	10.1	10
NanoString (NSTG)	7.8	10.1	9.6
AbCellera (ABCL)	5.7	10.1	9.4
Absci (ABSI)	6	9.2	8.6
Codexis (CDXS)	14.5	8.4	8.1
Seer (SEER)	15.4	8.1	7.9
Somalogic (SLGC)	3	8.3	7.6
Schrodinger (SDGR)	7.4	7.4	7.1
10x Genomics (TXG)	3.7	6.2	6.7
Sema4 (SMFR)	6.3	7.0	6.6
Maravai (MRVI)	3.6	4.7	5.8
Quanterix (QTRX)	3.2	3.9	4.3
Bruker (BRKR)	3.3	2.8	3.1
MaxCyte (MXCT)	4.4	4.7	3.1
Average	6.9%	8.0%	7.7%

Growth Dx EV/Sales 2022 Multiples

Company (Ticker)	January 2022 (as of 1/07/2022)	November 2022 (as of 11/15/2022)	Change
Guardant Health (GH)	21.1x	13.2x	(38%)
Adaptive (ADPT)	16.6x	6.0x	(64%)
Veracyte (VCYT)	8.2x	6.9x	(16%)
Natera (NTRA)	8.7x	4.1x	(53%)
Exact Sciences (EXAS)	7.6x	4.8x	(36%)
Invitae (NVTA)	5.6x	3.9x	(31%)
Castle Biosciences (CSTL)	6.3x	2.9x	(54%)
NeoGenomics (NEO)	6.5x	3.2x	(51%)
Fulgent (FLGT)	3.2x	0.7x	(78%)
Myriad Genetics (MYGN)	2.6x	2.5x	(5%)
CareDx (CDNA)	5.3x	1.6x	(71%)
Orasure (OSUR)	1.2x	0.9x	(23%)
Quidel (QDEL)	4.0x	2.9x	(28%)
Average	7.5x	4.1x	(45%)

Growth Diagnostics Stock Performance

Company Name (Ticker)	Price	IPO Date	IPO Price	Price chg vs IPO	30D ADV shrs (mm)	30 Day VWAP Price	30D VWAP \$ Vol (mm)	Market Value	Enterprise Value	1-Day	1-week	MTD	3-month	6-month	YTD	1 YR
Adaptive (ADPT)	\$8.51	06/27/2019	\$20.00	(57.6%)	1.13	\$7.35	\$7.02	\$1,213	\$1,061	(9.2%)	5.1%	20.1%	(22.9%)	43.8%	(66.7%)	(72.3%)
Burning Rock Biotech (BNR)	\$3.50	06/12/2020	\$16.50	(86.4%)	0.18	\$2.04	\$0.32	\$198	\$41	(2.2%)	17.9%	11.7%	(34.1%)	(34.8%)	(75.9%)	(84.1%)
Castle Biosciences (CSTL)	\$27.52	07/25/2019	\$16.00	41.1%	0.24	\$22.52	\$3.96	\$595	\$338	0.8%	2.1%	(12.2%)	(34.5%)	23.8%	(47.7%)	(57.6%)
Centogene (CNTG)	\$1.41	11/07/2019	\$14.00	(94.1%)	0.02	\$0.98	\$0.02	\$19	\$26	(6.8%)	(1.4%)	(7.4%)	(40.9%)	(72.5%)	(83.2%)	(90.9%)
Exact Sciences (EXAS)	\$34.51	01/31/2001	\$14.00	220.1%	2.66	\$35.07	\$72.13	\$7,962	\$10,020	(3.3%)	23.3%	33.2%	9.4%	(3.9%)	(40.5%)	(48.5%)
Dermtech (DMTK)	\$5.37	08/10/2017	\$10.00	(75.0%)	0.67	\$2.98	\$1.52	\$76	(\$41)	(10.1%)	67.5%	(13.7%)	(55.7%)	(57.2%)	(82.4%)	(88.4%)
Fulgent Genetics (FLGT)	\$42.20	09/29/2016	\$9.00	299.1%	0.29	\$37.66	\$6.89	\$1,057	\$627	(8.5%)	3.3%	(1.0%)	(24.2%)	(19.4%)	(61.0%)	(54.1%)
Genetron (GTH)	\$1.14	06/19/2020	\$16.00	(94.8%)	0.14	\$0.83	\$0.11	\$76	\$30	0.0%	3.7%	3.1%	(9.2%)	(34.4%)	(86.2%)	(93.6%)
Guardant Health (GH)	\$47.29	10/04/2018	\$19.00	153.9%	1.31	\$47.36	\$44.87	\$4,943	\$5,900	(9.9%)	13.3%	8.2%	0.8%	85.8%	(46.5%)	(49.1%)
Myriad Genetics (MYGN)	\$21.76	10/06/1995	\$18.00	13.1%	0.66	\$18.86	\$9.53	\$1,649	\$1,645	(3.0%)	26.9%	1.2%	(21.4%)	5.7%	(23.9%)	(33.4%)
Natera (NTRA)	\$48.11	07/02/2015	\$18.00	97.0%	1.27	\$43.38	\$38.64	\$3,461	\$3,710	(12.3%)	(9.0%)	(13.9%)	(24.5%)	43.8%	(56.7%)	(64.3%)
NeoGenomics (NEO)	\$9.64	11/02/1999	-	-	1.59	\$7.71	\$10.63	\$1,383	\$1,589	(2.7%)	53.9%	47.9%	(8.5%)	52.4%	(67.0%)	(73.5%)
Veracyte (VCYT)	\$19.25	10/30/2013	\$13.00	120.4%	1.08	\$19.65	\$17.11	\$2,056	\$1,995	(4.3%)	22.8%	48.9%	17.5%	93.8%	(27.3%)	(36.3%)

Short Interest Trends (% of float) - Growth Dx

Company (Ticker)	January 2022 (as of 1/07/2022)	October 2022 (as of 10/1/2022)	November 2022 (as of 11/15/2022)
Guardant Health (GH)	11.1	17.9	20.2
CareDx (CDNA)	6.2	9.1	9.3
Natera (NTRA)	6.1	6.4	6.5
Quidel (QDEL)	9.6	6.7	6.4
Invitae (NVTA)	8.9	6.3	6.3
Exact Sciences (EXAS)	6.6	6.7	5.8
Orasure (OSUR)	4.9	6.0	5.4
Myriad Genetics (MYGN)	4.7	4.9	5.0
Castle Biosciences (CSTL)	4.3	5.1	4.8
NeoGenomics (NEO)	5.6	3.4	4.6
Adaptive (ADPT)	2.7	4.6	4.3
Fulgent (FLGT)	4.4	3.9	4.1
Veracyte (VCYT)	3.3	3.4	2.8
Average	6.0%	6.5%	6.6%

Ark Buys & Sells

Company	Shares (as of 9/30/2022)	Share Change (since Q3)*	Total Shares to Date (11/15/2022)	% Total Ownership
BUYS				
Quantum SI (QSI)	--	12,107,577	12,107,577	2%
Schrodinger (SDGR)	--	4,120,694	4,120,694	4%
CareDx (CDNA)	5,787,120	834,121	6,621,241	4%
Adaptive (ADPT)	9,336,619	507,445	9,844,064	4%
Personalis (PSNL)	5,446,512	437,476	5,883,988	1%
908 Devices (MASS)	3,775,194	171,526	3,946,720	2%
Twist (TWST)	6,676,908	120,011	6,796,919	5%
SELLS				
Invitae (NVTA)	30,468,381	(5,641,519)	24,826,862	2%
Ginkgo Bioworks (DNA)	133,686,627	(3,552,760)	130,133,867	7%
Berkeley Lights (BLI)	5,468,825	(2,514,037)	2,954,788	1%
SomaLogic (SLGC)	11,017,672	(1,623,873)	9,393,799	1%
PacBio (PACB)	28,692,494	(1,382,861)	27,309,633	7%
Veracyte (VCYT)	9,081,363	(1,341,415)	7,739,948	5%
Exact Sciences (EXAS)	17,561,702	(669,930)	16,891,772	15%
10x Genomics (TXG)	4,576,814	(289,242)	4,287,572	3%
Codexis (CDXS)	4,273,485	(56,165)	4,217,320	1%
Guardant (GH)	542,113	(6,996)	535,117	1%



Notable Events

(M&A, C-suite and BOD Chairman changes, RIFs)

Notable Event Summary

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M&A Transactions

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C-suite and BOD
Chairman Changes

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RIF Announcements

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Capital Raises and
Shelf Filings

M&A Transactions

Date	Acquirer (Ticker)	Target (Ticker)	Deal Value	Deal Terms and Rationale
Oct 4	Ginkgo Bioworks (DNA)	Altar (Private)	Undisclosed	<ul style="list-style-type: none"> • Synergies between Altar's ALE platform to Ginkgo's existing strain engineering capabilities
Oct 4	Ginkgo Bioworks (DNA)	Circularis (Private)	Undisclosed	<ul style="list-style-type: none"> • Circularis platform strengthens Ginkgo's platform for development of cell and gene therapies, providing the capability to rapidly identify novel promoters with appropriate strength and tissue-specificity designed into customer specific delivery modalities
Oct 5	Quest Diagnostics (DGX)	LabCare Plus (Private)	Undisclosed	<ul style="list-style-type: none"> • Quest to acquire select assets of Summa Health's outreach laboratory services business, referred to as LabCare Plus, in an all-cash transaction. Quest to acquire select assets of Summa Health's outreach laboratory services business, referred to as LabCare Plus, in an all-cash transaction.
Oct 31	Thermo Fisher (TMO)	Binding Site (Private)	\$2.6 Billion	<ul style="list-style-type: none"> • All cash deal • Binding Site provides specialty diagnostic assays and instruments to improve the diagnosis and management of blood cancers and immune system disorders
Nov 1	Myriad Genetics (MYGN)	Gateway Genomics (Private)	\$68 million	<ul style="list-style-type: none"> • Cash payment with potential incentive payments if Gateway reaches certain targets • Gateway anticipates total revenue of around \$20 million in 2022 and is forecast to grow at a compound annual growth rate of 20% over the next three to five years according Myriad's estimates • Myriad adds the SneakPeek Early Gender DNA test to its portfolio of women's health products
Nov 3	Werfen (Private)	Immucor (BLUD)	\$2.0 Billion	<ul style="list-style-type: none"> • Mix of cash and new senior credit • By combining two complementary Specialized Diagnostics companies, Werfen hopes to expand its global presence

M&A Transactions (continued)

Date	Acquirer (Ticker)	Target (Ticker)	Deal Value	Deal Terms and Rationale
Nov 7	Fulgent Genetics (FLGT)	Fulgent Pharma*	\$100 million	<ul style="list-style-type: none"> The combined company plans to offer a vertically integrated solution to combat cancer with the potential to unlock significant long-term upside for both the therapeutic and diagnostic businesses, *Both were under common control prior to Fulgent Genetics' IPO
Nov 8	Bruker (BRKR)	Inscopix (Private)	Undisclosed	<ul style="list-style-type: none"> Inscopix revenue in FY 2022 is anticipated to be approximately \$20-25 million Bruker expects Inscopix to continue to grow revenues with double digit annual growth rates
Nov 14	Bruker (BRKR)	Neurescence (Private)	Undisclosed	<ul style="list-style-type: none"> Creates strong synergies with Bruker's existing Ultima multiphoton solutions and newly acquired Inscopix head-mounted miniscopes

C-suite and BOD Changes

Date	Company (Ticker)	Position	Name	Details
Sep 8	Quanterix (QTRX)	COO	Daniel Pikora	Appointed Daniel Pikora as COO effective Sept 6
Oct 3	Maravai (MRVI)	CEO	William "Trey" Martin III	BOD appointed William "Trey" Martin, III as its CEO
Oct 3	Codexis (CDXS)	COO	Kevin Norrett	Appointed Kevin Norrett, effective immediately on Oct 3
Oct 4	Quantum-Si (QSI)	CEO	Jeff Hawkins	Appointed Jeff Hawkins as CEO effective Oct 10, succeeding interim CEO Jonathan Rothberg
Oct 14	Azenta (AZTA)	COO	Matthew McManus	Matthew McManus "will no longer serve as the COO effective as of Oct 14"
Oct 17	Exagen (XGN)	CEO	John Aballi	Appointed John Aballi as CEO
Oct 17	Somalogic (SLGC)	BOD Chairman	Chuck Lillis	The current Chair, Chuck Lillis, will remain on the board. Changes were effective Oct 17
Oct 26	Twist (TWST)	COO	Patrick Finn	Patrick Finn promoted to the newly created position of president and COO, previously served as CCO
Oct 31	Cytek (CTKB)	COO	Chris Williams	Appointment is effective immediately, reporting directly to Dr. Wenbin Jiang, chairman and CEO
Nov 1	Quest Diagnostics (DGX)	CEO	Jim Davis	Completed Leadership Succession as Jim Davis Becomes CEO and President, Joins Board of Directors
Nov 1	Codexis (CDXS)	Chief Legal Officer	Margaret Fitzgerald	Appointed Margaret Fitzgerald as Chief Legal Officer and General Counsel
Nov 2	Maravai (MRVI)	CEO	Carl Hull	Carl remains executive chairman and involved in MRVI's strategic direction. William "Trey" Martin III will be CEO
Nov 6	T2 Biosystems (TTOO)	COO	Alec Barclay	Announced resignation of Alec Barclay as Chief Operations Officer, Effective November 30, 2022

Announced Cost Savings

Reorganizations / Reductions in Force (RIF)

Date	Company (Ticker)	Size	Details
Oct 5	TwinStrand Biosciences (Private)	RIF of 50%	<ul style="list-style-type: none"> • 50 layoffs
Nov 1	Lucira Health (LHDX)	RIF of 25% of workforce	<ul style="list-style-type: none"> • 56 layoffs • Saves \$8.3 million/year, part of cost reduction plan
Nov 8	NanoString (NSTG)	RIF of 10% of workforce	<ul style="list-style-type: none"> • ~80 layoffs • To decrease its costs and create a more streamlined organization to support its business
Nov 14	Illumina (ILMN)	RIF of 5% of workforce	<ul style="list-style-type: none"> • ~450 layoffs • Realigning Core Illumina OpEx to reflect the current macro-economic environment
Nov 14	Sema4 (SMFR)	RIF of 33% of workforce	<ul style="list-style-type: none"> • 500 layoffs • Exiting the reproductive health testing early next year and closing its laboratory in Stamford, CT

Announced Capital Raises and Shelf Filings

Equity Offerings

Date	Company (Ticker)	Offering Type	Offering Value	Bookrunners
Aug 26	Cytek Biosciences (CTKB)	Shelf	\$150 million	Piper
Aug 26	Sema4 (SMFR)	ATM	\$300 million	Canaccord
Sept 12	Relay Therapeutics (RLAY)	ATM	\$300 million	BofA, Cowen, Goldman Sachs, JPM
Sept 28	Catalent (CTLT)	Mixed Shelf	4.3 million shares	--
Oct 5	Ginkgo Bioworks (DNA)	Mixed Shelf	\$500 million	--
Oct 7	Chembio Diagnostics (CEMI)	ATM	\$21 million	Craig-Hallum
Oct 25	Recursion (RXRX)	Private placement	\$150 million	Lead: Morgan Stanley Co-Agents: Berenberg, KeyBanc Capital Markets and Needham
Nov 7	Akoya (AKYA)	Mixed Shelf	\$150 million	Piper Sandler
Nov 7	Biora Therapeutics (BIOR)	Direct Offering	\$9.8 million	H.C. Wainwright
Nov 15	Hologic (HOLX)	Mixed Shelf	--	--
Nov 15	Ginkgo Bioworks (DNA)	Common Stock	\$100 million	BTIG
Nov 15	Natera (NTRA)	Common Stock	\$350 million	Lead: Baird Co-Agents: MS, Cowen, SVB Securities

Announced Capital Raises

Fixed Income Offerings

Date	Company (Ticker)	Offering Type	Deal Value	Lender	Terms
Aug 9	Telesis Bio (DNAY)	Term Loan	\$30 million	MidCap Financial Trust	<ul style="list-style-type: none"> Tranche 1 loan of up to \$20.0 million, a tranche 2 worth up to \$5.0 million, and tranche 3 loan of up to \$5.0 million
Aug 31	Bio-Techne (TECH)	Line of Credit	\$1.4 billion	BMO Harris Bank	<ul style="list-style-type: none"> Provides a revolving credit facility of \$1 billion, which can be increased by an additional \$400 million subject to certain conditions
Sep 12	Adaptive (ADPT)	Multi-tranche royalty	\$250 million	OrbiMed Advisors	<ul style="list-style-type: none"> ADPT will receive an initial tranche of \$125 million with the option to receive an additional \$75 million OrbiMed entitled to receive 5% of ADPT's GAAP revenues, increasing to 8% and 10% if the second and third tranches are drawn Royalty on ADPT's revenues not in perpetuity
Sep 13	Amyris (AMRS)	Term-Loan	\$80 million	Foris Ventures	<ul style="list-style-type: none"> Aggregate principal amount of up to \$80 million \$30 million tranche drawn in full on September 13, and a \$50 million tranche to be drawn in full by or before September 30, 2022
Oct 11	Amyris (AMRS)	Term-Loan	\$100 million	DSM Finance	<ul style="list-style-type: none"> Aggregate principal amount of up to \$75 \$50 million tranche to be drawn in full on October 11, 2022, and a \$25 million tranche to be drawn in full by or before December 31, 2022 Includes a provision for a third tranche of \$25 million
Nov 7	Syneos Health (SYNH)	Term-Loan	\$1.35 billion	JPM Chase	<ul style="list-style-type: none"> Five-year \$1.35 billion term loan A facility available in U.S. Dollars Five-year \$1 billion revolving credit facility available in U.S. Dollars
Nov 15	Thermo Fisher (TMO)	Senior Notes	1) \$1.2 billion 2) €1.25 billion	--	<ol style="list-style-type: none"> <u>Bookrunners:</u> BofA, Citi, Deutsche, Barclays, BNP Paribas, Credit Suisse, Goldman, HSBC, JPM, Mizuho, US Bancorp, Wells Fargo <u>Bookrunners:</u> BofA, Citi, Deutsche, Goldman, ING, Morgan Stanley, MUFG, RBC, SMBC, Scotiabank
Nov 16	Biodesix (BDSX)	Term-loan	\$50	Perceptive Advisors	<ul style="list-style-type: none"> BDSX will receive an initial \$30 million funding. An additional \$20 million will be available in two separate \$10 million tranches

