Zacks Small-Cap Research

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Biomerica Inc (BMRA-NASDAQ)

BMRA: Base Business Bouncing Back

We use sum of the parts to value BMRA. Comparable P/S and P/B values the base business at ~$2.00/share. Applying 'upfront' multiple that Celtis paid for rights to InFoods in S. Korea to U.S. market values InFoods at ~$1.50/share. Sum of parts values BMRA at $3.50/share.

Current Price (04/18/17)	$2.29
Valuation	**$3.50**

OUTLOOK

While recent financial performance has not been as strong as it had been in the past (although has recently returned to near-historical highs), it has greatly improved (particularly in Asia) and, importantly, BMRA continues to move down the road with what could potentially and eventually be their most significant product to-date, InFoods, their proprietary IBS test being developed to help physicians guide treatment decisions through identifying patient-specific trigger foods. Our analysis of the IBS drugs market indicates high unmet need for alternative, more effective therapies – setting the stage for InFoods. We believe that the minimal effectiveness and drawbacks of prescription drugs means that the "attractiveness hurdle" that novel IBS therapies must meet to generate interest from the ~$1B+ U.S. IBS market is relatively low. That should be particularly true for non-drug, side-effect-free products such as InFoods. Our sum of the parts values BMRA at approximately $3.50/share. Additional progress and clarity related to the regulatory pathway (and related specifics), requisite clinical trial programs (including scope, size, design and outcome measures) and additional validation of the performance, replicability and clinical utility of InFoods could push our valuation higher.

SUMMARY DATA

52-Week High	**$3.24**
52-Week Low	**$1.41**
One-Year Return (%)	**45.81**
Beta	**-0.49**
Average Daily Volume (sh)	**19,605**
Shares Outstanding (mil)	**8**
Market Capitalization ($mil)	**$19**
Short Interest Ratio (days)	**N/A**
Institutional Ownership (%)	**1**
Insider Ownership (%)	**26**
Annual Cash Dividend	**$0.00**
Dividend Yield (%)	**0.00**
5-Yr. Historical Growth Rates	
Sales (%)	**-4.2**
Earnings Per Share (%)	**N/A**
Dividend (%)	**N/A**
P/E using TTM EPS	**N/A**
P/E using 2017 Estimate	**N/A**
P/E using 2018 Estimate	**N/A**
Zacks Rank	**N/A**

Risk Level	**High,**
Type of Stock	**Small-Growth**
Industry	**Med-Drugs**

ZACKS ESTIMATES

Revenue
(in millions of $)

	Q1 (Aug)	Q2 (Nov)	Q3 (Feb)	Q4 (May)	Year (May)
2016	1.29 A	1.17 A	1.36 A	1.33 A	5.14 A
2017	1.41 A	1.43 A	1.50 A	1.47 E	5.81 E
2018					6.31 E
2019					6.84 E

Earnings per Share

	Q1 (Aug)	Q2 (Nov)	Q3 (Feb)	Q4 (May)	Year (May)
2016	-$0.01 A	-$0.01 A	-$0.02 A	-$0.16 A	-$0.20 A
2017	-$0.01 A	-$0.02 A	-$0.04 A	-$0.02 E	-$0.09 E
2018					-$0.10 E
2019					-$0.08 E

Zacks Projected EPS Growth Rate - Next 5 Years % **N/A**

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WHAT'S NEW……

Q3 2017 Results / Operational Update: *Third Consecutive Quarter of Sequential Revenue Growth…*

Biomerica reported financial results for their fiscal 2017 third quarter ending February 28. This marked the third straight quarter that revenue surprised on the high-side. While both fiscal Q1 and Q2 beat our respective estimates by 12%, which was largely due to better than expected performance in Asia, the most recent quarter's top-line came in about 8% better than our number from relative outperformance in Europe and the U.S. But, despite the encouraging revenue trends – which includes sequential growth over the last three consecutive quarters and Q3 reaching the highest revenue since fiscal Q4 2014 (ending May 2014) – this did not translate into improved operating loss as a result of moderate narrowing of gross margin and relatively higher OpEx.

Q3 revenue of $1.5M was up 10% yoy, up 5% sequentially and about 8% better than our $1.4M estimate. While revenue in the U.S., at $345k, was down 7% yoy, it was at the highest level since Q3 2016 and the third highest level since Q3 2010. The single-digit contraction in U.S. revenue was more than offset by 20%+ yoy growth in both Europe and Asia which, BMRA notes in the 10-Q, benefitted from an increase in clinical laboratory product sales.

Revenue from Asia was $448k, up 22% from $367k in Q3 2016 (i.e. yoy) but down 37% from $716k in Q2 2017 (i.e. sequentially). While Asia has been a territory which has historically experienced relatively high short-term sales volatility – which was again evident with the large q-to-q drop from Q2 – sales in this part of the world have recently shown an encouraging upward trend. This is evident in the ninth-month results – through the first three quarters of fiscal 2017 sales in Asia were $1.7M, up 43% from the comparable year-earlier period and higher than in all of fiscal 2016. In fact, the current 9-month annualized run-rate implies Asia sales could almost match their second highest fiscal year level ever. Given that Asia accounts for 40%+ of total revenue, even incremental growth from current levels in this territory will have a meaningfully positive effect. We continue to model low double-digit annual growth in Asia sales over the next several years.

Europe has not been nearly as positive which saw sales fall 20% in fiscal 2016 and shed another 7% through the first half of fiscal 2017. But while one quarter does not make a trend, the most recent period bucked the prior 18-months of disappointing sales. Q3 '17 European revenue of $654k was 20% better than the prior year number, up 41% from Q2 and the highest since Q4 2015. While Biomerica has never provided much in the way of detailed trends effecting revenue, they do note in the Q3 10-Q that an increase in sales of clinical laboratory products benefitted both their Asian and European segments. As we noted in previous updates, we viewed recent signs of European revenue stabilizing around ~$500k/quarter as encouraging relative to the potential for this territory to return to positive growth in the coming (i.e. current) year. The Q3 number, which pushed European revenue through the first nine months of 2017 up to $1.672M, or 2% higher than the comparable prior-year period, further reinforces our hopefulness towards that end.

Meanwhile, the U.S. continues to struggle to gain much traction towards growing revenue. Q3 revenue at $345k, while better than our estimated $241k and about twice that of the $172k posted in Q2, was down 7% yoy. Through the first nine months of 2017, U.S. sales are down 4% from the comparable period in 2016. While we continue to model roughly flattish U.S. sales from the company's currently commercialized product portfolio, that would almost certainly change if and when InFoods, the company's novel IBS product, gains FDA regulatory clearance and launches.

As we detail below, the deleteriousness of IBS and significant prevalence of the disease has spawned a number of new entrants to the IBS drug market. But all of these drugs, which target only the symptoms and not the underlying cause, provide relief to only a relatively small portion (~15% - 20%, based on clinical study data) of sufferers. And 'relief', for those that do show a treatment response from these drugs, is often only partial and temporary. As such, an alternative that can effectively address the underlying cause of IBS, such as what InFoods is being developed to do, would likely garner significant appeal and demand.

Financials
Q3 revenue of $1.50M was up 10% yoy, up 5% sequentially and about 8% better than our $1.39M estimate. European and U.S. sales beat our numbers by 23% and 44%, respectively, while sales in Asia were 19% below our estimate. Revenue from the other geographic territories, which combined account for about 4% of total revenue, was about 20% shy of our estimate ($53k A vs. $66k E).

Q3 gross margin was 30.0% - which is well below both our estimate (37.5%) as well as the 39.9% average in the first six months of 2017. However, it is up significantly from 25.3% in Q3 2016. While we have no particular insight into the change in gross margin, we do note that it can bounce around q-to-q. Through the first nine months of 2017 gross margin was 36.5% which compares favorably to the prior-year period (30.9%). Additionally, despite the relative softness in the current quarter, both gross margin and gross profit have been trending up – in fact the $1.58M in gross profit through the first nine months of 2017 is the highest over any consecutive three-quarter period since the $1.70M generated through fiscal Q2 – Q4 2013.

Q3 OpEx were $767k, or 51% of revenue, compared to our $756k, or 54% of revenue estimate. SG&A in Q3, on both an aggregate dollar spend basis as well as a percentage of revenue basis looks to be the highest in recent history (at least as far back as fiscal 2010) – the previous high (on both measures) was Q2 2017. BMRA notes in the 10-Q that an increase in reserves for bad debts related to two foreign accounts is reflected in the increase in SG&A. We note, however, that based on the company's financial statements and footnotes, that there does not appear to be an opinion regarding significant risk of uncollectable A/R (i.e. we do not have meaningful concern relative to collectability).

Meanwhile, R&D expense was $257k and $782k in the three and nine months ending Feb 2017 – which compares to $185k and $574k in the comparable year-earlier periods – which we think largely reflects additional activity on new products under development, including InFoods.

We note that while our model reflects an expectation of incremental InFoods-related development and regulatory expenses, we continue to refrain from modeling any potential revenue for the product due to significant uncertainties related to the regulatory pathway (and related specifics), requisite clinical trial programs (including scope, size, design and outcome measures) and additional validation of the performance, replicability and clinical utility of the product. We will, however, continue to revisit this assumption on a regular and ongoing basis and consider updates to our model (potentially including InFoods-related revenue contribution) with additional and substantive development and/or regulatory progress.

Cash

BMRA exited Q3 with $1.5M in cash and equivalents. Cash used in operating activities was $82k and $389k ($202k and $340k ex-changes in working capital) in the three and nine months ending Feb 28, 2017. BMRA first noted in their fiscal Q2 2017 10-Q (and reiterated in the most current 10-Q) that the Board has authorized the filing of an S-3 registration statement, although also notes that the company does not intend to immediately sell securities. Additional, non-dilutive funds, could come from BMRA's agreement with Celtis Pharm Co. of S. Korea which calls for that company to pay Biomerica up to $1.25M in exclusivity fees based on "certain milestones including Biomerica's starting clinical trials in the United States, receipt of US FDA clearance and Celtis' first sales of IBS Products in Korea".

Operational Update

BMRA has made meaningful operational progress over the last several quarters – most notably with their IBS test product candidate ('InFoods') including further development activities, assemblage of an expert scientific advisory board to help guide strategy and with intellectual property protection. So while recent financial performance has not been as strong as it had been in the past (although has recently returned to near-historical highs), it has greatly improved (particularly in Asia) and, importantly, BMRA continues to move down the road with what could potentially and eventually be their most significant product to-date.

BMRA is moving further towards the possibility of bringing their IBS test to market. In early calendar 2015 the company filed the first set of patents related to the product. In March 2016 the company announced that their international method and composition patent claims were reviewed by the International Search Authority (ISA) which found them to be novel and non-obvious. Locking down the IP will be an important initial step. Currently 17 patents are pending. In June 2016 the international patent bureau effected an application communication date of May, 19 2016. Additional details regarding the specific test-related methodology is included in the patent application as are examples of how InFoods' methodology differs from prior art (in our opinion prior art is somewhat surprisingly lacking in robustness of statistical and other scientific methodology in regards to identification of IBS-related trigger foods).

Additional positive developments related to InFoods includes feedback from FDA indicating de novo 510(k) regulatory pathway should be acceptable and the July 2016 announcement that FDA has determined InFoods is

eligible to pursue 'nonsignificant risk' (NSR) clinical studies (additional details below) - which means that BMRA can eliminate any need to file and have approved by the FDA an Investigational Device Exemption (IDE). Preparation and approval of which could have been lengthy. And in May of that same year, BMRA penned a favorable licensing/distribution agreement for the S. Korean market (details below).

InFoods Development, Strategy Led By Dream Team…

BMRA also recently beefed up its board of directors and brought on a scientific advisory board as well as a strategic advisory board to help further guide their strategy related to the pipeline candidate. This includes the 'who's who' of IBS and GI in the U.S. and brings on significant resources and knowledge in medical diagnostics commercialization.

The **scientific advisory board includes** Dr. Doug Drossman, an expert in IBS who has authored several articles and publications on the disorder and who serves as the President of the Rome Foundation. The Rome Foundation is a leading (non-profit) organization focused on the diagnosis and treatment of GI disorders, including IBS. Drossman was a key addition to BMRA due not only to his background, experience and contacts related to IBS but also, in our opinion, the legitimacy that he provides for the potential for InFoods. In fact, Biomerica has noted that Dr. Drossman was skeptical about BMRA's technology until he fully reviewed it – and afterwards agreed to join the company's scientific advisory board. Dr. Drossman was instrumental in recruiting other members to the scientific advisory board, which has grown to now include five members. Other members, which also have extensive and pertinent experience in the GI space, include Dr. Li Chang, Dr. William Chey, Dr. William Whitehead and Dr. Anthony Lembo. Their bios are included in our Appendix.

In January 2016 Charles Carter, PharmD, was appointed as a senior advisor and in July 2016 Dr. Mark Sirgo was brought on to the board of directors – both Drs. Carter and Sirgo were associated with Salix Pharmaceuticals. Carter was Salix Pharmaceuticals' Director of Medical Affairs and instrumental in getting that company's IBS-D (irritable bowel syndrome with diarrhea) candidate, Xifaxan, through FDA regulatory approval. Sirgo served on Salix's board of directors. Salix's product portfolio, which is mostly focused on gastrointestinal disorders, spans 10+ GI drugs, screening preps and other treatments. Xifaxan, which is also approved for traveler's diarrhea caused by E. coli as well as for overt hepatic encephalopathy, was their largest selling product when the company was acquired by Valeant Pharmaceuticals (NYSE: VRX) in April 2015. Valeant ponied up over $11B to acquire Salix, which represented an almost 44% equity premium. Valeant cited the strong market for GI products as an impetus for the acquisition.

And more recently, Biomerica added a **strategic advisory board** with Ned Barnholt initiated in July 2016 as the first member. This board will be tasked with guiding BMRA's licensing and commercialization strategy for InFoods. Mr. Barnholt (full bio in Appendix) is chairman of KLA-Tencor, on eBay's board of directors and was former chairman, president and CEO of Agilent Technologies.

FDA Determines InFoods is 'Nonsignificant Risk' Device: Eliminates Need for IDE Approval, Supports Expectation of De Novo Pathway…

In July 2016 Biomerica announced that the FDA determined InFoods is eligible to pursue 'nonsignificant risk' (NSR) clinical studies. While we were not surprised of the agency's determination, the news is meaningful as it means that BMRA can eliminate any need to file and have approved by the FDA an Investigational Device Exemption (IDE). Preparation and approval of IDE's can be a lengthy process - spanning anywhere from several months to a year or more, depending on the particular product candidate and other circumstances.

NSR determination also means that InFoods should almost certainly not need to follow the FDA Premarket Approval (PMA) pathway, which is relatively lengthy and costly. While this was also a prior assumption of ours, having NSR classification now makes this all but a certainty. As there is no predicate for InFoods, we think de novo 510(k) (appropriate for novel low-risk products for which there is no predicate) is the likely U.S. regulatory clearance route that the candidate will follow.

FDA determines a device is of **'significant risk'** (SR) if it;

• Is intended as an implant and presents a potential for serious risk to the health, safety, or welfare of a subject;
• Is purported or represented to be for use supporting or sustaining human life and presents a potential for serious risk to the health, safety, or welfare of a subject;
• Is for a use of substantial importance in diagnosing, curing, mitigating, or treating disease, or otherwise preventing impairment of human health **and** presents a potential for serious risk to the health, safety, or welfare of a subject; or
• Otherwise presents a potential for serious risk to the health, safety, or welfare of a subject.

If a device does not meet the definition above, then it is considered a **'nonsignificant risk'** device. Per FDA guidelines, NSR studies follow abbreviated requirements (as compared to SR devices) related to labeling, institutional review board (IRB) approval, informed consent, monitoring, records, reports, and prohibition against promotion. And unlike SR studies, there is no need to make progress reports or final reports to FDA. But, perhaps the greatest advantage is that NSR studies do not require the sponsor (i.e. BMRA) to file for or receive IDE approval prior to commencing the study. And while, of course, IRB approval will still be required prior to commencement of any NSR study, the IRB is not required to inform FDA in order for the study to be conducted.

IRB's will also make their own determination of whether a device is NSR or SR. But with FDA already determining InFoods meets their NSR definition, the IRB's can use this to facilitate (i.e. speed up and confirm) their own risk determination process.

Korean Market Licensing Agreement: Includes $1M Equity Investment at ~100% Premium…

In May 2016 BMRA announced consummation of an agreement whereby they granted Celtis Pharm Co. of S. Korea exclusive rights to market and sell InFoods in S. Korea. The deal calls for;

- Celtis to pay BMRA up to $1.25M in exclusivity fees based on "certain milestones including Biomerica's starting clinical trials in the United States, receipt of US FDA clearance and Celtis' first sales of IBS Products in Korea"

- If BMRA fails to obtain FDA clearance, $250k of the upfront exclusivity fee will convert into 83k BMRA common shares at $3/share

- Celtis to pay BMRA royalties in the "mid-teens" of sales of InFoods in S. Korea. Minimum royalty to maintain exclusivity status is $7.25M over five years (or longer if Korean regulatory approval is obtained prior to May 31, 2019) beginning when Korean regulatory clearance is obtained

- Upon achieving Korean regulatory clearance and commencement of commercialization, BMRA will sell InFoods to Celtis at cost plus (undisclosed) margin

- Celtis is responsible for funding and obtaining regulatory clearance for the S. Korean market

- Cetlis purchased 333k shares of BMRA common stock @ $3/share (in a private placement) - representing ~100% premium over the quoted market price the day prior to the licensing agreement announcement

The exclusivity agreement can be expanded to other territories in Asia if agreed upon by both parties. It spans five years plus an additional two years for Celtis to obtain Korean regulatory clearance, begins when InFoods is granted FDA marketing clearance. It is cancellable if BMRA has not obtained FDA clearance by December 31, 2017.

Our Comments…

Perhaps relating to significant potential for InFoods, while all details of this licensing agreement were not made public, from our experience this is a somewhat atypical type of deal in that it appears to significantly favor BMRA with most of the financial risk borne by Celtis…

- It implies that even if InFoods fails to gain FDA clearance that $250k of the (up to $1.25M total) exclusivity fees will be converted into BMRA at a ~100% premium to then-current market value

- Celtis purchased $1M of restricted BMRA common stock at a 100% premium - essentially paying BMRA another $500k upfront

- Celtis bears all financial risk of obtaining Korean regulatory clearance

- BMRA will receive a mid-teens royalty plus margin on sales of InFoods to Celtis

InFoods IBS Test

Important to understand about IBS and why we believe InFoods has so much potential is that while food is implicated as a trigger in exacerbating symptoms, the same foods do not affect every IBS sufferer the same (i.e. different people may have different trigger foods). So it is not as simple as just identifying certain foods and eliminating those from anyone's diet that has the condition. As such, the heterogenous nature of IBS requires a diagnostic (i.e. InFoods) that accounts for varying and different causation between certain foods and an individuals' symptoms, or lack thereof.

Additional details about InFoods have been made public recently – this includes information gleaned from BMRA's patent applications as well as from the company's recent investor presentations.

Below we summarize what we believe are some of the most salient points regarding InFoods;

- blood test to identify certain trigger foods that may cause or exacerbate IBS symptoms
  - will be used only with individuals already identified with IBS symptoms
  - extensive analysis was done to rank the top several dozen foods most associated with exacerbating IBS
  - we expect somewhere in the range of 20 – 25 foods may be included on the initial panel
  - ELISA test quantifies food-specific IgG antibodies (i.e. 'signal scores') from individual IBS patients which are elicited as immune response
  - signal score 'cutpoints' for each food (and gender) were determined by comparing signal scores of IBS patients with those of non-IBS patients. Additional testing and analysis was done to refine these cutpoints, which represent the 90th and 95th percentiles. For each food, IBS subjects with resulting signal scores above these cutpoints are considered 'positive' for that particular food (i.e. that particular food exacerbates IBS)
  - results of the ELISA test provide a simple 'yes' or 'no' result indicating whether a particular person's IBS symptoms are being triggered by each of the foods on the panel
- InFoods is expected to help physicians in guiding treatment protocol including putting the patient on a specific dietary regimen and can be used in combination with IBS drugs. This is different then other IBS tests which only focus on diagnosing presence of the disease. BMRA's test would be the first to both help diagnose IBS and to help guide treatment decisions
- expected to have utility for all forms of IBS (i.e. constipation (C), diarrhea (D) and mixed (M))
- test will be available for use in both the clinical lab and physician office settings. Lab product is the first which they will pursue (regulatory hurdle is likely lower) and POC will follow
- would be reimbursed under existing CPT codes. As reimbursement is critical for maximizing early adoption, availability of payment under existing CPT codes is a significant benefit
- in addition to the significant benefit of already established CPT coding is that it could be expected that patients would be tested more than once (i.e. 2 - 3x) over the course of a year, depending on changes in their diets
- 17 patents are currently pending. In March 2016 BMRA announced International Search Authority reviewed their international method and composition patent claims and found them to be novel and non-obvious (i.e. the claims are valid)
- FDA has indicated that the risk profile of the test would likely not require a Class III (i.e. 'high risk') device designation. This was further supported when in July 2016 BMRA announced that FDA determined InFoods is eligible to pursue 'nonsignificant risk' clinical studies. BMRA expects to apply for the de novo route which allows manufacturers of novel low-risk (Class I and II) products for which there is no predicate to avoid the much costlier and time-consuming PMA route

Analysis of IBS Drugs Indicates High Unmet Need For Alternative, More Effective Therapies

Unmet Need for IBS Relief Highlighted By IBS Drugs' Low Effectiveness, Low FDA Approval Hurdle

The U.S. market for IBS drugs is approximately $1B+, almost twice the size of what it was only just a few years ago. The market is likely to continue to grow at a rapid pace, largely driven by new drugs that have either recently come to market or that are expected to do so in the near-term. But while the number of drugs available to treat IBS and related expenditures continues to grow, their relative ineffectiveness in providing relief has not significantly changed.

Today, the prescription IBS drug market is mostly concentrated across four products; Linzess (Allergan) and Amitiza (Takeda) for IBS-C, and Xifaxan (Valeant) and Viberzi (Allergan) for IBS-D. No drug is approved in the U.S. for the treatment of IBS-M. All of these gained FDA approval for their respective IBS indications since 2012 and two, Xifaxan and Viberzi, were approved for the U.S. market in May 2015 and launched later that year.

Low FDA Approval Hurdle…

FDA has clearly recognized the seeming futility drugmakers have experienced in their quest to develop a therapy that provides significant and long-term relief of IBS. This is evidenced by the low bar the U.S. regulatory agency has recommended in terms of efficacy endpoints that novel drugs are assessed against in order to determine whether they will be approved for sale. We note that while FDA updated their recommendations for evaluation of

novel IBS drugs in 2012 to better assess their effectiveness in addressing symptoms of IBS, the effectiveness hurdle (i.e. improvement vs. placebo) remains low.

The table below describes the pre-updated primary endpoints that have been used in many IBS drug trials. FDA updated their guidelines as they felt that while the prior endpoints could capture the direction of change, they did a poor job of providing useful information of the effect of treatment on sign and symptoms of IBS.

Prior IBS Endpoint Guidelines

Drug and Indication	Primary Endpoint	Questions (Single-Item) Used to Assess Efficacy	Responses
Alosetron — IBS-D[1]	Adequate relief	*In the past 7 days, have you had adequate relief of your IBS pain or discomfort?*	Binary (Yes/No)
Tegaserod — IBS-C[2]	Satisfactory relief	*Did you have satisfactory relief of your overall IBS symptoms during the last week?*	Binary (Yes/No)
		Did you have satisfactory relief of your abdominal discomfort or pain during the last week?	Binary (Yes/No)
	Subject Global Assessment of Relief (SGA)	*Please consider how you felt during the past treatment period in regard to your IBS, in particular your overall well-being, and symptoms of abdominal pain/discomfort and altered bowel habit. Compared to the way you usually felt before entering the trial, how would you rate your relief of symptoms during the past week?*	5-Point Likert scale
Lubiprostone — IBS-C[3]	Modified version of the SGA	*How would you rate your relief of IBS symptoms (abdominal discomfort/pain, bowel habits, and other IBS symptoms) over the past week compared with how you felt before you entered the trial?*	7-Point Likert scale

SOURCE: US Dept HHS, FDA, CDER. IBS – Clinical Eval of Drugs. May 2012

The updated recommended guidelines are more defined in terms of assessment of the effect on symptoms and specifically cites a defecation component and an abdominal pain component. For IBS-C drugs, recommendation is that defecation is assessed by stool frequency (number of complete bowel movements per week) while IBS-D drugs be assessed by stool consistency (based on Bristol Stool Form Scale). The pain component, for both IBS-C and IBS-D, can be based on an 11-point numeric scale.

The table below describes the updated (i.e. 2012) recommended guidelines for primary endpoints of IBS-C and IBS-D investigational drugs. Here we can see that the definition of treatment 'response' in these updated guidelines is more directly tied to IBS symptoms (as compared to prior guidelines). But also, the 'response' thresholds are arguably meek (and, in the case of the pain measure, potentially still fraught with subjectivity).

Note that 'response' related to abdominal pain is a decrease of 30% or more (in weekly average worst pain) in the past 24 hours. Weekly stool consistency 'response' is reduction of 50% or more days per week with mushy or watery stools. These endpoints are far from complete reprieve of IBS symptoms and, we think, underscores not only the difficulty in effectively addressing the disease but also, when we look at the substantial revenue generated by and number of prescriptions written for these drugs, how desperate IBS sufferers are for something that will provide even minor and temporary relief.

Current IBS Endpoint Guidelines

Indication	Primary Endpoints	Entry Criteria	Responder Definition
IBS-C	Abdominal Pain Intensity AND Stool Frequency	**Abdominal Pain Intensity** Weekly average of *worst abdominal pain in past 24 hours* score of ≥ 3.0 on a 0 to 10 point scale AND **Stool Frequency** < 3 CSBMs per week	**Abdominal Pain Intensity** Decrease in weekly average of *worst abdominal pain in the past 24 hours* score of at least 30% compared with baseline AND **Stool Frequency** Increase of 1 or more CSBM per week compared with baseline
IBS-D	Abdominal Pain Intensity AND Stool Consistency	**Abdominal Pain Intensity** Weekly average of *worst abdominal pain in past 24 hours* score of ≥ 3.0 on a 0 to 10 point scale AND **Stool Consistency** At least 2 days per week with at least one stool that has a consistency of Type 6 or Type 7 BSS (see Figure 1 for details)	**Abdominal Pain Intensity** Weekly responder defined as: decrease in weekly average of *worst abdominal pain in past 24 hours* score of at least 30% compared with baseline Daily responder defined as: decrease in *worst abdominal pain in the past 24 hours* score of at least 30% compared with baseline AND **Stool Consistency** Weekly responder defined as: decrease at least 50% in the number of days per week with at least one stool that has a consistency of Type 6 or 7 compared with baseline Daily responder defined as: a patient whose stool consistency is less than 5 for all bowel movements on that day or no bowel movement

SOURCE: US Dept HHS, FDA, CDER. IBS– Clinical Eval of Drugs. May 2012

Unmet Need For Relief Drives Demand For Drugs, Despite Being Barely Better Than Placebo…
IBS sufferers' high unmet need for any symptom relief becomes even more obvious when examining primary endpoint outcomes data from the pivotal FDA studies of each of the four prescription drugs that account for 90%+ of the U.S. IBS drug market. In the table below we have summarized efficacy data of the phase III studies used to support FDA approval filings for each of the leading IBS drugs (see Appendix for more details about each compound and the phase III studies). Also included is Trulance, for which an FDA filing for IBS-C is expected to happen in the near term.

Our table also includes estimated current annualized U.S. sales and total prescriptions as well as our comments, all meant to help elucidate the significant demand for IBS drugs despite their relative lack of effectiveness and in many cases, highly unpleasant and even dangerous side effects.

Points of particular interest:

- **Majority of patients did not respond**: response rates ranged from a low of approximately 12% up to 41%
- **Barely more effective than placebo**: response rates as compared to placebo indicate a substantial placebo effect in treatment "response". While subjectivity of endpoint measures (particularly with 'legacy' measures) may play a part (our supposition), the data suggests that none of these drugs are much more effective than placebo. As an example, Linzess, which currently generates ~$600M in annual U.S. revenue and for which ~2.8M prescriptions are written each year, demonstrated only 7% - 13% superiority on primary efficacy endpoints compared to placebo
- **Drawbacks**: besides cost and relatively low efficacy there are other drawbacks to IBS drugs. This includes side effects which are often unpleasant - such as diarrhea, and which can even be dangerous – Lotronex carries a black box warning related to the risk of potentially serious GI events. Some drugs, such as Xifaxan, are not recommended for chronic use while others, such as Amitiza and Lotronex, are only indicated for women due to lack of data for use with men

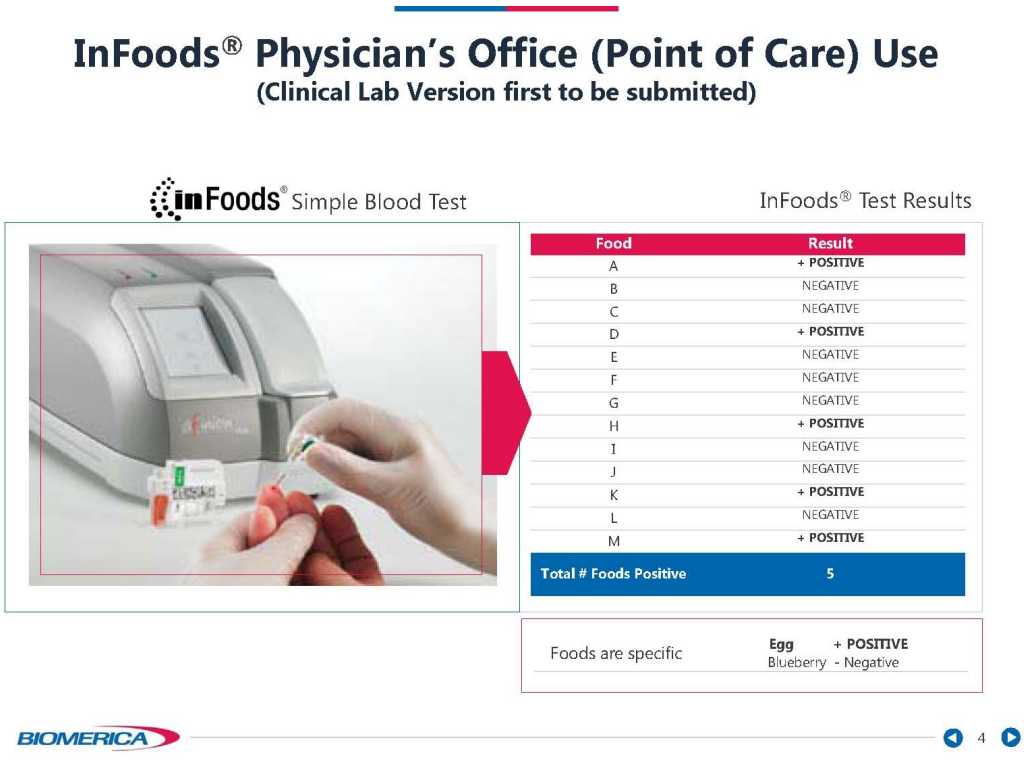
Indication	Drug	FDA Appr	Treatment Response	Delta vs placebo	Cost*	Annualized U.S Sales (M)	TRx (M)	Comments
IBS-C	Linzess	2012	12% - 34%	7% - 13%	$382	$603**	2.80**	Diarrhea side effect (20%)
	Amitiza	2008	13%	6%	$380	$409**	1.56**	Indicated for w omen only as not studied for men
	Trulance	NA	22% - 30%	7% - 12%	NA	NA	NA	Not yet FDA approved
IBS-D	Xifaxan	2015	41%	9%	$550	$950***	1.00***	Not for chronic use
	Viberzi	2015	25% - 30%	7% - 14%	$1,000	$125	0.15	Abdominal pain (secondary) endpoint not met
	Lotronex	2002	NA	13% - 20%	$940	$60	0.04	For w omen only. Black box w arning

*Cost - per Drugs.com. Based on retail price of 30-day supply of lowest dose **Includes CIC and IBS-C
***Includes overt HE and IBS-D

The Low "Attractiveness Hurdle" Should Play In InFoods' Favor…
While there is not yet enough publicly available information relative to the performance of InFoods to make any informed opinions regarding its clinical effectiveness, the current lack of effective therapies and debilitating symptoms of the disease means that doctors and patients are likely to be receptive to just about anything that has the potential to provide even incremental benefit (whether it be incremental to existing therapies or alone).

We believe that the minimal effectiveness and drawbacks of prescription drugs means that the "attractiveness hurdle" that novel IBS therapies must meet to generate interest from the ~$1B+ U.S. IBS market is relatively low. That should be particularly true for non-drug, side-effect-free products such as InFoods.

And with InFoods testing expected to be covered with existing CPT codes, coupled with the likelihood of a substantial cost-benefit as compared to IBS drugs, we think the market could be very receptive to the product. We look forward to updates from the company on expected clinical trial design and other details related to validating effectiveness and clinical utility of the test.



Market considerations related to InFoods: *Living with IBS is hell…*

- "Living with IBS is hell" – plug that into a Google search and it is apparent that the chronic disease symptoms and lack of treatment options leaves IBS sufferers feeling helpless and desperate for more effective options
- Diagnostic cost of IBS in the U.S. is approximately $10.5B in annual direct costs and over $30B when including indirect costs

- IBS afflicts as much as 20% of the U.S. population, 25% of Japan, and 22%+ each of China and the U.K
- IBS is a top 10 reason for primary care doctor visits
- IBS is difficult to diagnose and difficult to treat
    - Exact cause of IBS is not known although adverse reaction to certain foods is largely accepted as a significant contributor in many cases
    - Types of foods and food reactions do not appear to be homogenous from patient-to-patient (i.e. cocoa may trigger symptoms in one patient but not another). Therefore it is important to be able to identify which foods trigger symptoms in each individual patient
    - IBS drugs, such as Xifaxan, Linzess, Amitiza, Viberzi and Lotronex (see our discussion below) only treat the symptoms but not the underlying cause, are effective in only about 15% - 20% of IBS sufferers, often provide only temporary and partial relief (in those patients who do show a response) and can have unwelcome side effects
    - While new IBS drugs are in development, including at least one (Trulance) that could gain FDA approval and launch in the coming months, these also only address IBS symptoms and not the underlying cause
    - FDA has a low effectiveness hurdle related to approving IBS drugs – which also speaks to the lack of effective treatments for the disease
    - GI doctors also often prescribe SSRI's off-label, which have shown to help regulate bowel flow – this again, illustrates how limited the treatment options are for IBS
    - Physicians have very limited tools to treat IBS – typical recommendation is for patients to (arbitrarily) begin eliminating certain foods from their diet and/or prescription of symptom-targeting drugs which often fail to provide significant relief, particularly over the long-term
- Win, win, win for patients, physicians and insurers. InFoods could benefit all major stakeholders. Physicians are frustrated with lack of treatment options. Patients feel helpless. Insurers are paying for relatively high cost drugs which do not address the underlying cause and therefore may be chronically prescribed
- Unlike many new medical technologies (drugs, devices and diagnostics) which offer only incremental benefit compared to an existing product and may be geared more towards profit than clinical outcome (and often require a lot of marketing to convince of the 'benefits'), InFoods could be a pioneer in providing a new level of relief for the IBS afflicted. And if InFoods can do that, it should require limited initial awareness-building before the test sells itself via demand-pull from physicians and patients

VALUATION

Previously we had not considered InFoods in our valuation of BMRA as we felt the limited available information about the test was not substantive enough for us to form even an initial opinion about its potential utility or eventual chance of regulatory and commercial success. But the additional public information that has recently become available including the general methodology employed in identifying and ranking specific trigger foods and statistically-driven rationale powering the output decision (i.e. 'yes' or 'no' for trigger food x) provides enough information for us to be at least comfortable with the soundness of the science that is employed and presumption that a similar test does not already exist (eventual patent grant should confirm this).

And while more anecdotal in nature, we think there are other reasons that support the proposition of the potential of InFoods. This includes the fact that Drs. Drossman and Sirgo (and others prominent in the field), all of which have significant experience in the IBS space, recently came onboard and presumably did so because they believe in the robustness of the science (including the non-publicly available information) behind InFoods, is a vote of confidence in the potential for success of the test. The addition of someone of Ned Barnholt's caliber to the newly formed strategic advisory board provides that much more credence to BMRA's pursuit.

The agreement with Celtis, which seems to favor BMRA, may also be interpreted as an "insider" liking what they see. The fact that, based on terms of the agreement that were made public, Celtis effectively made an upfront, nonrefundable $750k payment to BMRA suggests the S. Korean company believes in the potential of InFoods.

We also think it is worth reiterating that there is a significant unmet need for an effective IBS treatment. As such, if InFoods can help to evenly modestly improve patient's lives, we think it could be wildly successful and rapidly adopted. The dearth of acceptable options to treat IBS is illustrated by IBSchek, a laboratory developed test from Commonwealth Labs (and which Valeant had at one point indicated they would acquire) which tests for two distinct antibodies associated with IBS. Despite it suffering from high false-negative rates (56%), not being useful in the diagnosis of IBS-C and questionable practical utility (if someone has IBS, it's probably very apparent and they don't need a test to tell them) news of its launch received massive news coverage (including featured on CBS Nightly News) when it was introduced in 2015.

And particularly telling of the desperation and difficulty in developing effective IBS therapies is the low FDA efficacy hurdle used to evaluate IBS drugs and the less than compelling clinical trial data used to (successfully) support FDA approval. Minimal effectiveness and drawbacks of IBS drugs has created what we believe is a relatively low "attractiveness hurdle" and, coupled with a lack of side effects and expected cost-benefit, one that may be easily cleared if InFoods is able to demonstrate only incremental benefit (either alone or to existing therapies).

Recently updated methodology values BMRA at $3.50/share

We are now using sum of the parts to value BMRA; the base business (everything except InFoods) plus InFoods. We continue to value the base business using a comparable cohort of five companies of various market capitalizations in the medical diagnostics space with products/services that target the POC and/or clinical lab markets to value BMRA. Based on several metrics and excluding the negative and outlier values, BMRA's base business is valued at approximately $2.00/share.

Base Business Comparable Multiples

Ticker	P/E (ttm)	P/E (FY1)	P/E (FY4)	P/Book	EV / EBITDA (ttm)	P/S (ttm)	P/S (FY1)
TRIB	-1.3	12.0	N/A	1.2	12.0	1.3	1.2
OXFD	N/A	N/A	N/A	4.8	N/A	4.1	2.9
CEMI	N/A	N/A	0.0	4.2	N/A	4.1	2.6
ALR	-70.0	21.0	-326.7	3.0	19.1	1.8	1.8
VIVO	19.2	19.8	10.6	3.4	10.0	2.9	2.9
QDEL	N/A	N/A	N/A	3.8	41.0	4.0	3.2
ABAX	32.0	34.2	22.8	4.1	17.4	4.7	4.4
Average	**-5.0**	**21.8**	**-97.8**	**3.5**	**19.9**	**3.3**	**2.7**

FY1, FY4 = forecast year 1, forecast year 4

Value Based On Comp:

	P/E (ttm)	P/E (FY1)	P/E (FY4)	P/Book	P/S (ttm)	P/S (FY1)	AVG
BMRA	N/A	N/A	$0.08	$2.22	$1.98	$2.00	**$2.06**

Value InFoods at ~$11M (~$1.50/share):
We think the Celtis agreement provides insight into the value of InFoods. As noted, we think the agreement was somewhat unusual and favored BMRA – the reason for which likely relates to the value that Celtis places on InFoods. While our methodology is admittedly back-of-the-envelope, it piggy-backs off of Celtis' assumed much greater insight they gleaned when they presumably had full access to data sheets and related information on InFoods during due diligence.

Prevalence of IBS in S. Korea is approximately 6% of the population, or ~3M people. Celtis effectively paid $750k upfront (nonrefundable) for rights to InFoods – which equates to approximately $0.25 per person in S. Korea with IBS. There are ~45M people in the U.S. with IBS – applying the same $0.25 per person multiple values InFoods at approximately $11M. While this is arguably conservative as it ignores all of Europe and any other parts of the world (ex-S. Korea), we think this is a fair representation of the current value of InFoods. Additional progress towards locking down IP and in development and regulatory activities should push value on InFoods higher from this estimated $11M current base.

Our sum of the parts of $2.00/share for the base business and $1.50/share for InFoods values the entire company at approximately **$3.50/share.**

APPENDIX: IBS Drugs Overview

Xifaxan (Salix/Valeant):

- Xifaxan (rifaximin) is a semisynthetic antibiotic initially approved by FDA (May 2004) for the treatment of traveler's diarrhea caused by E. coli (200mg), in March 2010 it (550mg) received FDA approval for overt hepatic encephalopathy and in May 2015 it (550mg) received FDA approval for the treatment of IBS-D in adults.
- Recommended dosing is one tablet, 3x/per day for 14 days. Recurrence can be retreated twice at the same dosing regimen
- Method of action is not completely understood, but hypothesized to relate to changes in the bacterial content in the GI tract
- Most commonly reported side effects are nausea (~3%) and increase in ALT (liver enzyme in the blood, 2%)
- Clinical data used to support FDA filing consisted of three double-blind, placebo-controlled phase 3 trials (TARGET 1,2,3).
    - **Trials 1 and 2**: enrolled 1,258 patients diagnosed (per Rome II criteria) with IBS symptoms of abdominal pain and discomfort. Patients were randomized to Xifaxan (n=624) or placebo (n=634) for 14 days and followed for a subsequent 10-week treatment-free period.
    - **Primary endpoint** was proportion of patients who achieved adequate relief (based on patients' 'yes' or 'no' response) of IBS symptoms for at least 2 of 4 weeks during the month following 14 days of treatment. Key **secondary endpoint** was proportion of patients who achieved relief of bloating during the same primary evaluation period.
    - **Results:**
        - **Primary endpoint** of the combined studies: Significantly (p<0.001) more Xifaxan patients (41%) than placebo patients (32%) reported adequate relief of IBS symptoms. Relief from IBS symptoms maintained statistically significant through the entire 3-month study period (p<0.001).
        - **Results on the key secondary endpoint** were similar to that of the primary endpoint with significantly (p<0.001) more Xifaxan patients (40%) than placebo patients (30%) reporting adequate relief of IBS-related bloating.
    - **Trial 3** was powered to assess effectiveness of Xifaxan in cases of recurrence. 636 patients who did not meet a composite endpoint in TARGET 1,2 of relief of abdominal pain and loose stools were randomized in TARGET 3 for retreatment and received Xifaxan (n=328) or placebo (n=308) for another 14 days, followed by a 4 week treatment-free period. **Results** showed that significantly (p=0.02) more Xifaxan (33%) patients achieved symptom relief as compared to placebo patients (25%)

	Proportion of Patients with Response					
Primary endpoint	**Xifaxan**	**%**	**Placebo**	**%**	**Difference**	**P-value**
Weekly global IBS symptoms						
Target 1	126/309	40.8%	98/314	31.2%	9.6%	0.01
Target 2	128/315	40.6%	103/320	32.2%	8.4%	0.03
Combined	254/624	40.7%	201/634	31.7%	9.0%	< 0.001
Key secondary endpoint	**Xifaxan**	**%**	**Placebo**	**%**	**Difference**	**P-value**
Weekly IBS-related bloating						
Target 1	122/309	39.5%	90/314	28.7%	10.8%	0.005
Target 2	129/315	41.0%	102/320	31.9%	9.1%	0.02
Combined	251/624	40.2%	192/634	30.3%	9.9%	< 0.001

Viberzi (Allergan):

- Viberzi (eluxadoline) received FDA approval May 2015 for the treatment of IBS-D in adults. Launched in U.S. December 2015
- Eluxadoline targets opioid receptors (it is a μ- and κ-opioid receptor agonist and δ-opioid receptor antagonist) in the portion of the nervous system that govern the GI tract, thereby reducing bowel contractions and related pain.
- Recommended dosing is one tablet, 2x/day and can be taken as long as doctor recommends
- Most commonly reported side effects are constipation, nausea and abdominal pain
- Clinical data used to support FDA filing consisted of two Phase 3 double-blind, placebo controlled studies
    - Combined studies enrolled 2,425 patients (study 1 = 1,280, study 2 = 1,145) diagnosed with IBS-D (Rome III criteria) randomized to either 75mg or 100mg Viberzi (n=1,616) twice daily or placebo (n=809)
    - Patients treated over 26 weeks
    - Primary endpoint was simultaneous improvement in worst abdominal pain score by $\geq$ 30% as compared to baseline and improvement in stool consistency (based on Bristol Stool Scale) on at least 50% of the days within a 12-week time interval (for FDA) and through 26 weeks (for EMA)
    - Secondary endpoints included improvement in the defined pain score at 12 weeks and improvement in the defined stool consistency score at 12 weeks
    - **Results**:
        - 12 weeks on composite (primary FDA) endpoint (pain and stool):
            - Study 1: 24% (75mg) to 25% (100mg) of Viberzi patients vs. 17% of placebo patients met composite endpoint, indicating statistically significant improvement favoring treatment arm of 7% - 8% ($p < 0.05$)
            - Study 2: 29% to 30% of Viberzi patients vs. 16% of placebo patients met composite endpoint, indicating statistically significant improvement favoring treatment arm of 13% - 14% ($p < 0.001$)
        - 26 weeks on composite (primary EMA) endpoint (pain and stool):
            - Study 1: 23% to 29% of Viberzi patients vs. 19% of placebo patients met composite endpoint. The 10% difference to the 100mg arm was statistically significant ($p \leq 0.014$) while the 4% difference to the 75mg arm was not
            - Study 2: 30% to 33% of Viberzi patients vs. 20% of placebo patients met composite endpoint. The 13% - 14% difference was statistically significant ($p \leq 0.014$)
        - 12 weeks on abdominal pain (secondary) endpoint:
            - Study 1: 42% to 43% of Viberzi patients vs. 40% of placebo patients reported reduction in abdominal pain. The 2% - 3% difference was not statistically significant
            - Study 2: 48% to 51% of Viberzi patients vs. 45% of placebo patients reported reduction in abdominal pain. The 3% - 6% difference was not statistically significant
        - 12 weeks on stool consistency (secondary) endpoint:
            - Study 1: 30% to 34% of Viberzi patients vs. 22% of placebo patients reported improvement in stool consistency. The 8% - 12% difference was statistically significant

- Study 2: 36% to 37% of Viberzi patients vs. 21% of placebo patients reported improvement in stool consistency. The 15% - 16% difference was statistically significant

- **Rescue loperamide: % of patients requiring rescue loperamide during 26-week treatment phase**
  - Study 1: 25% of Viberzi vs. 28% of placebo
  - Study 2: 29% of Viberzi vs. 35% of placebo

	Study 1			Study 2		
	VIBERZI 100mg twice daily n=426	VIBERZI 75mg twice daily n=427	PBO n=427	VIBERZI 100mg twice daily n=382	VIBERZI 75mg twice daily n=381	PBO n=382
Composite[1] Response over 12 weeks						
Responder rates	25%	24%	17%	30%	29%	16%
Treatment difference	8%[2]	7%[4]		13%[3]	13%[3]	
95% CI (%)	(2.6, 13.5)	(1.4, 12.2)		(7.5, 19.2)	(6.8, 18.5)	
Composite Response over 26 weeks						
Responder rates	29%	23%	19%	33%	30%	20%
Treatment difference	10%	4%		13%	10%	
95% CI (%)	(4.7, 16.1)	(-1.0, 9.9)		(6.4, 18.8)	(4.2, 16.4)	
Abdominal Pain Response Improved ≥30% over 12 weeks						
Responder rates	43%	42%	40%	51%	48%	45%
Treatment difference	4%	3%		6%	3%	
95% CI (%)	(-3.0, 10.2)	(-3.8, 9.4)		(-1.3, 12.8)	(-4.3, 9.8)	
BSS <5 Response over 12 weeks						
Responder rates	34%	30%	22%	36%	37%	21%
Treatment difference	12%	8%		15%	16%	
95% CI (%)	(6.3, 18.2)	(2.1, 13.8)		(8.4, 21.0)	(9.7, 22.4)	

[1]Composite= Simultaneous improvement of Worst Abdominal Pain (WAP) by ≥30% and Bristol Stool Score (BSS) ≤ 5 on the same day for ≥ 50% of days over the interval
[2] $P<0.01$
[3] $P<0.001$
[4] $P<0.05$

SOURCE: Viberzi label, Actavis. Accessdata.fda.gov

Linzess (Allergan):

- Linzess (linaclotide) is a peptide agonist of guanylate cyclase 2C (GC-C) approved by FDA in 2012 for the treatment of adults with IBS-C as well as for the treatment of chronic idiopathic constipation (CIC)
- Recommended dosing is one tablet daily
- Most commonly reported side effects are diarrhea (20%), abdominal pain (7%) and flatulence
- Method of action: linaclotide stimulates secretion of intestinal fluid resulting in acceleration of GI transit and reduction on abdominal pain
- Clinical data used to support FDA approval for IVS-C consisted of two double-blind, randomized, placebo-controlled phase 3 studies
  - Combined studies enrolled 1,604 patients (study 1 = 800, study 2 = 804) diagnosed with IBS-C (Rome II criteria) randomized to either Linzess (n=806) or placebo (n=798)
  - Patients treated for 12 weeks
  - Primary endpoint: there were four primary endpoints:
    - In at least 9 of the first 12 weeks of treatment patient had to have;

- Combined responder endpoint (9 of 12 weeks): ≥ 30% reduction from baseline in abdominal pain, ≥ 3 complete spontaneous bowel movements (CSBM) and an increase of ≥ 1 CSBM from baseline, all in the same week
- ≥ 30% reduction from baseline in abdominal pain
- ≥ 3 complete spontaneous bowel movements (CSBM) and an increase of ≥ 1 CSBM from baseline in the same week

▪ Combined responder endpoint (6 of 12 weeks): In at least 6 of the first 12 weeks of treatment patient had to have ≥ 30% reduction from baseline in abdominal pain and an increase of ≥ 1 CSBM from baseline, all in the same week

o **Results:**

▪ Combined responder 9 of 12 weeks:
- Study 1: 12% of Linzess vs. 5% of placebo met endpoint
- Study 2: 13% of Linzess vs. 3% of placebo met endpoint

▪ Abdominal pain 9 of 12 weeks:
- Study 1: 34% of Linzess vs. 27% of placebo met endpoint
- Study 2: 39% of Linzess vs. 20% of placebo met endpoint

▪ CSBM 9 of 12 weeks:
- Study 1: 20% of Linzess vs. 6% of placebo met endpoint
- Study 2: 18% of Linzess vs. 5% of placebo met endpoint

▪ Combined responder 6 of 12 weeks:
- Study 1: 34% of Linzess vs. 21% of placebo met endpoint
- Study 2: 34% of Linzess vs. 14% of placebo met endpoint

▪ Differences between treatment and placebo arms on all endpoints were statistically significant

At least 9 of first 12 weeks

	Trial 1			Trial 2		
	LINZESS 290 mcg (N=405)	Placebo (N=395)	Treatment Difference [95% CI]	LINZESS 290 mcg (N=401)	Placebo (N=403)	Treatment Difference [95% CI]
Combined Responder* (Abdominal Pain and CSBM Responder)	12.1%	5.1%	7.0% [3.2%, 10.9%]	12.7%	3.0%	9.7% [6.1%, 13.4%]
Abdominal Pain Responder* (≥ 30% Abdominal Pain Reduction)	34.3%	27.1%	7.2% [0.9%, 13.6%]	38.9%	19.6%	19.3% [13.2%, 25.4%]
CSBM Responder* (≥ 3 CSBMs and Increase ≥1 CSBM from Baseline)	19.5%	6.3%	13.2% [8.6%, 17.7%]	18.0%	5.0%	13.0% [8.7%, 17.3%]

At least 6 of first 12 weeks

	Trial 1			Trial 2		
	LINZESS 290 mcg (N=405)	Placebo (N=395)	Treatment Difference [95% CI]	LINZESS 290 mcg (N=401)	Placebo (N=403)	Treatment Difference [95% CI]
Combined Responder* (Abdominal Pain and CSBM Responder)	33.6%	21.0%	12.6% [6.5%, 18.7%]	33.7%	13.9%	19.8% [14.0%, 25.5%]

* Primary Endpoint, ** Secondary Endpoints
Note: Analyses based on first 12 weeks of treatment for both Trials 1 and 2
CI =Confidence Interval

SOURCE: Linzess label. Allergan

Amitiza (Takeda):

- Amitiza (lubiprostone) received initial FDA approval in 2006 for the treatment of chronic idiopathic constipation in adults and in 2008 received FDA approval for the treatment of women with IBS-C

- Amitiza is a bicyclic fatty acid that acts on GI epithelial cells to promote secretions which helps to soften the stool and increase motility
- Recommended dosing for IBS-C is orally, twice daily
- Most common side effects are nausea (8%), diarrhea (7%) and abdominal pain (5%)
- Clinical data used to support FDA approval for IBS-C consisted of two double-blind, placebo-controlled phase 3 studies (Note: FDA guidelines for evaluating novel IBS drugs changed in 2012; i.e. after Amitiza rec'd FDA approval)
    - Combined studies enrolled 1,154 patients (92% of which were female) with IBS-C and received Amitiza 2x/day or placebo for 12 weeks
    - Primary endpoint compared the proportion of "Overall responders" in each arm based on 7-point global relief questionnaire. "Monthly responder" was defined as reporting "significantly relieved" for at least 2 weeks of the month or at least "moderately relieved" in all four weeks of the month. "Overall responders" were those that were "monthly responders" for at least 2 of the 3 months of the study.
    - Results:
        - Study 1: 14% of Amitiza patients vs. 8% of placebo patients were "overall responders"
        - Study 2: 12% of Amitiza patients vs. 6% of placebo patients were "overall responders"
        - In both studies the difference between treatment and placebo was statistically significant

Lotronex (Prometheus):

- Lotronex (Alosetron) originally received FDA approval in February 2002 for the treatment of women with IBS-D but the manufacturer voluntarily removed it from the market later that year due to reports that use of it had been associated with life-threatening adverse effects including serious intestinal damage and severely obstructed bowels. In 2002 FDA approved an sNDA, allowing for restricted marketing of Lotronex only for women with severe diarrhea-predominant IBS. Less than 5% of IBS is considered severe. The revised labeling also includes a black box warning related to potentially serious GI adverse events
- Lotronex acts as an agonist to receptors of the GI-related nervous system, helping to increase water absorption and slow GI motility
- Recommended dosing is orally, twice per day for 12 weeks
- Most commonly reported side effects are constipation (29%), abdominal pain (7%) and nausea (6%)
- Clinical data: Lotronex has been studied in three clinical studies in women with severe diarrhea-predominant IBS, including two studies (i.e. studies 1,2) with patients with bowel urgency $\geq$ 50% of days and one study (i.e. study 3) with patients with 1 or more of the following: frequent and severe abdominal pain or discomfort, frequent bowel urgency or fecal incontinence, disability or restriction of daily activities due to IBS
    - **Results**;
        - Studies 1,2: Lotronex patients had 13% to 16% (statistically significant) greater increase compared to placebo patients in the median percentage of days with bowel urgency control. In addition, 50% of Lotronex patients had bowel urgency no more than 1 day in the last week compared to 29% of placebo patients. Also, 12% of Lotronex patients had bowel urgency no more than 2 days per week in any of the 12 treatment weeks compared to 1% of placebo patients
        - Study 3: Lotronex dosed at three different doses; 0.5mg/day, 1mg/day or 1mg 2x/day. All Lotronex groups had significantly greater number of responders (43% to 51%) versus placebo (31%) based on 7point GIS scale at 12 weeks

IN LATE-STAGE DEVELOPMENT

Trulance (Synergy):

- Trulance (plecanatide) received FDA approval for the treatment of adults with chronic idiopathic constipation in January 2017. It has also completed two phase 3 trials for the treatment of IBS-C, an indication for which Synergy has said they expect to file an sNDA for in Q1 2017.
- Similar to Linzess, Trulance is a GC-C agonist. It is a 16 amino acid peptide which acts to stimulate increased intestinal fluid and accelerate GI transit.
- Recommended dosing for IBS-C is orally once/day
- Clinical studies: Top-line data from two (3mg and 6mg doses) phase 3 studies in IBS-C was released in December 2016.
    - Combined studies enrolled 2,189 patients (study 1 = 1,135, study 2 = 1,054) with IBS-C who were randomized to Trulance (n = 1,456) or placebo (n = 733)
    - Patients treated once daily for 12 weeks
    - Primary endpoint is percentage of patients who are "overall responders", defined as those patients that simultaneously experience $\geq$ 30% reduction in worst abdominal pain and increase of $\geq$ 1 CSBM from baseline, in the same week, for at least 50% of the 12 treatment weeks
    - **Top-line results**
        - Study 1 (n = 1,135): 21.5% of Trulance 3mg and 24.0% of Trulance 6mg patients vs. 14.2% of placebo patients met primary endpoint. The difference between placebo and both Trulance dose cohorts was statistically significant (p=0.009 for 3mg, p<0.001 for 6mg)
        - Study 2 (n = 1,054): 30.2% of Trulance 3mg and 29.5% of Trulance 6mg patients vs. 17.8% of placebo patients met primary endpoint. The difference between placebo and both Trulance dose cohorts was statistically significant (p<0.001) for 3mg, p<0.001 for 6mg)
        - Adverse events: the most common adverse event in the IBS-C phase 3 studies have been diarrhea (~4%)

APPENDIX: Scientific Advisory Board

Dr. Douglas Drossman
Dr. Drossman is a veteran of over 50 FDA clinical trials and is the current president of the Rome Foundation, a leading international organization that provides support and guidance in the diagnosis and treatment of functional gastrointestinal disorders. The Rome Foundation is responsible for creating the Rome process, and the criteria developed through this process are the most widely employed in clinical trials related to IBS.

Dr. Lin Chang
Director, Digestive Health and Nutrition Clinic UCLA GI Fellowship Training Program and Professor, Digestive Diseases/Gastroenterology. Dr. Chang has significant experience with pharmaceutical and healthcare companies as she has been an advisor or consultant to over 32 major pharmaceutical companies, including GlaxoSmithKline, Novartis, Merck, Allergan, Takeda, Salix, Synergy, Johnson & Johnson, Entera Health, and Ardelyx. Her experience with the FDA includes serving on the Gastrointestinal Drugs Advisory Committee of the FDA 2005-2010 (Chair 2009-2010) and again 2015-2019 as well as working as a FDA Special Government Employee from 2009-2013.

Dr. William Chey
Professor of Internal Medicine, Director of the GI Physiology Laboratory, and Director of Medical Services for the Michigan Bowel Control Program at the University of Michigan. Dr. Chey has also worked with many major pharmaceutical and healthcare companies as an advisor or consultant, including Entera Health, Ironwood, Nestle, Proctor and Gamble, Salix, and Takeda. He is the Chair of the U.S. Scientific Advisory Board at SmartPill Corporation and a member of the Clinical Advisory Board at Synthetic Biologics.

Dr. William Whitehead

Director of the Center for Functional GI & Motility Disorders and Professor of Medicine Adjunct Professor of OB-GYN at University of North Carolina School of Medicine. He has worked on 29 NIH grants (19 as principal investigator, 10 as co-investigator) and has been continuously funded by NIH since 1977. On behalf of the International Foundation for Functional Gastrointestinal Disorders, he organized two international consensus conferences on the treatment of fecal incontinence (1999 and 2002) and led a workshop on design of treatment trials for pharmaceutical companies, academic investigators, the NIDDK, and the FDA for 8 years. As a consultant, he has worked with large pharmaceutical companies on clinical trial design, including Takeda, Sucampo, Ironwood, Forest, Ono, and McNeil.

Dr. Anthony Lembo
Director of the GI Motility Laboratory at the Beth Israel Deaconess Medical Center's (BIDMC) Division of Gastroenterology in Boston, MA and as an Associate Professor of Medicine at Harvard Medical School. Dr. Lembo completed his residency and GI Fellowship at UCLA Medical Center. He is an accomplished expert in afflictions of the gastrointestinal tract and IBS. He divides his time between clinical medicine and research at Beth Israel Deaconess Medical Center in Boston. He has authored numerous original clinical studies and other research articles related to IBS.

Strategic Advisory Board

Ned Barnholt
Currently chairman of the KLA-Tencor Corporation and serves on the board of directors of eBay and Adobe. He is the former chairman, president, and chief executive officer of Agilent Technologies, a leading company in life sciences, diagnostics and applied chemical markets. Mr. Barnholt led the Agilent Technologies spin-off of Hewlett-Packard Company which broke records as the largest initial public offering (IPO) in Silicon Valley history at the time of the IPO (US $2.1 billion).

FINANCIAL MODEL

Biomerica Inc.

	2016 A	Q1A	Q2A	Q3A	Q4E	2017 E	2018 E	2019 E	2020 E
Total Revenues	$5,139.8	$1,410.1	$1,432.2	$1,499.9	$1,467.4	$5,809.7	$6,307.1	$6,839.6	$7,324.3
YOY Growth	*3.6%*	*9.6%*	*22.9%*	*10.2%*	*10.6%*	*13.0%*	*8.6%*	*8.4%*	*7.1%*
Cost of Goods Sold	$3,615.8	$833.1	$875.5	$1,050.5	$924.5	$3,683.7	$3,878.9	$4,172.2	$4,431.2
Gross Income	$1,524.1	$577.0	$556.7	$449.4	$542.9	$2,126.0	$2,428.3	$2,667.4	$2,893.1
Gross Margin	*29.7%*	*40.9%*	*38.9%*	*30.0%*	*37.0%*	*36.6%*	*38.5%*	*39.0%*	*39.5%*
SG&A	$1,570.7	$418.3	$475.3	$510.4	$454.9	$1,858.9	$1,936.3	$2,065.6	$2,131.4
% SG&A	*30.6%*	*29.7%*	*33.2%*	*34.0%*	*31.0%*	*32.0%*	*30.7%*	*30.2%*	*29.1%*
R&D	$780.3	$224.2	$301.0	$256.7	$295.0	$1,076.9	$1,425.0	$1,385.0	$795.0
% R&D	*15.2%*	*15.9%*	*21.0%*	*17.1%*	*20.1%*	*18.5%*	*22.6%*	*20.2%*	*10.9%*
Operating Income	($826.9)	($65.6)	($219.5)	($317.7)	($207.0)	($809.8)	($933.0)	($783.1)	($33.3)
Operating Margin	*-16.1%*	*-4.7%*	*-15.3%*	*-21.2%*	*-14.1%*	*-13.9%*	*-14.8%*	*-11.4%*	*-0.5%*
Total Other Income (Expense)	$31.0	$10.2	$16.6	$13.6	$6.0	$46.4	$18.0	$24.0	$25.0
Pre-Tax Income	($796.0)	($55.4)	($202.9)	($304.1)	($201.0)	($763.4)	($915.0)	($759.1)	($8.3)
Tax expense (benefit)	$703.8	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Tax Rate	*-88.4%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*
Net Income	($1,499.8)	($55.4)	($202.9)	($304.1)	($201.0)	($763.4)	($915.0)	($759.1)	($8.3)
YOY Growth	*352.4%*	*-25.3%*	*100.8%*	*13.8%*	*-68.3%*	*-49.1%*	*19.9%*	*-17.0%*	*-98.9%*
Net Margin	*-29.2%*	*-3.9%*	*-14.2%*	*-20.3%*	*-13.7%*	*-13.1%*	*-14.5%*	*-11.1%*	*-0.1%*
EPS	($0.20)	($0.01)	($0.02)	($0.04)	($0.02)	($0.09)	($0.10)	($0.08)	($0.00)
YOY Growth	*348.0%*	*-31.3%*	*90.1%*	*11.5%*	*-68.7%*	*-53.3%*	*10.8%*	*-20.6%*	*-98.9%*
Diluted Shares O/S	7,626	8,170	8,189	8,434	8,480	8,318	9,000	9,400	9,600

Brian Marckx, CFA

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