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INVESTMENT LETTER AND COMMENTARY

SHAKESPEARE UNDERSTOOD MUCH ABOUT SLEEP, BUT DID HE KNOW WHAT SLEEP APNEA WAS?

ResMed (NYSE: RMD) and Universal Display (NASDAQ: OLED)

By Fredric E. Russell

In *Macbeth*, first published in 1623, Shakespeare created several powerful metaphors to celebrate the magical, almost supernatural therapeutic power of sleep:

> *Methought I heard a voice cry, "Sleep no more!*
> *Macbeth does murder sleep"—the innocent sleep,*
> *Sleep that knits up the raveled sleave of care,*
> *The death of each day's life, sore labor's bath,*
> *Balm of hurt minds, great nature's second course,*
> *Chief nourisher in life's feast.*
> *(William Shakespeare, Macbeth 2.2.46-51)*

Shakespeare wrote of the wondrous effects of sleep, but did he know enough about its physiology to understand that sometimes, even when sleep does arrive, it can be spoiled by many forces, one of which is sleep apnea, a condition in which interrupted breathing forces a person to awaken from sleep, often gasping for air and usually terrified because he does not know what is going on?

Did Shakespeare know that sleep apnea can have a markedly deleterious effect on the quality of sleep, countering sleep's restorative effects so that a person suffering from sleep apnea will wake up the next morning not refreshed and rejuvenated but discouraged and tired, vulnerable to negative and pessimistic thoughts?

It is unlikely that Shakespeare would have known what sleep apnea is. Even if he had observed sleep apnea in action he would not have applied the description of sleep apnea to it. That is because in Shakespearean times the understanding of sleep apnea was probably primitive if not nonexistent.[1]

Difficulty with falling asleep or staying asleep caused by drinking too much coffee or, paradoxically, by consuming too much alcohol, especially too close to bedtime, was something that scientists in Shakespeare's day understood. But other unpleasant situations that could occur during the night, such as sleep apnea, situations that could interfere with repairing "the raveled sleave of care" were less common than they are today.

Life was much simpler for Shakespeare. Maybe that was true because he had far fewer choices, and far fewer decisions to make every day. Maybe life was simpler and easier to manage because there were far fewer stimuli to enjoy, to encounter, and to integrate into your life.

For Shakespeare, for example, evenings were much more tranquil than they are for us. Shakespeare did not suffer interruptions created by the noise from a cellphone ringtone, the noise made by a delivered text message, and the relentless procession of bland, forgettable and vacuous advertisements for an endless variety of household cleaners, paper products, automobiles, and anything else you can think of, advertisements that can cause extreme

[1] Interestingly, although the causes, treatment, and official diagnosis of sleep apnea may not have been known to Elizabethan scientists, the condition was not unknown to them. Some modern sleep scientists believe that Shakespeare described the character Falstaff from *Henry IV* as having what would now be diagnosed as Obstructive Sleep Apnea, a condition that was widely recognized at the time as being aggravated by obesity and the excessive consumption of alcohol (Yury Furman, M.D. "Shakespeare and sleep disorders." *Neurology*, October 1997). (Katie Michaels-Johnson, one of my colleagues, provided the preceding commentary and insight.)

fatigue and anxiety, especially if they are repeated several times a day over many months to the American household viewing audience, which averages five hours a day of television viewing. (The Geico insurance advertisements, featuring a charming and curious gecko, are a refreshing exception to the usual cable advertising fare.)

The ritual of sharing of the day's triumphs, frustrations, achievements, and disappointments at the dinner table and afterwards before retiring to sleep strengthens the emotional and intellectual bonds of the family. Today, this ritual is often subordinated to interruptions, many of which are unnecessary and mindless.

Shakespeare could enjoy a simple dinner with his family and friends, unlike the inhabitants of today's civilized societies (societies at least presumed to be civilized or advanced). Shakespeare's dinner companions were protected from a wide range of destructive stimuli while they ate vegetables grown from their garden and meat slaughtered from a farm less than two hundred yards or so from their house.

Shakespeare looked forward to the evening meal when the family, a cohesive social unit (or at least more so than today), exchanged experiences and ideas and engaged in lively and comforting conversation around the dinner table. Evenings were tranquil, except for the occasional call of a fox or wolf, or the noise of a man's head hitting the top of the bar in a fist fight a few hundred yards away at the local pub. People were protected from the mesmerizing, some say mindless, but deeply addictive force of television and the endless chatter of the radio.

At the dinner table Shakespeare did not nervously check his iPhone, accessing the web site of Charles Schwab & Co., Inc. to examine his portfolio and to gauge whether it had gone up or down during the day, ignoring the admonitions of such respected investors as Warren Buffett to resist the emotions that create rapidly changing sharp, and often inexplicable price changes in common stocks but to focus on the intrinsic value of the company under examination.

Shakespeare's concentration was not interrupted by the custom ring of the telephone, marked by an easily recognized melody, commanding him to pick up the phone because the call demanded immediate attention. He did not have to suffer any anxiety knowing that at any time his boss, Indra Nooyi, the chief executive officer of PepsiCo, Inc. (NYSE: PEP), could call, and with her exasperation and tension barely under control, could inform him that someone had reported to her an inventory shortage of Doritos corn chips at the distribution center in Dallas, one of several under his authority, and that he would have to get on the phone immediately with the head of the night shift at the center to straighten out the problem. Otherwise, she continued, profits would be hurt, the *Wall Street Journal* might report on Pepsi's poor inventory control, and the company's board of directors could vote to cut back on her otherwise almost guaranteed rise in annual stock option awards. This, she suggested, would not be good, especially for Shakespeare.[2]

After dinner, Shakespeare and his family settled down by the fire, if it was winter, and read books, listened to home-made music, and continued the comforting and stimulating conversations begun at the dinner table.

In contrast, twenty-first century American citizens turn on the television and subject themselves to an endless parade of crime and detective shows with disturbing displays of emotional and physical violence, shows that never fail to raise cortisol levels just when nature says that it is time for these levels to decline, wreaking havoc with hormones and circadian rhythms and otherwise making it difficult for Morpheus to do his work. (Morphine derives its name from Morpheus, the Greek god of dreams.)

Incidentally, some psychologists, recognizing the value of a simple uncluttered lifestyle and understanding the anxiety produced when the

[2] With respect to stock options, and because the Securities & Exchange Commission does not mandate that publicly traded companies disclose their stock option policy, it is always part guessing game to determine what future stock options will be awarded and how these rewards may dilute the percentage ownership of shareholders who are not part of management.

consumer has hundreds of ways to enjoy a service, as is the case with enhanced cable offerings of hundreds of channels, have maintained, as Swarthmore College psychology professor Barry Schwartz writes in *The Paradox of Choice*, that having many choices may lead to indecision and confusion, not liberation and pleasure.

> Bottled water was displayed in at least 15 flavors. In the pharmaceutical aisles, I found 61 varieties of suntan oil and sunblock, and 80 different pain relievers—aspirin, acetaminophen, ibuprofen; 350 milligrams or 500 milligrams; caplets, capsules, and tablets; coated or uncoated. There were 40 options for toothpaste, 150 lipsticks, 75 eyeliners, and 90 colors of nail polish from one brand alone. There were 116 kinds of skin cream, and 360 types of shampoo, conditioner, gel, and mousse. Next to them were 90 different cold remedies and decongestants. Finally, there was dental floss: waxed and unwaxed, flavored and unflavored, offered in a variety of thicknesses. (Schwartz, Barry. *The Paradox of Choice*. Harper Collins E-books, page ten)

Perhaps we would all be better off if we had listened to the advice of Henry Ford, who once famously said that a customer could purchase a car "in any color that he wants, so long as it's black."

After dinner, Shakespeare did not have to face the gross cunning, flagrantly bad manners, and the inane conversation of the heroines (if that is an accurate term) of *Desperate Housewives*[3], whose twin behavior role models, greed and materialism, were on display in one episode featuring a birthday party for one of the characters, a party with so much cake, ice cream, and liquor that the partygoers were never able to say what they had consumed the night before, or what they did that night. In the morning, with the carpet stained by food, bourbon, scotch and other great drinks, the hung-over hostess could say like Lady Macbeth, consumed by guilt over her part in the regicide her husband committed, "Out, damned spot!" (*Macbeth*, 1.5.25)

Nor did Shakespeare have to decide, after dinner, which of his children could play which video games; there were no video games. If the children did have orchestrated entertainment, it was a game of checkers or chess. And if there were squabbles about the control of the checkers board and the chess board, Shakespeare could quickly rule on who got to play what and silence would prevail.

Shakespeare did not have to worry about suffering a late-night bout of anxiety because he had turned on Netflix (NASDAQ: NFLX) and was drawn to *Forensic Files*[4] and to a story about a deranged, pathologically jealous wife who had murdered a woman the wife thought was having an affair with her husband, when in fact the murdered woman was innocent of the affair: it was another woman who had corrupted the husband of the jealous wife.

SHAKESPEARE WOULD HAVE BEEN THRILLED TO HAVE WATCHED HIS PLAYS PERFORMED ON A TELEVISION MADE WITH ORGANIC LIGHT EMITTING DIODES (OLEDS)

Shakespeare dealt with fewer stimuli in the evening than we do today. Of course, neither did he have the privilege of watching programs on an organic light emitting diode (OLED) television set with the colors supplied by Universal Display (NASDAQ: OLED), a color display or presentation protected by more than four thousand patents that Universal Display owns.[5]

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[3] *Desperate Housewives* aired for eight seasons on ABC from 2004 through 2012. It's a comedy-drama that follows the lives of a group of women as seen through the eyes of their deceased friend, who committed suicide in the pilot episode.

[4] *Forensic Files* ran from 1996 through 2011 on various networks: TLC (1996-1999), Court TV (2000-2007), NBC (2002), and truTV (2008-2011), sometimes under the name *Medical Detectives*. It is a documentary-style series showing how forensic science is used to solve violent crimes, mysterious accidents, and outbreaks of illness.

[5] For more than fifteen years, liquid crystal displays, known commonly as LCDs, have dominated the flat panel display market. OLED displays, however, offer advantages versus LCDs: higher power efficiencies which can reduce energy consumption; a thinner profile and a lighter weight; higher contrast ratios, leading to sharper picture images and graphics; and lower manufacturing costs.

On August 13, 2013, Samsung announced the availability of a 55-inch curved OLED television in the United States at a price of $8,999.99. (Reflecting the rapid acceptance of the OLED concept and the introduction of OLED televisions into mass or mainstream production, a friend paid $2,992.89 for a LG Electronics curved 55-inch 4K Ultra Smart OLED television on July 31, 2016, an almost sixty-seven per cent decline in less than three years.)

I had not had a television in my home for twenty-nine years when, one Saturday afternoon in the summer of 2014, while watching a Netflix movie at a friend's house, and after experiencing the brilliant colors and the sharply defined images of a Samsung Electronics Co. Ltd (KRX: 005930) television with color created by organic light emitting diodes, I was very curious to know whether it was Samsung or another company that controlled the technology that produced the impressively captivating picture I had enjoyed. After some investigation I determined that it was not Samsung, but Universal Display Corporation, controlling the OLED technology, that was the chief player in the OLED arena, having licensed the OLED technology to Samsung, and that the potential reach of the OLED concept was staggering:

> We are a leader in the research, development and commercialization of organic light emitting diode, or OLED, technologies and materials for use in display and solid-state lighting applications. OLEDs are thin, lightweight and power-efficient solid-state devices that emit light that can be manufactured on both flexible and rigid substrates, making them highly suitable for use in full-color displays and as lighting products.
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> OLED displays are capturing a growing share of the flat panel display market, especially in the mobile phone, television, virtual reality and automotive markets. We believe that this is because OLEDs offer potential advantages over competing display technologies with respect to power efficiency, contrast ratio, viewing angle, video response time, form factor and manufacturing cost.
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> We also believe that OLED lighting products have the potential to replace many existing light sources in the future because of their high-power efficiency, excellent color rendering index, low operating temperature and novel form factor. **Our technology leadership and intellectual property position should enable us to share in the revenues from OLED displays and lighting products as they continue to be more broadly adopted.**
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> OLEDs, on the other hand, are larger in size and can be viewed directly, without using diffusers that are required to temper the intense brightness of LEDs. OLEDs can be added to any suitable surface, including glass, plastic or metal foil, and could be cost-effective to manufacture in high volume. Given these characteristics, product manufacturers are working and have introduced limited product applications of OLEDs for diffuse specialty lighting applications and ultimately general illumination.
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> If these efforts are successful, we believe that OLED lighting products could begin to be used for applications currently addressed by incandescent bulbs and fluorescent lamps, as well as for new applications that take advantage of the OLED form factor. In particular, **the ability of OLED technology to produce uniform illumination over arbitrary shapes is making OLED lighting very attractive to the automobile industry.** (Universal Display, 10-K for the calendar year ended December 31, 2016, pp. 2, 3.)

This was exciting and motivated me to make a trip to the Best Buy Co., Inc. (NYSE: BBY) store at 5520 E. Skelly Drive in Tulsa to compare the OLED televisions side by side with their LCD predecessors, to make sure that I was not mistaken in thinking that organic light emitting diodes were

more powerful and colorful than liquid crystal displays. I was not disappointed.

After the Best Buy visit, and after performing the conventional or standard number analysis—looking for example at the company's five year growth in sales, operating income, and cash flow, looking at the income statement to see whether the company was spending adequate amounts on research and development, and looking at the balance sheet along with the percentage of revenue devoted to interest expense or servicing debt—I was satisfied that an investment in Universal Display made sense for my clients and for myself.

The next step was to gather our portfolio managers to plan strategy for executing the purchase of 100,000 shares. This was a tricky business: at the time of our meeting, the average daily volume for the previous thirty days was 633,782 shares. Because our intended purchase could represent a significant portion of Universal Display common shares bought and sold on the Nasdaq that day, we had to be careful and patient with our execution.

A few weeks later, believing that I ought to enjoy the rewards of disciplined research, I called my friend, Gary Garner, arranged to give him my credit card, and asked him to visit Best Buy and purchase a 55-inch OLED LG television. He did a wonderful job setting up the television in time for us to enjoy magnificent OLED color for the November 29, 2014 football drama and war between the University of Michigan and Ohio State University.

Michigan football is my only football interest other than, of course, watching The University of Oklahoma and Oklahoma State University play.

My interest in Michigan football stems from living in Ann Arbor between 1972 and 1974 while teaching accounting and finance at Eastern Michigan University, located in Ypsilanti, Michigan seven miles from my apartment on State Street in Ann Arbor. It was an inevitable interest, given Ann Arbor's obsession with Michigan football, an obsession stimulated by Michigan's number six ranking in 1972's college polls.

The experience of watching Michigan play football on my new OLED television was so enthralling that it made me focus on the positive effects of the television viewing experience, so much so, that in the course of writing this letter, I believe that even Shakespeare may have given up the calmer and simpler pleasures of life in favor of television consumption if he had had the opportunity to enjoy the stunning display of an OLED television.

A PRIMER ON SLEEP APNEA

In sleep apnea, breathing pauses or interruptions lasting from a few seconds to minutes may occur thirty times or more in an hour. The cumulative effect of these pauses or interruptions has a profoundly negative effect on health, much more so than television watching, and perhaps as much as diabetes and obesity (though as we shall see later in the letter, obesity, diabetes, and sleep apnea reinforce each other, feed off each other, and all nefariously contribute to a marked deterioration in health, a cycle that is ResMed's corporate mission to diagnose and control).

Sleep apnea comes in two forms. Obstructive sleep apnea (OSA) is the most common category of sleep-disordered breathing. The muscle tone of the body ordinarily relaxes during sleep. At the level of

The most common signs and symptoms of obstructive and central sleep apnea include:

- Loud snoring, which is usually more prominent in obstructive sleep apnea
- Episodes of breathing cessation during sleep witnessed by another person
- Abrupt awakenings accompanied by shortness of breath, which more likely indicates central sleep apnea
- Awakening with a dry mouth or sore throat
- Morning headache
- Difficulty staying asleep (insomnia)
- Excessive daytime sleepiness (hypersomnia)
- Attention problems

the throat, the human airway is composed of collapsible walls of soft tissue which can obstruct breathing. Mild occasional sleep apnea, such as many people experience during an upper respiratory infection, may not be significant, but severe obstructive sleep apnea (OSA) requires treatment to prevent low blood oxygen (hypoxemia), sleep deprivation, and other complications. Obstructive sleep apnea is almost always chronic.

> The upper airway has no rigid support and is held open by active contraction of upper airway muscles. Normally, during REM sleep and deeper levels of non-REM sleep, upper airway muscles relax and the airway narrows. Individuals with narrow upper airways or poor muscle tone are prone to temporary collapses of the upper airway during sleep, called apneas, and to near closures of the upper airway called hypopneas. (ResMed 10-K for the fiscal year ended June 30, 2017, p. 3.)

In the second type of sleep apnea or Cheyne–Stokes respiration, the brain's respiratory control centers are imbalanced during sleep. Blood levels of carbon dioxide, and the neurological feedback mechanism that monitors them, do not react quickly enough to maintain an even respiratory rate, with the entire system cycling between apnea and hyperpnea, even during wakefulness. The sleeper stops breathing and then starts again. There is no effort made to breathe during the pause in breathing: there are no chest movements and no struggling. After the episode of apnea, breathing may be faster (hyperpnea) for a period of time, a compensatory mechanism to blow off retained waste gases and absorb more oxygen.

Scientists in Shakespeare's time had at best a primitive understanding of the physiology and dynamics of dreams, sleep, and the forces that help and hinder sleep. Scientists understood that inadequate sleep makes you tired and irritable, predisposes a person to pessimism, and compromises productivity, but that was about the extent of their knowledge.

With such limitations, it was understandable that some of the complexities and subtleties of the sleep dynamic escaped scientists and often led them incorrectly to believe that the sleep process was pretty much a simple matter. If you worked hard during the day and you were tired at night, you fell asleep. If you did not work hard, or perhaps if you had a guilty conscience, you did not fall asleep. Perhaps one reason for scientists in Shakespeare's time not understanding sleep apnea is this fact: the physiology and dynamics of sleep are complicated.

SLEEP: A SIMPLE PLEASURE, BUT A COMPLEX PROCESS

Today, after much research into the dynamics of brain activity, we know a lot about sleep, and we know that it is not a simple activity. We know, for example, that sleep has two states, each markedly different from the other.

> Sleep is a complex neurological process that includes two distinct states: rapid eye movement, or REM, sleep and non-rapid eye movement, or non-REM, sleep. REM sleep, which is about 20-25% of total sleep experienced by adults, is characterized by a high level of brain activity, bursts of rapid eye movement, increased heart and respiration rates, and paralysis of many muscles. Non-REM sleep is subdivided into four stages that generally parallel sleep depth; stage 1 is the lightest and stage 4 is the deepest. (ResMed 10-K for the fiscal year ended June 30, 2017, p. 3.)

Breathing interruptions, often termed events, can significantly impair a night's sleep.

> These breathing events result in a lowering of blood oxygen concentration, causing the central nervous system to react to the lack of oxygen or increased carbon dioxide and signaling the body to respond. Typically, the individual subconsciously arouses from sleep, causing the throat muscles to contract, opening the airway. After a few gasping breaths, blood oxygen levels increase and the individual can resume a deeper sleep until the cycle repeats itself. Sufferers of OSA [obstructive sleep apnea] typically

> experience ten or more such cycles per hour.

SLEEP APNEA: OFTEN UNRECOGNIZED

Obstructive sleep apnea has a dubious honor: it shares comorbidity with diseases that are making people around the world sick.

> While OSA has been diagnosed in a broad cross-section of the population, until recently, it has typically been diagnosed among middle-aged men who are obese. However, we believe the importance of OSA in women is increasingly being recognized, with nearly 40% of new CPAP patients being female. A strong association has been discovered between OSA and a number of cardiovascular and metabolic diseases. Studies have shown that SDB is present in approximately 83% of patients with drug-resistant hypertension, approximately 72% of patients with type 2 diabetes, approximately 77% of patients with obesity and approximately 76% of patients with chronic heart failure. (ResMed 10-K for the fiscal year ended June 30, 2017, p. 3.)

Lynne Imhoff, M.D. is chief of the Department of Anesthesia at the Center for Orthopedic Reconstruction and Excellence in Jenks, Oklahoma (Greg Holt, M.D., a good friend of mine is an Orthopedic Surgeon at Center for Orthopedic Reconstruction and Excellence). A wonderful friend and a brilliant and compassionate doctor, she has relayed the empathetic agony she endures when sedating overweight and or diabetic patients before surgery. These conditions, she knows, are especially dangerous in surgery because they can precipitate complications.

The presence of sleep apnea presents special challenges to the administration of anesthesia and pain medications that may affect respiration or relax muscles. Since most people who have sleep apnea do not know it, the anesthesiologist or pain clinician is well advised to screen the patient for OSA before proceeding. Should it be determined there is a likelihood that OSA is present, a sleep study should be considered. If not possible, the patient should be considered to have sleep apnea and treated with appropriate precautionary steps.

In a pamphlet prepared for patients about to undergo surgery, the American Society of Anesthesiologists advises:

> Anesthesia also can cause the throat to relax and close up and sleep apnea can lead to breathing problems after surgery. It also can make it more difficult to regain consciousness after surgery and take a breath.

ResMed reports in its 10-K that OSA can cause serious problems for those who suffer from it.

> Several studies indicate that the oxygen desaturation, increased heart rate and elevated blood pressure caused by OSA may be associated with increased risk of cardiovascular morbidity and mortality due to angina, stroke and heart attack. Patients with OSA have been shown to have impaired daytime performance in a variety of cognitive functions including problem solving, response speed and visual motor coordination, and studies have linked OSA to increased occurrences of traffic and workplace accidents. (ResMed 10-K for the fiscal year ended June 30, 2017, p. 4.)

In conclusion, there is universal agreement that diabetes, obesity, and poor cardiovascular health are effects of a sedentary life style which often includes the viewing of television in copious amounts, but there are many people who watch television who do not suffer from these three illnesses.

We do know that cardiovascular deterioration, diabetes, and obesity are linked to sleep apnea, or in the language of medical professionals who study sleep apnea, we know that sleep apnea shares a comorbidity factor with these three illnesses. Which is the chicken and which is the egg is difficult and unnecessary to determine.

We also know that bad hearts, bad blood sugar, and a forty-inch waist are part of a vicious cycle

INVESTMENT THESIS

Because of diabetes, obesity, and sedentary lifestyle, aggravated by a high daily diet of television, sleep apnea is a large and growing problem around the world. As dangerous as sleep apnea is, it is often unrecognized and frequently untreated.

> A long-term epidemiology study published in 2013 estimated that 26% of adults age 30-70 have some form of obstructive sleep apnea. In the United States alone, this represents approximately 46 million people. Despite the high prevalence of OSA, there is a general lack of awareness of OSA among both the medical community and the general public. It is estimated that less than 20% of those with OSA have been diagnosed or treated. (ResMed 10-K for the fiscal year ended June 30, 2017, p. 3.)

Sleep apnea sufferers represent a growing market, both as more people begin to suffer from sleep apnea and as current sufferers are diagnosed and begin treatments. Two companies, ResMed (NYSE: RMD) and Respironics, a division of the Dutch company Philips (NYSE: PHG), together control more than ninety per cent of the global market, enjoying a dynamic duopoly.

that includes sleep apnea and a sedentary but non-tranquil lifestyle and will contribute to the likelihood of someone suffering from sleep apnea.

The negative effects of sleep apnea do not stop with sleep apnea. As is true of any vicious cycle, such as the opioid crisis we are now experiencing, or the condition of poverty that has always afflicted some group in this country, one pernicious situation often leads to another harmful state.

Sleep fragmentation and the loss of the deeper levels of sleep caused by OSA can lead to excessive daytime sleepiness, reduced cognitive function, memory loss, lack of concentration, depression, and irritability. Escaping the cycle of poor health and its effects can be as insidiously difficult as it is to escape from the death cycle of poverty.

The loss of deep sleep produces excessive amounts of a hormone—ghrelin—which enhances appetite. I sometimes stay up late attempting to decipher the jargon and deliberate obfuscation that permeates the annual 10-K documents and other forgettable communications between a publicly held company and its shareholders.

If I have had a short night the first item on my food list, after coffee of course, is chocolate, especially a Hershey chocolate bar. My tastes in chocolate are not sophisticated—some of my friends would say that there is no sophistication in much of my tastes—so I will buy a less expensive Hershey bar versus a Godiva chocolate.[6]

I have no illusions about the dietary implications or repercussions of eating a lot of chocolate: there goes the weight way up, moving blood pressure into dangerous territory.[7]

[6] By the way, I always thought that Godiva chocolate, because of its cachet, had to be made by a chocolate confectioner located in Switzerland. I googled the word Godiva and found that from 1967 to 2007, Godiva was owned by the Campbell Soup Company, based in Camden, New Jersey. Joseph Draps founded Godiva in 1926 in Brussels, Belgium. The first Godiva shop outside Belgium was opened in Paris on the fashionable Rue Saint Honoré in 1958. In 1966, the company's products reached the United States, where they were sold at luxury strip malls. The following year, it was purchased by the Campbell Soup Company. In 1972, the first Godiva boutique in North America was opened on New York City's Fifth Avenue. By 2007, Godiva had annual sales of approximately $500 million. In August of that year, Campbell Soup Company announced it was "exploring strategic alternatives, including possible divestiture, for its Godiva Chocolatier business" as the "premium chocolate business does not fit with Campbell's strategic focus on simple meals." On December 20, 2007, Campbell announced that it would sell Godiva to Yildiz Holding, a Turkish food conglomerate. Yildiz completed its $850 million acquisition of Godiva on March 18, 2008.

> We all know there is nothing like a good night's sleep—sack time enhances mood, memory, immune function and hormonal balance—and yet the scientific underpinnings for sleep continue to be a mystery.
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> Taken as a whole, these studies of human physiology suggest that reduced sleep could lead to increased weight—a hypothesis supported by at least fifty other studies. In several investigations, children from six to nine years who got less than ten hours of sleep were one and a half to two and a half times more likely to be obese, and studies in adults suggest a fifty percent increase in obesity with participants with fewer than six hours of sleep.
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> A recent analysis of depression of nineteen studies found that treating sleep apnea with CPAP (continuous positive airway pressure) significantly reduces depression. (*Scientific American*, Summer 2017, pp. 57-58.)

THE WRITER UNDERGOES A SLEEP TEST AND OBTAINS A RESMED AIR CURVE TEN, ALONG WITH AN AIRFIT N20 MASK

So, how do individuals recognize and fight obstructive sleep apnea?

A few years ago, in the middle of the night, I awakened gasping for breath. I dismissed the experience as unimportant, but when a few nights later I suffered the same event, I realized that something was wrong. My internist ordered a sleep study and within ten days I had a sleep machine which infused air down my throat, opening the throat so I could breathe more efficiently. I also had a mask which I wore and which was connected to the machine. My sleep improved dramatically. I was lucky. I had professional help in pinpointing the nature and the extent of my sleep apnea problem. Of the United States population, many are not so fortunate.

> Generally, an individual seeking treatment for the symptoms of OSA is referred by a general practitioner to a sleep specialist for further evaluation. The diagnosis of OSA typically requires monitoring the patient during sleep at either a sleep clinic or the patient's home. During overnight testing, respiratory parameters and sleep patterns may be monitored, along with other vital signs such as heart rate and blood oxygen levels. (ResMed 10-K for the fiscal year ended June 30, 2017, p. 4.)

THE WRITER VISITS A SLEEP LAB AND UNDERGOES A POLYSOMNOGRAM, A SLEEP TEST DURING WHICH HE IS FITTED WITH ENOUGH WIRES AND ELECTRODES TO LOOK LIKE A MAIN CHARACTER IN A *STAR WARS* MOVIE

A sleep test, which one can take either in the sleep lab at St. Francis or St. John or at thousands of hospitals and sleep centers in the United States, and which I undertook last summer at the sleep center of the St. Francis Health System in Tulsa, is called a polysomnogram.

The gold standard clinical assessment of sleep quality is the attended laboratory polysomnogram. This includes typically four or six

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[7] There are two major differences you will find between American and European chocolates. One is the cocoa content. The United States requires only ten per cent cacao in their chocolates, while in Europe anything labeled "chocolate" must contain twenty percent or higher cacao. For example, if you were to compare a Hershey bar made in America versus a Cadbury Dairy Milk bar made in Europe, you would find a significant taste difference. That's because those Cadbury milk bars contain 23 per cent cacao in comparison to the American-made Hershey bars, which contain only eleven percent cacao, resulting in a much darker, richer taste in the Cadbury bar. The second major difference is sugar content. As a result of American-made chocolate having lesser percentage cacao, there is a higher sugar content. That's why Americans are usually known for their lighter, sweeter milk chocolates while European chocolates can be almost bitter as a result of the low sugar content. My colleagues Katie and Ying, who both have dogs, told me that cacao is fatally poisonous to dogs. But they do not seem to worry too much if any of their dogs eat Hershey bars by accident, since there is not much chocolate in them. However, they will worry and will take a dog to the veterinary clinic immediately if a European chocolate bar were to go mysteriously missing.

electroencephalogram (EEG) leads, which forms the basis of much of sleep-awake staging. Electromyography (EMG) of the chin and bilateral electro-oculogram (EOG) complement the EGG.

In case your doctor suspects that you have sleep apnea and has ordered a sleep test for you and you have scheduled the polysomnogram, I want to disabuse you of any fantasy you might have about having a carefree evening watching *Jimmy Kimmel Live!* and relaxing in your pajamas.

You arrive at the sleep lab and are quickly escorted to your private room, politely asked to disrobe and to change into the usual hospital patient uniform with the opening at the back, and then the technician puts all kinds of electrodes on you, after shaving your chest if you are a male, and turns off the light to disappear into a room with a one-way window where he can record your pulse, your heart rate, and of course any apneas you experience. He does not offer you a Kahlua or a Drambuie, and you are not allowed to watch the offerings on the television. It is lights out except when he or she comes into your room to change masks.

> Simpler tests, using devices such as our Apnealink Air, or our automatic positive airway pressure devices, monitor airflow during sleep, and use computer programs to analyze airflow patterns. These tests allow sleep clinicians to detect any sleep disturbances such as apneas, hypopneas or subconscious awakenings.
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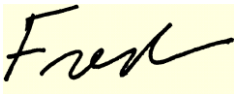
> Before 1981, the primary treatment for OSA was a tracheotomy, a surgical procedure to create a hole in the patient's windpipe. Alternative surgical treatments have involved either uvulopalatopharyngoplasty,[8] or UPPP, in which surgery is performed on the upper airway to remove excess tissue and to streamline the shape of the airway or implanting a device to add support to the soft palate. UPPP alone has a poor success rate; however, when performed in conjunction with multi-stage upper airway surgical procedures, a greater success rate has been claimed.
>
> These combined procedures, performed by highly specialized surgeons, are expensive and involve prolonged and often painful recovery periods. Surgical treatments are not considered first line therapy for OSA. Other alternative treatments available today include nasal surgery, mandibular advancement surgery, dental appliances, palatal implants, somnoplasty, nasal devices and electrical stimulation of the nerves or muscles. Alternative pharmaceutical therapy treatments are reported to be under development. (ResMed 10-K for the fiscal year ended June 30, 2017, p. 4.)

If the sleep lab tests show that you have sleep apnea, you will be given a face mask or nasal interface connected to a small portable air device, usually made by ResMed or Respironics, a division of Philips, that delivers room air at a positive pressure.

Continuous air pressure applied in this manner acts as a pneumatic splint to keep the upper airway open and unobstructed. Interfaces include nasal masks and nasal pillows and sometimes a full-face mask. The machines are easy to operate, and ResMed has created a cloud-based system that gives you a score every morning on the previous night's compliance, encouraging you to use the machine as many hours as possible during the night.

Sincerely,



Fredric E. Russell
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This INVESTMENT LETTER AND COMMENTARY is not a recommendation of

[8]If you cannot pronounce uvulopalatopharyngoplasty, don't feel bad; you are not alone.

purchase nor does it purport to offer advice regarding the purchase or sale of any security or industry sector.

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Our web site www.ferimc.com contains an archive of INVESTMENT LETTERS AND COMMENTARIES

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Clients and employees (through taxable and tax-deferred accounts, including the Fredric E. Russell Investment Management Co. 401(k) Plan and other accounts controlled by Fredric E. Russell) own, as of November 20, 2017, **51,675 shares** of **ResMed Inc. (NYSE: RMD)** and **22,180 shares** of **Universal Display Corporation (NASDAQ: OLED)**.

We may liquidate, decrease, or increase our position in ResMed or OLED at any time, without notice before or after we do so. This letter is not a recommendation of purchase or other action.

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For further information, please contact Bruce Clemens via email at bwc@ferimc.com or call him at 918.743.5959.

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Katie Michaels-Johnson and Ying Qi made important research contributions to this investment letter and commentary.

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Fredric E. Russell: Brief Authorized Biography

Fredric E. Russell graduated from Deerfield Academy in Deerfield, Mass and then earned a B.A. from Swarthmore College in Swarthmore, PA and an M.A. from Washington University in St. Louis, MO. He also holds the CPA certificate and has taught accounting and finance, at the university level, before realizing that he could make real money for himself and for people he knew, using some of the analytical qualities that the studying and teaching of accounting and finance demanded. Consequently, he retired from academic life, which he enjoyed tremendously and which gave him everything he needed, except a comfortable amount of cash and marketable securities, and the freedom to write INVESTMENT LETTERS AND COMMENTARIES in a manner he thought would be informative and entertaining for the clients of the investment management firm he always wanted to have.

We believe that our INVESTMENT LETTERS AND COMMENTARIES are an indispensable part of our engagement with our clients, giving them an understanding of what we think is important in our investment decisions.

In these letters, I attempt to tell the story of a company—what it does, how it makes money, and what its competitive advantages are—to give our clients and others an understanding of our investment approach.

There is no schedule for these letters. I write them when I am excited and inspired. I do not believe that we ought to spend time on delivering something just because other firms deliver something at a conventional time and in a conventional format.

Therefore, you may not see any year-end review, and if so that is because I believe that often there is nothing to add that is exceptional when compared to all the year-end reviews you might see elsewhere, which are the conventional method that investment firms use to communicate with clients, forecasting market developments such as employment figures and interest rates. We have no special skills in that arena and therefore I believe there is no point in bombarding our clients with information that is available from many sources, and free, if you do not consider the energy and time one uses to wade through this information. Our focus will continue to be understanding a small group of companies, with an attempt to analyze this group with more acuity than the competition.