The Food Addiction Institute

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A Scientific Review Paper

Physical Craving and Food Addiction

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ABSTRACT

In 1993, Wilson reviewed the scientific research on binge eating and found the theory that foods cause physical cravings was “without convincing empirical support.” In l994, Nobel *et al* at UCLA discovered that some obese adults who were “bingeing on dense carbohydrates” and who were neither alcoholic nor drug addicted had the same D2 dopamine gene marker that distinguished alcoholism and other drug addictions. In the following years, Hoebel *et al* at Princeton reviewed 251 animal studies designed to mimic human ingestion of sugar and found positive indication of physical craving. More recently, Ahmed’s research in France showed that intense sweetness - not just refined sugar, but also artificial sweeteners - surpasses cocaine as a reward in laboratory animals. Just this year (2009), Leibowitz of Rockefeller University demonstrated that overconsumption of fats can be correlated with brain systems which, when activated, further stimulate the intake of fat. Gold at the University of Florida presented summaries of the brain imaging research at several leading universities showing that “palatable food” created the same types of changes in the dopamine receptors of the human brain as alcohol and other widely recognized addictive substances. And a series of studies by Wang of the Brookhaven Institute now demonstrates that those with severe problems with foods can be triggered simply by viewing pictures of the foods on which they tend most often to binge. At such times, their brains look like they are already experiencing a state of biochemical craving.

Colantuoni *et al* (2002*)* analyzed over a hundred peer reviewed articles, each of which showed that humans produce opioids - the chemically active ingredient in heroin, cocaine and other narcotics - as a derivative of the digestion of excess sugars and fats. Ifland *et al* (2009) established that some obese adults were able, while overeating refined foods, to identify a physical craving for these foods as a significant and frequent trigger of bingeing behavior. Drewnowski at the University of Washington, Bellingham has reported an experiment showing that naloxone, a common opiate blocker, curtailed people’s interest in candies, cookies and other sweets when compared with those who did not take this drug. Noble's genetic research, Gold's brain imaging research, and the research on endogenous opioids - including opioid blockers inhibiting craving of foods - all focus on pleasure enhancing aspects of physical craving and converge at the D2 dopamine receptors, that is, the pleasure centers of the brain.

There is also research on out of control consumption of food related to the pain reduction centers which focus on the serotonin mechanisms in the brain. Katherine summarized the research showing malfunctions in serotonin processing correlates with an addiction to sugars and flours.

There are studies suggesting other biochemical explanations for aspects of out of control eating. Shapira *et al* shows that behaviors of people with low leptin levels, especially those with Prader-Willi Syndrome, tend to be related to the behavior of those with very strong biochemical urges to eat and binge on all foods – what self-assessed food addicts call “volume addiction” or “overeating of all foods.” Those with celiac disease - an allergy to gluten, especially wheat - experience insatiation for completely different biochemical reasons. Similarly, Gonzales, from her clinical work with food addicts as a dietician, developed a theory of how deficiencies in the insulin system could create a “false starving” experience in self-assessed food addicts.

Findings from laboratory-based scientific research correspond closely with other clinical observations of

professionals working with food addicts. Working with 4000 food addicts over twenty years, Werdell found that bingeing clients reported “having to eat” and “bingeing on" the same foods scientists find most "addictive”: sugar, fat, flour, wheat, salt, artificial sweeteners, caffeine and volume. Kriz’s research found that self-assessed food addicts in Overeaters Anonymous were successful in weight loss by dealing first with physical craving and abstaining completely from their major binge foods. Carroll studied five year outcomes of a selected sample of 8000 alumnae from a psychiatric hospital’s residential food addiction program - for those whom dieting, therapy and even 12 Step programs had not worked - and found they were treated at least as successfully in an “addictive model” program as alcoholics and drug addicts were treated in residential chemical dependency programs. That food abstinence relieves physical craving, enables sustained weight loss and supports internal recovery, provides a strong argument for the existence of both physical craving and food addiction.

Discussion: There is substantial evidence that some binge-eaters experience physical craving, that is, craving that can be characterized as being primarily physiologically-based rather than psychologically, socially or environmentally-based. This does not mean that social and environmental factors do not contribute to most of these situations. Fairbank’s and Wilson’s 1993 data make it clear that prior trauma, family dysfunction, and lack of rational-behavioral skills are correlated to binge eating disorder, and Adam and Epel’s recent review of current scientific literature assures us that stress – and the inability to cope with stress without food – continues to be an important cause of eating disorders and obesity. However, for those whose problems with binge eating are progressive and/or for those who are not successful in arresting the problem with dieting, behavior modification or talk therapy, there can often be an internal chemical basis to the problem. There is now more scientific verification for physical craving as a part of food addiction than there was for physical craving with regard to alcoholism and other drug addictions when they were first designated as substance use disorders. There are important implications for treatment and for related public health policy.

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1.1 Wilson's Argument on Physical Craving, 1993.

In his 1993 article "Binge Eating and the Addictive Disorders" G. Terrance Wilson, psychology professor at Rutgers University and a national authority on eating disorders, wrote that at that time there was no "convincing empirical support" that the physical craving binge eaters report is a direct result of ingesting a particular food or food in general. Most clinicians who were working successfully with food addicts in the early 1990s agreed that there was nothing in the peer reviewed literature that gave a scientific understanding, much less empirical proof, that food could be authoritatively identified as an addictive substance.

Wilson considered the concept of craving to be "an elusive and controversial one in the science of eating disorders." In his own article he defined craving as an "enhanced response to a substance after use and then abstinence."

Wilson's main point was that the scientific literature at that time presented "evidence showing craving is heavily influenced by the psychological and environmental conditions in which it is assessed." However, he found no evidence for an internal chemical or addictive basis for the food cravings of binge eaters.

Wilson cited Bemis's l985 review of the literature concluding that there was "no evidence that people with eating disorders experience a craving as a direct biochemical result of consuming a

particular ‘toxic’ nutrient.” This, he said, was confirmed by Wardel in 1987 and also by a full review of this literature in 1987 by Roden and Reed. The latter concluded that there was “no clear body of literature showing a systematic relationship between the response to sweetness and eating disorders.”

The Wilson article noted that there were peer reviewed articles which assumed food addiction existed and that there were several studies showing that some who just binged on food without purging had different self-reports than some of those who were anorexic or those who binged and purged. However, none of this “pro-food-addiction” professional literature offered a thoroughly tested scientific explanation for physical craving in specific cases or for food as a type of chemical dependency in general.

In the early 1990s, most of the prominent health professionals actively treating food as an addiction agreed; as Jan Wilson (no relationship to G.T. Wilson), the then editor of *Food Addiction News* wrote in 1989, there was not yet scientific evidence that would convince a skeptical health professional that food addiction existed purely by reading the scientific literature.

G. T. Wilson acknowledged the similarities between the ‘real’ addictive cravings of alcoholism and drug addiction, and what he thought of as the ‘so-called physical cravings' of self-assessed food addicts. However, Wilson called these similarities “superficial”; it was one of “reasoning by analogy,” Wilson used the critique of Vandereycken to suggest why this “false” reasoning was so convincing, i.e., “the hazard of …. selective reduction.”

Vandereycken had reasoned that in naming the strong draw towards food “physical craving” – like those in alcoholism and drug addiction, certain resemblances were emphasized and differences were ignored. The resemblance between the two disorders (alcoholism and binge eating disorder), however superficial, was both salient and familiar. The analogy was readily available to us and biased our judgment.

This was certainly possible, though it is as hard to challenge an alcoholic’s judgment about their subjective experience as it is to prove that a medical researcher or clinician is not prejudiced and biased on a matter such as this.

The question which this paper addresses is: fifteen years after Dr. G. Terrance Wilson wrote his 1993 critique of binge eating as an addictive disorder, is there still no systematic evidence of a biochemical basis to physical craving regarding food?

1.2 Definitions of Physical Craving.

Wilson’s general definition of physical craving has endured. It is still frequently cited, though there have been some refinements. In the area of animal research, there are more evidence based definitions, and there are new definitions of physical craving emerging for qualitative research with humans.

In common language, physical craving describes an experience different than normal hunger. This is implicit in the idea that a person eats a food, and then wants to eat more even though they had not expected to want more before they started eating. *Or* the person eats food and – after a period of not eating it – has a stronger desire for the food even though not needing more nutrition by objective standards.

Binge eaters often talk about "having to eat" a particular food or food in general. They also describe the experience as "dying to eat" or "starving". Thus, a common slogan in food addiction support groups: "no one has ever died of starvation between meals." This helps recovering food addicts because when they were actively binge eating, they sometimes acted as if they were starving - not just hungry or having a taste for a particular food - even after they had eaten a full meal.

It is important for the purposes of science, though, to have a definition of physical craving that can be empirically tested. Wilson's definition did meet this criterion by stating that "After use and then abstinence," a person has "an enhanced response."

As experimental research advanced in studying questions of physical craving of alcohol and other addictive drugs - particularly highly controlled animal research - scientists developed more rigorous ways of measuring behavior and of describing "an enhanced response." Bartley Hoebel, professor of psychology and neuroscience at Princeton University, summarized these operant definitions of physical craving as a) resistance to response extinction, b) incubation, and c) the deprivation effect.

What do these behavioral definitions for physical craving in the substance abuse literature mean? In a recent article, Hoebel writes: a)"Resistance to response extinction" is obs,erved when an animal continues behaviors it was previously rewarded for long after the reward is withdrawn"; b) 'Incubation' is defined as an increase in response to repeated cues for the same substance over time; and c) the 'deprivation effect' is when an animal takes more than in the past after a period of abstinence. It is the combination of these three indicators which definitively rules out social and environmental factors as the exclusive cause for the behavior in question.

Rats are used in research about addiction because it has been found that their brains react to addictive substances in ways that are very similar to the reactions of human brains. Therefore, an important question in examining whether or not there is physical craving for excessive eating of food by humans is: can the animal research demonstrating physical craving for alcohol and other drugs be replicated for food? We will review the animal research on craving of food in 1.4.

More recently, brain imaging – PET and CAT scans – shows what happens in animals and in humans when they experience physical craving of alcohol or other addictive substances. This has helped develop an explanation of how physical craving operates in the brain. A simple form of testing whether or not physical craving develops regarding food is to look at PET and CAT scans of animal and human brains just before, during and after the eating of hypothetically

addictive food substances. We explore later in 1.5 how these images compare to those of alcoholics and drug addicts.

Another way of defining and measuring craving in humans as well as animals can be and has been applied to food. This research method using the drug naloxone was initially used for studying alcoholism and other drug addictions. As it was learned that the addictive properties of some substances were contained in a chemical class called opioids, scientists found that another chemical named naloxone worked as an "opiate blocker." Thus, a controlled experiment could be conducted where one group of animals or humans would be given naloxone and another control group would not. This is well explained by Dr. Neal Bernard, author of several books on nutrition. If participants do not know which members are taking naloxone, there can be a blind, controlled quantitative study of the addictive properties of a particular substance. See 1.6.

We can also empirically study physical craving for a particular substance by withdrawing the substance completely. Does the experience of craving go away or lessen? We posit later in this paper that reduced response to a substance after its elimination – the other side of enhanced response after use – is also a useful empirical measure for establishing the validity of chemically based addiction. See 1.9.

Quantitative research, by virtue of its own self-imposed definitions and rules, often fails to help with issues critical to treatment. Behavioral studies do not define context. And quantitative substance abuse treatment research does not address a particularly critical aspect of the recovery process: biochemical addictive denial. These matters can only be researched by including a description of the food addict's own subjective experience, and for this it is necessary to employ qualitative research methodologies.

In qualitative research that studies the phenomenon of food addiction, a useful definition of physical craving is defined as "false starving." See 1.83. In such research, a person can be asked to describe "what happened – physically, emotionally, mentally and spiritually?" The description can be evaluated: was the experience of "having to eat" rational in retrospect? Or was it more like a medical test which gave a "false positive"?

While not necessarily as definitive in proving or disproving the existence of physical craving, this more qualitative approach to research can be most useful in the design of treatment modalities. It can also provide a critical bridge between scientific findings and self-assessed food addicts' own self-reports.

1.3 Genetic Causes of Craving

We begin reviewing recent research on physical craving and food addiction with a survey of relevant studies from one of the newer sciences, genetics. These investigations seek to determine if there are any genetic associations with food addiction, in general, and/or with physical craving, in particular.

In the late l980s and early 1990s Ernest Noble, then Chair of the Department of Psychiatry at the UCLA School of Medicine, found a genetic marker for alcoholism and other substances of abuse. Further investigation discovered that the gene marker was associated with the dopamine receptors in the brain, an area of the brain already implicated in addiction. In 1994, Noble and his colleagues published a study of obese adults who were selected for not having symptoms of alcoholism or drug addiction. They found that these overeaters had the same marker on the D2 Dopamine Receptor Gene as alcoholics and other drug addicts.

This finding did not in itself prove that binge eaters exhibited physical craving. However, it did show that at least some obese adults had the same genetic difference found in most alcoholics and drug addicts. On the face of it, this suggested that if there was a genetic marker associated with the condition of obesity and this marker was associated with addiction, it would be altogether reasonable to test the hypothesis that obesity in some individuals might be better understood as resulting from an addiction to food. That is, there appeared to be good reason to suspect that binge eating was not in all cases *only* caused by social and environmental factors.

The finding of a genetic connection to food addiction by Noble and his colleagues has since been validated in a number of ways. During the last fifteen years, there has been an explosion of genetic research. This includes a great many studies looking into the underlying causes of obesity.

For example, Dr. Rudy Liebel and others at Columbia University discovered the “ob gene,” another so-called “obesity gene marker,” which correlated positively with chronically fat rats. In another quite different example, Dr. Sarah Leibowitz and her associates at Rockefeller University established a genetic connection to a part of the digestion of fat which stimulates the brain to signal the need for more fat. A different line of research by Shapira et al found a genetic link between lower leptin levels in human patients with Prader-Willi Syndrome who manifested out of control bingeing similar to what self-assessed food addicts call “volume addiction.”

These latter studies suggest that other genetic links to physical craving and food addiction are possible and even likely. There may be other biochemical types of food addiction which, as we will see, fit closely both with other scientific findings and with the clinical data from treatment and recovery research. For example, researchers at Rockefeller University have identified over two dozen gene markers related solely to the digestion of food. These findings suggest that the biochemical basis of some binge eating may be quite complex, much more complex than previously appreciated.

1.4 Animal Research on Physical Craving

Over the last decade, research progressed in animal laboratories at universities across the nation continuing to replicate findings on drugs and alcohol and to see if there were any similar results for food , particularly sugar, as an addictive substance. In 2007, Averna, Rada and Hoebel published a review paper of 251 relevant peer-reviewed articles including many of their own studies. They concluded that “under some circumstances, sugar can be addictive.”

Animal researchers used a basic definition of physical craving almost the same as Wilson's, "enhanced responding…following abstinence." Then they used the more rigorous behavioral tests developed in prior alcohol and drug research. In the alcohol and drug literature, standard lines of experimentation had developed – one each for three specific behavioral indications of physical craving.

First, after self-administering the drug of abuse and being forced to abstain, animals often persisted in unrewarded operant conditioning. They kept doing what they had done to get the drug long after the drug was no longer available, i.e. they exhibited resistance to response extinction.

Second, the animals increased their responses to the drug over time. They needed more and more of the drug to be satiated, i.e. they exhibited incubation behavior.

And, third, if the drug was made available again after a period of abstinence, the animals would take more than they consumed prior to abstinence. This demonstrated what is referred to as the deprivation effect.

None of these things, resistance to response, the incubation effect or the deprivation effect, could happen if the chemicals from digesting the food did not in some way change the biochemical pathways in the brain. It was considered further evidence of "physical craving" if animals facing adverse consequences still went after the drug.

When these experiments were replicated by Hoebel and his colleagues using sugar as the possible substance of abuse, the results were the same as for alcohol and narcotics. Thus, laboratory animal research originally designed to mimic human behavior with alcohol and narcotics showed that sugar could cause biochemical cravings.

The same deprivation research paradigm was used by other researchers to test sweet substances other than refined sugar. They found that rats could also become addicted to corn syrup and to artificial sweeteners. Interestingly, Serge Ahmed, a scientist at the University of Bordeaux in France, recently used a challenge paradigm to compare the tendency of animals to choose sweet tasting substances (e.g. sucrose, fructose, and saccharine) over cocaine; consistently, the rats, even cocaine addicted rats, chose "sweetness" over cocaine.

Sugar and other sweet tasting foods are not the only things that produce cravings. Sarah Leibowitz, Associate Professor at the Laboratory of Behavioral Neurobiology of Rockefeller University, has found that overconsumption of dietary fats produce a vicious cycle in which the digestive process of excess fat "activates certain brain systems that further stimulate fat intake." Thus, physical craving is demonstrated in animals not just for sugar and other sweets but also for fats, and the biochemistry of the brain for sugar is different than the biochemistry for dietary fat.

Dr. David Kessler, former commissioner of the U.S. Food and Drug Administration, adds salt to the substances of concentrated sugar and excess dietary fat as food substances that "focus

attention on food" such that the "reward center" of the brain overpowers the "homeostatic system" of the human mind/body. Kessler finds that sugar, fat and salt tend to be mutually reinforcing. An anonymous food industry consultant calls these the "three points of the compass" that make food compelling. Studies at the University of Carleton in Canada, the University of North Carolina at Chapel Hill, the University of Washington and the University of Western Washington State have all confirmed this three way mutual reinforcement with animal research. Further, Kessler's recent book, The End of Overeating, cited a study by Dr. Anthony Sclafani of the City University of New York, showing that a variety of foods and ready availability of foods "further amplify overeating".

The work of Dr. Di Chiara of the University of Cagliari in Italy found that "The complexity of the stimulus increases its association to reward." Thus, Kessler concluded, "When layer upon layer of complexity is built into the food (such as with chocolate), the effect becomes more powerful." Kessler reiterated that this substantial mutual reinforcement effect notwithstanding, we would do well to remember that sugar and other sweet tasting foods are the single strongest group of stimulators of physical craving behaviors in animals.

While these animal experiments have been carefully designed to simulate human behavior as much as possible – and have proven to be reliable in investigations of other addictions - some will still be skeptical about whether or not these findings concerning food cravings in animals can really be applied to humans. Hoebel himself is always careful to say that his laboratory research only shows that there can be food addiction in animals, not in humans. Next, we will explore the research on humans.

1.5 Evidence of Craving from Human Brain Imaging Research

During the last fifteen years, there has been a major increase in funding for using PET and CAT scan research methodologies for investigations focused on physical craving and food addiction, including a growing collection of studies that focus on what is going on in the brains of obese human adults. In 2004, Mark Gold, professor of psychiatry and neuroscience at the University of Florida and a noted scientist whose work led to cocaine being classified as a narcotic, compiled a collection of articles entitled *Eating Disorders, Overeating, and Pathological Attachment to Food: Independent or Addictive Disorders?* This book examined the recent brain research on obesity and eating disorders at the University of Florida's McKnight Brain Institute, Brookhaven National Laboratories, Pennsylvania State University, Harvard University, Yale University, and U.C.L.A.

In his overview Dr. Gold asserted that "neuroimaging studies have supported the hypothesis that loss of control over eating and obesity produced changes in the brain which are similar to those produced by drugs of abuse." We will look at several specific addictive characteristic of loss of control in our next review paper. The question we focus on here is: Does this avenue of research show evidence of physical craving?

Several articles in Gold's book focused directly on the question of cravings.

- Kalra and Kalra demonstrated “the relationship of eating messengers in the brain to targets for drugs of abuse.”

- Liu *et al* demonstrated that “the hypothalamus senses that eating has occurred with a delay in time that increases with the mass of the body.

- A paper by Wang described how “the brain’s somatosensory cortex changes with overeating and obesity so that the mouth and tongue increase their geographical area on the homunculus.”

Addictive craving comes from the internal processing of a substance which changes the chemistry of the brain such that at a subsequent time there is a stronger need or desire for that substance. And each of these findings shows a type of “enhanced response” to a food substance, especially after a period of abstinence.

One particularly interesting study by Dr. Jean-Jack Wang, Director of the Brookhaven Research Institute, *et al* showed that the dopamine areas of the brain light up in obese binge eaters when they just look at a picture of one of their binge foods. This is exactly the type of experiments that have shown that visual cues can create the same brain responses for alcohol and narcotic drugs as does direct ingestion of these substances. And this corresponds to the clinical observation and food addict self-assessment that just “thinking of a binge” food can cause physical craving.

In “Similarity between Obesity and Drug Addiction as Assessed by Neurofunctional Imaging: a Concept Review,” Wang and Dr. Nora Volkow, Director of the Institute for Drug and Alcohol Studies, National Institutes of Health, *et al* summarize the findings of 69 recent peer reviewed research articles. They conclude that “overeating in obese individuals shares similarities with the loss of control and compulsive drug taking behavior in drug-addicted subjects.” One of the evidences of loss of control in these papers was frequently “enhanced response,” that is, the basic Wilson definition of “physical craving.”

Taken as a whole, this body of research confirms the theory that “a decreased level of DA D2 (dopamine) receptors in the brain predisposed subjects to search for reinforcers,” in the case of drug-addicted subjects for the drug and in the case of obese subjects for food. This process became a means of temporarily compensating for a decreased sensitivity of DA D2 regulated reward circuits. In other words, food bingeing - on specific foods or large volumes of food in general - created a change in the dopamine area of the brain, and the brain change created the increased instinctual appetite for the same foods that changed the brain – i.e., physical craving. This is the basis for a new definition of physical craving that is both physiological and behavioral. This research also demonstrates that the similarities between craving in cases of alcohol and drug addiction and in the cases of obese food bingers are not at all superficial.

1.6 A Biochemical Mechanism of Food Craving

Science has long established that the body creates opioids by itself. These endogenous opioids are of the same chemical makeup as the addictive elements of narcotic substances like heroin and morphine. A closer look at the process by which these endogenous opioids are produced shows that a major cause of this phenomenon is a pattern of ingesting sugar and/or fat, then restricting, then ingesting it again. In short, binge - restriction - binge behavior can create a biochemically addictive process with certain foods that engages the dopamine 2 receptors in the brain in the same way that alcohol and addictive drugs do. The existence of this process has been shown in both animal and human research on endogenous opioids. It has been confirmed with experiments using an opiate blocker, e.g. naloxone.

1.61 Endogenous Opioid Production Research in the 1980s showed that people internally produce substances which have the same chemical structure as the opioids in addictive narcotics; further, they produce these chemicals as derivatives during their regular process of digesting dietary sugars and fats, especially after periods of excess eating and then restricting. In 2002, Dr. David Katz, Director of the Center for Preventive Medicine at the Yale University School of Medicine, wrote that there were proteins produced by the human body in the process of digesting fats which were opioids. There was nothing an individual could do about these chemicals by conscious choice, and they were either “addictive or something very similar.” About the same time, Colantuoni at Princeton University found over one hundred peer review scientific studies which substantiated endogenous opioid production from intermittent excess sugar intake. In 2005, Nicole Avena *et al* cited their own and many others’ research which showed that “intermittent oil releases DA,” and that, “like sugar, bingeing on a fat-rich diet is known to affect the opioid system in humans.”

The opioids of morphine and heroin change the dopamine reception areas of the brain. It is not a large jump to see that similar opioids created in the process of digesting food could produce a similar chemical dependency in the same part of the brain. Of course, as previously discussed, we know from brain imaging research that the exact same dopamine receptors of the brain light up in some obese people from ingesting palatable food as when alcoholic and drug addicts consume alcohol and/or other addictive drugs.

We also know that the genetic marker discovered in non-alcoholic carbohydrate bingers was on the D2 dopamine gene. Thus, when some people call themselves ‘foodaholics’ hooked on junk foods or simply ‘food addicts’, they are sensing something about themselves personally which is now scientifically credible.

But do the opioids in food have the same power to produce physical craving as those in narcotic drugs?

1.62 Naloxone, Opiate Blocker If there was any doubt that the endogenous opioids produced by the digestion of sugars and fats are causing physical cravings, the experiments by Drewnowski at the University of Washington offered definitive proof.

Research on addiction had long used an opiate blocker called naloxone in experiments to demonstrate that particular substances, e.g. morphine or heroine, are addictive narcotics. First in animals, and then in humans, it was found that when naloxone is administered prior to offering an alcoholic or drug addict their substance of choice, they are often able to decline, and report little or no interest. They are not interested in substances that previously they were strongly drawn to and about which they could not stop thinking. In short, the naloxone opiate blocking experiments were done to demonstrate that morphine or heroine are addictive narcotics.

While at the University of Wisconsin, Drewnowski developed a laboratory experiment in which two groups of students were invited to an event in which candy, cookies and other sweets, i.e., foods high in sugar and fat, were readily available. After determining the average eating patterns and quantities for a group of students, the same food was placed out again, but this time one group was given naloxone. This group almost completely lost interest in the food. The control group, not given the opiate blocker, continued to eat sugar, flour and fat foods just as before. The students were not told of the experiment until afterwards. They thought they were there for an entirely different reason, and the foods were just refreshments for the participants. So, it was a blind, controlled study. The only variable was the naloxone. As with earlier experiments with narcotics, the study showed that the naloxone blocked the desire for selected foods.

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Thus we see a whole system explaining food addiction focusing on alterations in the biochemistry of the brain's pleasure center, most specifically in the dopamine 2 receptor areas of the brain.

Beginning with the overeating of sugars and/or fats, then restricting use (to curtail such negative consequences as gaining weight), then bingeing again, the body of an individual becoming addicted to food produces more and more endogenous opioids. They compete for access to the D2 dopamine receptors and there can be a change in the dopamine uptake process which contributes to a sustained condition of biochemical dependence. The human experiments demonstrating this are confirmed by rigorous animal research, and the fact that this was originally a source of craving of specific foods is confirmed by the naloxone inhibitor studies. Finally, we see a difference at the genetic level between those obese people binge restricting on dense carbohydrates and non-obese non-bingers. The genetic marker for this is on the gene referring to the D2 dopamine receptor, the same genetic markers that have been found to be associated with physical craving for alcohol and other addictive drugs. Thus we have a rather full, evidence-based picture of physical craving and food addiction in the pleasure center of the brain.

1.7 Pain Reduction Research

Quite separately from the pleasure center causes of food addiction, there is evidence of

chemical and brain phenomena creating another addictive process associated with pain reduction processes in the brain.

1.71 Serotonin Dysfunction Research Dopamine in the brain creates the experience of pleasure and well being. The neurotransmitter serotonin reduces pain--the highs of anxiety and the lows of depression. The biochemistry of how food, especially refined foods, can lower the blood sugar and trigger serotonin release has long been known. This biochemical mechanism was first pointed to by Wurtman et al in 1988 as the possible mechanism of food addiction. It works like this: Insulin released in the digestion of simple carbohydrates lowers the blood sugar level, and tryptophan, another amino acid, goes more easily to the brain and creates a serotonin reaction.

Some contend that Wurtman's work does not make a direct connection with addiction. In fact, a diet developed by Drs. Heller and Heller building on this science suggested that the "carbohydrate addicts" could include one meal a day with as much of their prior binge foods as they wanted. Their argument was that some members of Overeaters Anonymous (OA) were not able to sustain an abstinence which included not eating their binge foods at all. There is a wide variety of food plans that work in OA and the other food-related 12 Step fellowships, and it is certainly possible that some could find the Heller plan helpful for at least one stage of their recovery. However, the vast majority of self-assessed food addicts in these fellowships who are able to sustain a stable food abstinence – this includes tens of thousands of members – *are* able to completely eliminate major binge foods. So, the Wurtman theory and the Heller practice are – at minimum – not the whole story of food addiction.

Other self-help writers on food addiction – Sheppard, Katherine, DesMaison, Danowski and Lazaro – summarize the scientific literature on serotonin more completely. One of the best summaries is in Katherine's *Anatomy of a Food Addiction: the Brain Chemistry of Overeating.* A key issue which she discusses is: Why do some people get addicted and not others? Her answer is that there is dysfunction in one part of the food addict's mind/body system. After discussing the biochemistry, Katherine writes, "So if your serotonin level is functioning poorly and your life becomes stressful, you can get some relief by eating sugar. We all learn pain relief very quickly. When something stops pain, we repeat it. If sugar stops pain, you will eat it again."

Use, though, can lead to abuse and ultimately to addiction; when the use of sugar becomes unconscious, a person is beginning to be food dependent. If one cannot stop the process of self-medicating with food, one has crossed over the line of food addiction. Katherine goes on, "Will you stop eating? If serotonin reaches certain concentrations, it is supposed to tell you to stop eating. It's suspected that some people have a malfunction in this feedback loop. So, these folks can eat a whole loaf of bread without triggering the 'stop eating' message." When someone cannot stop using a food substance by reason and willpower alone, this is chemical dependency on food.

The problem here is obvious. We have a theory, i.e., "suspected" reason, but not yet empirical proof of the serotonin receptor causing physical craving and addiction. There is the need for

similar animal and brain imaging studies as we have for the dopamine receptor. Basically, we can see the full scientific evidence for the dopamine addiction to the pleasure center of the brain, but we need further study to see how the clinical experience which would be explained by a serotonin addiction to the pain control center of the brain might actually work biochemically. Of course, the operative word in this last sentence is “might”; this too is speculative, not evidence-based, theory. Another possible (i.e., speculative) theory is that the malfunctioning of serotonin receptors of the brain is a part of the neurochemistry of emotional eating or psychologically-based eating disorders. This should be carefully distinguished from the changes in the dopamine receptors of the brain caused by their contact with addictive foods, i.e., an evidence-based theory of biochemical dependence on specific food(s) or food in general.

1.8 Other Food Addiction Related Research

There are three other clinical phenomena very commonly seen in food addiction for which possible biochemical explanations are emerging. First, there are some self-assessed food addicts who binge on wheat products whether or not they have been refined. Flour turns into sugar very quickly in the digestion process. In these cases, craving can be understood as a type of sugar addiction. However, some food addicts cannot stop bingeing until they eliminate all wheat from their diet, including non-refined wheat products. One possible explanation of this may be found in connection with the mechanisms seen to be operating in celiac disease.

Second, there are some self-assessed food addicts who binge on almost all foods, not just sugar, flour, wheat and excess fat. In recovery circles this is referred to as "addiction to volume of all foods” or simply “volume addiction." A common method of food abstinence is committing to specific foods for each meal in advance, and weighing and measuring as a way of assuring correct portion size. One possible explanation is a deficiency of leptin or a malfunction related to leptin in the process signaling satiation. Studies have documented that this occurs in extreme forms with some cases of Praeder-Willi Syndrome.

Third, a large number of food addicts say they are ‘starving’ or ‘have to eat’. This has little to do with dietary hunger; the food addict has often just eaten a meal. A possible explanation for this is that extreme changes in blood sugar – or a dysfunction in the body’s ability to chemical distinguish low blood sugars – creates an inaccurate message, i.e., that it is starving when just the opposite may be true. This is what some clinicians refer to as ‘false starving’.

Thus we see that science has found not just a single explanation for physical craving and food addiction. Rather, evidence demonstrates that there are several different types of physiologically generated food addictions just as there are several different biochemical processes contributing to addiction to narcotics and other addictive drugs.

1.81 Extreme Celiac Disease and Craving for Wheat.

A small percentage but large number of self-assessed and recovering food addicts report that they were not able to achieve and maintain physical food abstinence until they completely eliminated wheat.

Wheat is the most conspicuous and prevalent grain with significant amounts of gluten. About two per cent of the U.S. population has celiac disease, a severe allergy to gluten. When celiacs ingest grains containing gluten, the celia in their intestines stop working properly, and the nutrition from the food they are eating does not make it into the blood stream. This, you could say, is the beginning of a real starving experience.

When someone with advanced celiac disease eliminates wheat entirely– and sometimes all grains with gluten, the hunger/starving feelings and other symptoms diminish to normal levels. They continue to be relieved of physical craving as long as they continue to abstain from gluten based trigger foods. When such a celiac is diagnosed properly - and if they then abstain entirely from gluten products;, the abnormal hunger goes away and general health improves.

Celiacs are not usually diagnosed as food addicted. However, if the celiac is also addicted to sugar, the celiac disease can complicate the treatment of sugar addiction. The obvious suggestion would be a food plan which is free from sugar, flour and wheat. This is partly because the refined flour products turn quickly into sugar when digested, but, if the person is an advanced celiac, the gluten as a second pathology, creates a problem that very closely resembles ordinary addiction. Some food addicts even need to eliminate all wheat products, even if they were not refined into flour.

If sugar addicts are also celiac, they often need to abstain from all gluten-based grains before physical cravings are removed. There are cases where celiacs crave wheat even when they are not sugar addicted. Because wheat or gluten cravings do not have the same biochemical basis as traditional addictions, this might mean that we need to widen our definition of addiction, particularly food addiction.

1.82 Low Leptin Levels and Prader-Willi Syndrome There is also a long and large history of studies investigating the atomic particle leptin. Problems with the normal functioning of leptin are often found among the obese. Most significant of late, it has been found that many with Prader-Willi Syndrome - an autistic-like condition in which some of those with the disease have insatiable appetites, - have significantly low or low functioning levels of leptin. Stories of children who will not stop eating, whose parents often need to lock up all food including the refrigerator, often have advanced Prader-Willi Syndrome. These are clearly cases of physical craving – extreme physical craving.

Until recently, most people with Prader-Willi died very young, so there were few adults with the disease. With advances in care, there are a growing number of adults who are surviving. Interestingly, a common practice developed by higher functioning adults with Prader-Willi eating issues is to avoid restaurants and social gatherings with great displays of food and to carefully

weigh and measure portions that they do eat at meals. This is exactly the practice that many late stage food addicts use, especially in early recovery. Those food addicts in advanced stages of the disease who have trouble achieving and maintaining food abstinence without this rigorous level of structure are those who often describe themselves as “volume addicts.” They find that they will binge on large amounts of any food, not just foods containing one of the four or five most commonly addictive food substances.

Research on leptin and obesity has not yet addressed samples of self-assessed food addicts who binge on “all foods”. Again, we have speculation about whether or not leptin is involved in their self-reported craving for all foods in general. It is possible, however, that some self-described “volume” food addicts have deficiency in leptin or in their body’s ability to create effective biochemical messages of satiation. Much more research is needed.

1.83 Blood Sugar Imbalances and False Starving

It has long been known that most foods break down chemically during digestion in part into sugar, specifically, glucose. Different foods take shorter or longer times to do this. Foods with higher concentrations of sugar and foods that are more refined so that the sugar is more easily broken down chemically move glucose into the blood stream more intensely and rapidly. This is the basis of dieting which focuses on eating foods lower on the glycemic index. The “sugar busters” diet was useful to some overweight normal eaters, but it did not deal with the problem of food addicts who would binge on sugar-dense foods even when they had committed not to eat sugar.

Gonzales, a dietician working in a food addiction treatment program and herself a recovering food addict, developed a theory that those who secrete or use too much insulin push the blood sugar down not just to “hungry” but to “starvation” levels. Of course, food addicts experiencing these extreme lows in blood sugar are not physically starving. Just the opposite, the food addict would just have eaten, and frequently, if bingeing, the food addict would have overeaten. Thus, they subjectively believe their experience of starving, and for a food addict this would be better labeled as an experience of “false starving.” This is also a speculative rather than an evidence-based theory, but it is an interesting line of thinking and worth pursuing with more research because it could be another biochemical mechanism associated with (and possibly creating) physical cravings.

Some extreme binge eaters exhibit a blood sugar imbalance that their doctors call hypoinsulinism. They experience a sharp peak-and-valley blood sugar record similar, but often faster and more extreme than that in hypoglycemia. The theory of “false starving” is that there is a way the body chemically detects starving by very low amounts of glucose in the blood. If blood sugar levels are pushed down below this threshold by too much insulin or by a reaction that is too insulin sensitive after ingesting sugar or another refined food, the body would be alerted to the possibility of starvation, and this would be experienced by the food addict as extreme physical craving.

1.9 Clinical Evidence of Physical Craving

Possibly the most convincing proof that foods can produce cravings is that when specific potentially addictive foods are eliminated by some binge-eaters who reported they felt they "had to eat" or "couldn't stop", cravings are minimized or disappear completely, and they are able to move towards healthy eating without bingeing. To look at the clinical evidence for physical cravings, there are five bodies of evidence: 1) detailed case studies of recovered self-identified food addicts, 2) surveys of early stage food addicts regarding behaviors that show addictive characteristics and research on diets which remove whole categories of food, 3) research on the effectiveness of food related 12 step fellowships, 4) outcome research on professional food addiction treatment programs, and 5) qualitative research based on written incidents of powerlessness to develop a more complete picture of the subjective context of physical craving including food addictive denial.

1.91 **Recovery Stories** Summaries of four recovered food addicts**:**

Case #1 - One well known case of a self-identified food addict who did cure himself is William Dufty, author of *Sugar Blues.* He writes of his experience as an active food addict, "I tried giving up coffee, but it made it impossible for me to work. My day began with coffee, huge jugs of it with sugar and cream. I might have four or five before noon. After that destroyed my appetite for lunch, I would taper off to Pepsi-Cola. By dinner time I was in such a sugar stupor, it took Chinese duck or lobster a diablo to rouse my appetite. I tried (to) diet and got temporary relief. Then I would binge until the headaches returned. Then I would try again. But I was learning." What did he learn? Dufty learned that sugar and other specific foods were developing a physical craving.

Eventually Dufty stumbled on the idea of abstaining from all of the food substances on which he was bingeing. He writes, "I began the next morning with firm resolve. I threw all the sugar out of my kitchen. Then I threw out everything that had sugar in it, cereals, canned fruit, soups, bread. Since I had never really read the labels properly, I was shocked to find the shelves so empty; so was the refrigerator. I began by eating nothing but whole grains and vegetables." What was the result? A couple of days of "total agony….I had it very rough for about twenty-four hours, but the morning was a revelation. I went to sleep with exhaustion, sweating and tremors. I woke up feeling reborn. Grains and vegetables tasted like a gift from the gods…..The next few days brought a succession of wonders. My rear stopped bleeding, so did my gums. My skin began to clear up and had a totally different texture when I washed. I discovered bones in my hands and feet that had been buried under bloat. I bounced out of bed at strange hours, raring to go…To make a long story short, I dropped from 205 pounds to a neat 135 pounds in five months and ended up with a new body, a new head, and a new life." And the physical craving for sugar and the other specific food substances he completely eliminated went away.

The conclusion? The sugar had caused the physical cravings for sugar – and a lot of other secondary problems.

Case #2 - A very different case is one of Dr. Neil Bernard's patients who was an early stage food

addict. After following the doctor's nutritional suggestions for about a year, this patient concluded, "The most amazing things resulted from this endeavor (abstaining completely from her trigger foods). I have enjoyed not only a few new foods and wonderful tastes, but also marked improvement in my health. I have lost sixty-seven pounds in one year. For the first time in my life I am not on a diet. I was able to increase my exercise regiment due to weight loss. My cholesterol is under control – having dropped considerably in the last year. One of the most amazing results is the near disappearance of diabetic symptoms……I feel fantastic." What did she do? She learned that she was hooked on specific foods through a biochemical process of physical craving and— did the work of eliminating these specific foods from her body and then her diet.

Case #3 - A third case is the personal story of a man who "knew some foods were hard to resist." His weight went up and down 50 pounds most of his adult life. Towards the end he was baffled by how difficult it was to control his binge eating. As a doctor, he had access to all the latest scientific literature, and finally "cracked the code of overeating by explaining how our bodies and minds are changed when we consume foods that contain sugar, fat, and salt." Having made peace with food by completely abstaining from these offending foods, David wrote the book, "*The End of Overeatin*g: *Taking Control of the Insatiable American Appetite*". This, of course, is Dr. David Kessler, the activist director of the Food and Drug Administration who successfully challenged food industry labeling practices , the tobacco industry on the addictive properties of nicotine, and then went on to become Dean of Yale Medical School. Kessler summarizes his own personal solution to this problem by saying, "The ultimate goal is to not only change your eating behavior but also to fundamentally change your perceptions of hyperpalatable foods….It is not enough to be told that you shouldn't overeat or that foods high in sugar, fat and salt will only get you to eat more foods high in sugar, fat and salt." In short, those who are addictive have to learn to shy away from foods that cause them cravings.

Case #4 - Finally here is a summary of one of the many recovery stories published in 12 step literature. In *theconnection*, the recovery periodical of Food Addicts in Recovery Anonymous (FA), Lucky , a member of FA, writes, "At age 63, I felt that to anticipate spending the rest of my life in a normal size body was unrealistic, (but) after a lifetime of feeling different physically, ashamed and inferior to my companions, I was finally ready to try again. I had spanned the gamut of diets….I had success for limited times, but while the weight would temporarily change, my behavior and mental attitude never would….During the past 27 months (in FA) I shed 90+ pounds, lived through a life threatening illness, experienced the joy of my grandson's bar mitzvah, and lost one of my dearest friends….All this would have caused me to eat (in the past) …I did not know that FA could restore me to a peaceful, relatively sane and comfortable way of living." What was the difference with past diets? This time she abstained completely from sugar and flour, weighed and measured her food, and used the suggestions of the program to support her abstinence. While not speaking directly to a prior experience of physical craving, it is implicit that removing the foods that had pulled her back into eating, not just dealing with past mental and emotional issues, was essential to Lucky's success.

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There are thousands of personal stories easily accessible in articles, books and on the internet. Each of these alone is just one personal anecdote. Together, they are an impressive case for there being a class of people who have physical cravings from specific foods or food in general, i.e., the beginning of a chemically caused food addiction. Let's look at more systematic studies of two groups of people who fit this pattern.

1.92 Surveys of Food Addicts in Recovery

Most of the surveys of food addicts to date have been in feature stories in newspapers or magazines. But recently, Joan Ifland, Director of the Sugars and Flours Project. and her colleagues with the Refined Food Addiction Foundation published the first survey on food addicts meeting the APA's criteria on addiction in a professional journal. Ifland's research took a sample of participants from her Sugars and Flours Project, which helped employees in a hospital, a church, and a small business, eliminate sugars and flours from their diets. The sample group was questioned systematically about their experience while still using sugar and flour. The questions corresponded to the American Psychiatric Association's diagnostic criteria for Substance Use Disorder regarding food. One of the criteria was "use more than intended", close to the general behavioral definition for physical craving. Those who responded positively to this criterion explained their answers with the following comments:

- "It seemed like one bite of chocolate led to uncontrolled, frantic shoveling of chocolate into my mouth. It was like trying to put a fire out."
- "If my elbow is bending my mouth is flying OPEN to eat cookies and my elbow bending seemed to be involuntary."
- "One bowl of ice cream turns into 2 bowls, then 3 bowls. I start with one hand-full of chips and end up eating the whole bag."

Ifland concluded that these answers did meet the APA criteria. They also meet the behavioral criterion in this paper for physical craving.

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There is a much larger body of research regarding those who have used the Atkins diet. Although little of this research is intentionally about food addiction, there are reports that some people are able to stay on the Atkins diet when they completely eliminate a class of carbohydrates. However, many have immediate trouble maintaining moderate portions when they stop the diet and reintroduce carbohydrates. This can be argued as a case for physical cravings being eliminated during abstinence from certain food substances and then the cravings returning when the carbohydrates are re-introduced. There is no clear research on the Atkins diet about physical craving as of yet.

1.93 Evidence from 12 Step Programs While the research so far has described physical

craving with real incidents of enhanced response to specific foods or food in general, it is reasonable to say that if there is decreased response after eliminating toxic foods, this can also be seen as physical craving.

Three research studies show substantial evidence that Overeaters Anonymous (OA) is effective in decreasing the response to trigger foods after abstaining from ingesting these foods.

Survey #1 (conducted in 1992) found that 81% of the respondents had “an improvement regarding preoccupation with food”. The group as a whole had lost an average of 40.8 pounds and maintained that weight loss for 3.97 years. While this was an indication of general success of people in the program, it did not distinguish between those who considered themselves compulsive eaters and those who considered themselves chemically dependent food addicts. Further, there was not a rigorous definition of food abstinence or recovery.

Survey #2 - For a more rigorous analysis of outcomes, Overeaters Anonymous contracted with the Southern Methodist University School of Business to do a survey of their membership. A random sampling method was used, and the major results were of those who responded:

- 33% said they were abstinent at the time of the survey and another 45.6% reported a significant improvement in eating behaviors.
- 56% reported “food obsessions had been lifted”.
- 46% achieved a healthy body weight since joining OA.

This survey still did not have a rigorous definition of abstinence, nor a clear way of correlating elimination of specific food substances with lifting of craving. However, there was one third of the respondents who abstained (another 46% were moving toward abstinence) and over half who stopped experiencing obsession.

Survey #3 - More recently and completely independent of OA, Kriz of Virginia Polytechnic Institute conducted academic research on the effectiveness of Overeaters Anonymous. Of the 162 respondents:

- 68% said that they adhere to a food plan daily
- 70% were abstinent more than 30 days at the time of the survey
- 62% said they had completed the 4th Step moral inventory
- 46% said they weighed and measured 75-100% of the time
- 46% reported never or rarely relapsing

- 21% said they had completed making the 9th Step amends

While there were behavioral distinctions in the above survey, (e.g., complete abstinence and weighing and measuring), they did not attempt to define the specific foods eliminated. Moreover, the researchers in all of the aforementioned surveys did little to address the issue of an implicit bias in those who responded to the survey as opposed to those who did not.

Length of abstinence correlated significantly with the use of several of the OA "tools" and with rigorous "working" of the OA 12 Steps. Overall, Kriz found that "length of abstinence, OA meeting attendance, adherence to a food plan, frequency of phone calls, more frequent writing about thoughts and feelings were all significant predictors of decrease in the frequency of relapse."

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The evidence from these three surveys shows that there are definitely some people in Overeaters Anonymous and other food related 12 Step fellowships who self-identify as food addicts and are finding success with a program that begins with complete elimination of binge foods. Preliminary research suggests that more than half of those who are willing to be surveyed found success in an abstinence based on a committed food plan. Further research will be necessary to define different types of food abstinence. Still, the findings as a whole are congruent with the science regarding food cravings.

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There is one amazing non-12 Step situation where an effort to reduce the use of sugar to zero shows reduction of a number of indicators which suggests elimination or substantial reduction of craving. At the Browns Mill Elementary School, parents and educators came together to create a "sugar free zone". The Principle, Dr. Yvonne Sander-Butler, "banned all food high in refined sugar, high fat, and all process foods and drinks." Absolutely no sugared, high fat or refined items were served or sold on school property, and parents were urged to keep a sugar-free diet at home and urge their children not to eat junk foods.Within just a year, average weight of students went down, general health improved, delinquency reports dropped 28% and math and reading test results improved 15%. Not only did most students learn to like the "junk foodless" diet when sugar was completely eliminated, they were able and interested in staying on it; they not only felt better, they liked their accomplishments and those of their peers. They stopped the pattern of using, and they wanted the life they had without their "drug food." Although it was not measured specifically, the "sweet tooth" of students went away when there were **no** banned foods at school or at home; this could be inferred as something like a loss of physical craving.

1.94 Outcome Studies on Addiction Model Treatment

Treatment programs offer researchers the opportunity for a much more controlled study**.** There were several dozen hospital-based residential treatment programs for food addiction in the late

1980s and early 1990s – including at least one program based in a psychiatric hospital that was entirely dedicated to advanced cases of food addiction. All of these hospital based programs are now closed – primarily because private health insurance cut back severely on reimbursement for obese adults in treatment programs using the addictive model in the middle of the 1990's.

There are now just a few residential programs, primarily developed by institutions which served as halfway houses for the alumnae of the old hospital based program that needed extended structure and support. There are also a few programs which provided an alternative to treatment for food addiction using a workshop model. These programs, run by food addiction professionals, are where the most intensive treatment has been given for the complex and severe cases of food addiction. There has been a great deal of accumulated knowledge about the disease. Some of it sheds light on the issue of physical craving.

An Example of Informal Research Werdell, a front line Glenbeigh counselor who has worked with over 4000 food addicts since 1986, gave the same preliminary assignments to about 300 long term clients over six years. One of the questions clients were asked to answer was: what were your specific binge foods? Werdell's ability to observe rigorous work on this issue over time produced some useful empirical evidence about physical craving.

He summarized his finding as follows: "Almost all clients were able to identify their binge foods with great specificity. The lists varied enormously in length and in specific food preferences, but almost all the foods listed by every client had at least one of the following substances: sugar, flour, excess dietary fat, caffeine, and alcohol. There were many who listed foods containing wheat, excess salt, non-refined grains, artificial sweeteners, and, occasionally an odd food substance like meat, baking soda, rice cakes or a specific fruit or vegetable. Many reported that they binged on 'all foods' in volume.

"Interesting to me, over half of those who brought me their lists could not identify any of the food substances they had in common – even sugar. This seemed to me like very strong evidence of addictive denial. Even more interesting, when these clients had completed just a week of eating a food plan which eliminated all the most common binge foods – and also any of their own individual trigger foods – they reported that their thoughts and cravings had gone down considerably, often disappeared completely." This is evidence of a biochemical basis for physical cravings.

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An Example of Research With Indirect Findings As part of a study to evaluate the Eating Disorder Inventory and other tests for predictability of treatment outcomes, Carroll interviewed a selected sample of alumnae from the residential Food Addiction Treatment program who had worked on staying abstinent at least a year after completing the six to eight week Glenbeigh program. These were clients who had tried many diets, years of therapy and a serious effort at OA or another 12 Step program. None had been able to maintain a stable abstinence, some not

even for a day, and only a few had maintained a stable weight loss for more than a year.

Carroll found that 1/3 of her sample group had maintained a rigorous and stable abstinence for at least a year, some up to five years; all of this group were maintaining or moving towards a healthy weight loss. Another 1/3 had had at least one serious break in abstinence; some were in relapse for weeks or months, but each had regained a rigorous food abstinence; and they too were moving towards a healthy weight. The final 1/3 had relapsed and were still in relapse at the time of the survey; most did not have an appreciable weight loss, but almost all were thankful for the experience of treatment and knowing that they were chemically dependent on food. These outcomes compare very favorably with similar treatment outcomes for residential alcoholism and drug treatment. For the purpose of this paper, though, the important point is: many obese adults who were among the most difficult cases responded positively to the addictive model of treatment. If their cravings were reduced when they abstained from binge foods, then they stayed abstinent when the underlying emotional and spiritual issues were addressed. This is the kind of pragmatic evidence which is the essence of modern scientific medicine.

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An Example of Intentional Outcome Research More recently, ACORN Food Dependency Services has developed a new workshop based alternative to residential treatment for those who do not need hospitalization or direct medical supervision; it is called The ACORN Primary Intensive. In a preliminary study of outcomes, initial findings were presented at the recent international convention on “Promising Practices” of the International Society of Food Addiction Professionals. The study by Hillock, Prager and Werdell found that:

- 2/3 of participants were not food abstinent before the Intensive; and most were unable to maintain stable food abstinence for any length of time.
- 99% experienced substantial detoxification and were rigorously abstinent by the end of the five days.
- After at least one year, most saw themselves as food addicted and needing to abstain completely from their binge foods
    - 83% eliminated sugar
    - 79% weighed and measured
    - 68% eliminated flour
    - 68% eliminate alcohol
    - 51% eliminated at least one other binge food

- After a year 70% were working a program in Overeaters Anonymous; a smaller percentage was working in GreySheeters Anonymous, Food Addicts Anonymous, Food Addicts in Recovery Anonymous, and Recovering Food Addicts Anonymous.

For the purpose of this paper, again, the main point is that the findings of this study were congruent with the science-based theory that some obese adults have physical cravings and need to be treated in an addictive paradigm.

1.95 A New Approach to Qualitative Research on Food Addiction

Sometimes outcome research gives us a way to improve treatment; sometimes it is also possible to develop new approaches for research from newly effective methods of treatment. The latter is the case regarding a strategy for helping late stage food addicts break addictive denial: writing detailed descriptions of incidents of powerlessness. This treatment practice has already given us ways to understand denial of physical craving.

The strategy for dealing with food addictive denial is a series of written assignments – usually done in the context of a residential treatment community or on-going recovery group - which leads to the description of an incident of powerlessness over food. The writing process reveals what had often been forgotten or only partially remembered in four layers – physical, emotional, mental and spiritual.

An example of one of these exercises can be viewed in *Bariatric Surgery and Food Addiction* This incident of powerlessness is an increasingly detailed description of the binge of a late state food addict. It begins with a detailed physical description of "what happened?" The second draft adds feelings that he remembers. Then the thinking – both explicit and implicit –was added to another draft.

When the process began, this food addict thought that he was not able to remember what he ate, but as he tried to describe what happened as specifically as possible, the details emerged. Moreover, when he went back to add feelings and then his thinking, he recovered quite detailed memories of the incident. Ultimately, the food addict developed a picture of what really happened – nor just the euphoric vision he started with nor the moralistic guilt that he had at the end -- but rather all of this in a much richer context of specific foods, feelings and thoughts.

Some may have reservations with the quality of the food addict's memory in the process. Were the details about the food really accurate? Were the feelings he wrote down what he felt at the time or only now? Were his thoughts influenced by the process – and others helping him and giving feedback? The rule of thumb held by food addiction professionals facilitating this work is that the quality of the writing – and certainly the judgments by others about the writing – is only as good as the recovery consciousness of the leaders and the recovery group in which the food addict works.

But is there another standard which makes this type of writing both relevant and reliable as qualitative research? Does the denial breaking work enable the food addict to move toward a

stable food abstinence and recovery? Some form of effective work on breaking food addiction denial is essential to the effective treating of many late stage food addicts. Rigorous long term studies have yet to be done to verify this theory, but it is certainly a most important one to test.

For now, we can see in the description that the food addict experienced what could only be called physical craving. When he saw the Sarah Lee cheesecake in the refrigerator, he "lit up". The thought came up – completely against his intention to that point in the afternoon – that he could "eat just one." This corresponds to the brain imaging research of Wang that shows the dopamine receptors "lighting up" in both active drug addicts and active food addicts when the addict pictures their drug of choice in their minds eye.

When food addicts think they are in control – "this time I won't binge," "I'm only going to look in the refrigerator," "I decided I would only have one piece,"- they are, in fact, completely out of control. Being in the grip of physical craving, their mind tells them they can control their eating just at the point that they are, in fact, becoming powerless over food. This is not only physical craving; this is also addictive denial of the craving. This qualitative research shows the researcher and the food addiction professional exactly how chemically based food addiction is experienced. Thus, the research shows physical craving and addictive denial, including that when food addicts are actively eating out of control, they are blinded to the reality of their own experience.

(See Chart II on p. 47 for comparison of scientific research with clinical evidence.)

Discussion

Looking over all the information in this article, there are a number of obvious questions. 1) G. T. Wilson wrote that there was little evidence about physical craving and food addiction. Is this still true fifteen years later? 2) Looking at the new information, is it – as Wilson characterized the evidence in 1993 - superficial? 3) What can we say about food addiction from the scientific evidence about physical craving? 4) What are some of the implications for treatment of food addiction? 5) What of Wilson's claims that there is an abundance of evidence implicating social and environmental factors in binge eating? 6) What are the implications for public health policy?

***1) There is a whole new body of scientific knowledge about food addiction with hundreds of articles focusing on the issues related to physical craving*.** Fifteen years ago there were less than a dozen articles on food addiction in general and none fully explained the phenomenon of physical craving for food. Today there are 2748 peer reviewed journal articles and books related to food as a chemical dependency and hundreds of these are specifically about physical craving. There are over thirty review articles which show specific aspects of food addiction - including physical craving - to be settled science.

In 2009, there definitely is substantial evidence about physical craving and food addiction.

2) There is a complete description of one of the biochemical mechanisms that

***produce physical craving for palatable foods*.** There is an in-depth understanding of the biochemistry of food addiction related to the D2 dopamine receptor: the digestion of excess sugars and fats in humans produce endogenous opioids, the active addictive chemical in morphine, heroin and other narcotics; eating palatable foods changes the neurochemistry of the pleasure center in the human brain; and the marker on the D2 dopamine gene for alcoholism and drug addiction is also found for some obese adults who are not alcoholic or drug addicted.

The experiments on animals which established the causality of chemical dependency to alcohol and drugs in relation to the D2 are also positive for sugar, fat and other sweet substances. Obese adults who completely eliminate sugar, excess fat and other binge foods from their diet find that physical cravings diminish or disappear completely. Finally, if they participate in the recovery practices that have been found to work with recovering alcoholics and addicts, some food addicts are food abstinent and maintain a stable, healthy weight loss.

Any one of these findings alone would be enough to establish the probability of food as an addictive disease. Combined, they show an in-depth picture of one of the biochemical mechanisms of food addiction. This evidence is not superficial.

3) Food addiction is best characterized as a cluster of several different chemical dependencies. Research has found more than one gene marker associated with physical craving and food addiction. Besides the well-established evidence about chemical dependency on food revolving around a disorder in the D2 dopamine receptors, there are many other genes which affect digestion, and some of these create malfunctions which manifest in physical craving and can be treated as a food addiction. These genes control biochemical mechanisms related to digestion of fat, production and sensitivity to insulin, communication about satiety, among others. This suggests that there may be food addicts who are not easily helped by treatments and support groups which focus exclusively on abstinence from sugar and other refined foods. Also, there may be a biochemical malfunction which creates the experience of a “false starving”, and self-assessed food addicts who say they are addicted to “volume” or “eating more of all foods” could very well have a basis in science.

Just like there are several different drugs that can be addictive, there are several different foods – and sometimes food in general – that can be addictive. Wilson argued that there no biochemical mechanisms in which food creates addiction in humans. In fact, now there are several.

4) *The new science about physical craving and food addiction has important implications for treatment*. For other substances which cause physical craving, the first principle for treatment is complete abstinence from the toxic substance. Some say that you can’t abstain from food(s) because “you have to eat,” but this misses the recovery point. Alcoholics abstain from “drinking”, but this does not mean they do not drink anything;

alcoholics just don't drink – or eat foods containing – alcohol. Similarly, food addicts do not stop eating all foods; they just eliminate those foods which are toxic for them. This can be simply using a food plan that takes out the most commonly addictive foods or creating a food plan with a health professional which does not contain any individual binge foods. Other times it is more complex: Some food addicts need to eliminate foods like sugar in more rigorous ways than others; sometimes it takes time to discover exactly what foods are toxic and a food plan that works; and sometimes it takes dealing with emotional, mental and spiritual issues along with staying physically abstinent before one finds stable recovery.

In obesity treatment, the general prescription is less calories in (i.e., a diet) and more calories out (some form of exercise) and this is supposed to be done by simple human willpower. However, the physical craving of food addiction can become more powerful than willpower. So, if the foods which cause physical cravings are not eliminated from the body – completely withdrawn from the blood stream – the likelihood of success in losing weight and keeping it off over time is low. It is better to begin treating the food addict with a food plan which eliminates binge foods and provides balanced nutrition. Then, the calories in this food plan can be reduced for gentle weight loss and raised appropriately when a healthy maintenance weight is achieved.

Alcoholics and drug addicts whose disease of addiction has progressed often need more than just the insight and willpower to stop drinking. Similarly for more advanced food addicts, a food plan eliminating binge foods alone is just a diet and, over the long term, diets don't work because they do not address all the aspects of food addiction. The second principle of recovery is the need for support and the third principle is the need to break addictive denial. The goals of creating appropriate support and challenging food addictive denial needs to be built into any treatment plan when there is a diagnosis of chemical dependency on food. Also, many food addicts discover they have an underlying eating disorder when they start dealing with their irrational thoughts and difficult feelings **without** chemically active foods to medicate the pain. New emotional skills and cognitive tools are needed at this time. Even in some of the most advanced, complex and difficult cases, this approach works.

5) The nurture vs. nature debate regarding food addiction is resolved; it is both.
Fifteen years ago, there was an implicit assumption that those who were obese either had an eating disorder or a food addiction. Those who had success helping people heal from anorexia, bulimia and binge eating disorder using modern therapeutic techniques often argued that this was the only approach that should be used with all compulsive eaters. Those professionals who found that they themselves were chemically dependent often argued that everyone with a problem with food should be treated as a food addict. In fact, there were many overweight normal eaters – neither eating disordered nor foods addicted – who could lose excess pounds and maintain a healthy weight simply by eating less and/or exercising more. There were also people who were not obese but were anorexic or bulimic, who healed primarily by developing better cognitive and emotional skills and by resolving prior trauma. Moreover, there were some out of control eaters who could arrest their

addictive disease just by eliminating binge foods. Sometimes they needed the help of a recovery group or a 12 step fellowship. This group was exclusively food addicted.

It is much more common, however, to find the diseases of obesity, eating disorders, and chemical dependency on food coexisting. As of 2009, about 2/3rds of the U.S. population is considered medically overweight, about a third classified as obese and almost 10% as morbidly obese. While some are able to diet to a healthy stable weight, research shows that internal stress is a serious problem related to many cases of obesity. A Harvard University epidemiological study found that in the general U.S. population, 0.6% is anorexic, 1.0% is bulimic, and 2.8% have binge eating disorder. While some heal using cognitive behavioral

therapy, others who are chemically dependent on food do not experience long term healing without addressing their addiction. In the programs where late stage food addicts are treated, over 4/5ths are obese, eating disordered **and** chemically dependent on food(s).

Neither obesity nor eating disorders are necessarily caused by physical craving. Obesity is entirely defined by excess and dangerous weight, and some are able to diet and maintain a healthy weight by willpower alone. Eating disorders – anorexia, bulimia, and binge eating disorder – are primarily psychological diseases. Some may have physical cravings, but others definitely do not. But there are many obese people and many with eating disorders who do have physical craving. Food addiction is a disease that is different and distinct from obesity and eating disorders.

The standard treatment for binge eating disorder usually involves behavioral modification and cognitive readjustment, but the physical craving of food addiction can become more powerful than even willpower and reason combined. If someone is both food addicted and has an eating disorder, a more effective long term strategy is to begin with physical abstinence and the support to do the needed emotional and spiritual work on the substance use disorder.

6) ***There are a number of implications for public health policy: a public education campaign about physical craving and food addiction; retraining health professionals in the assessment and treatment of food addiction; large scale preventative policies in the public and private sectors; and specific basic and treatment outcome research*****.**

First, even if estimates of food addiction are at the low range, i.e., 6-8% of the U.S. population found for other addictions, this would be a total number of eighteen to twenty-four million serious cases of food as a substance use disorder. If this is true, a quarter of the cases of obesity could not be treated by diet alone or even by diet and therapy together. All of these people would be increasingly susceptible to diabetes, heart disease and chronic joint problems. If, as with diabetes, there are two types of food addiction (Type I: genetically predisposed and Type II: acquired through chronic overeating of refined foods), then the number of overweight, obese and morbidly obese cases which cannot be treated by diet and exercise alone is much higher. This suggests that, at a minimum, a massive public

education campaign that teaches about physical craving and food addiction as well as obesity and eating disorders is urgently needed.

Second, and equally important, is the reeducation of doctors, dietician and therapists. Most current health professionals were trained and still believe that there is not yet enough scientific evidence of chemically induced physical craving to assume that food addiction even exists as a medical problem. Health professionals need to be retrained to diagnose food as a substance use disorder, and whole cadres of specialists are needed to run dedicated food addiction treatment programs. There needs to be at least one hospital-based residential food addiction treatment programs in every state and/or major city. There needs to be outpatient and workshop-based programs for those who do not require in-patient treatment yet need more than 12 Step or other food addiction support groups. There needs to be food addiction prevention programs for parents and students in every school.

Third, there are a number of policy and program initiatives which can be implemented by businesses and other private organizations such as healthy eating in company cafeterias, health insurance rewarding maintenance of a healthy weight, and more employee assistance programs dedicated to food addiction recovery as well as obesity treatment. Some, which reset the social default mechanisms to favor healthy eating over food addiction, can only be enacted by local, state and/or federal government.

Finally, there is a need for further research. It is essential to have scientific review papers on the other characteristics of addiction with regard to food. Specifically, there is a need for articles on loss of control, withdrawal, tolerance, and addictive denial.

It is vitally important to continue basic animal research, brain imaging research, and treatment outcomes research for food addiction. Consider all the specific substances which have not been tested for addictive properties as yet. What about historical biochemical and neurological effects of advanced active addiction and of long term abstinent recovery? What about comparisons of treatment outcomes for obesity using diets, therapy, addiction models and bariatric surgery?

Clinicians require assessment tools which can differentiate between obesity, eating disorders and food addiction and between different stages of chemical dependency on food. Policy makers must have epidemiological studies which can show the range and depth of food addiction among the obese. Food addiction professionals and food addicts aspiring to recover need qualitative research – such as descriptions of “incidents of powerlessness” – to better understand how to treat addictive denial of physical craving and food addiction denial.

***

In conclusion, research on physical craving and food addiction has come a long way since

Wilson's 1993 review article. It is now clear from the science that one major form of food addiction - that connected to the D2 dopamine receptor and most like the addiction to alcohol and drugs - does exist in humans. There are likely several other types of chemical dependency on food. Finally, it is also clear that food addiction – a cluster of chemical dependencies on food beginning with physical craving - is more pervasive, more complex and more treatable than had been assumed just fifteen years ago.

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Appendix A

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The Food Addiction Institute

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* Degrees, publications and organizational affiliations are for identification purposes only and do not represent support for the Institute or any policies it may establish by these institutions.

Appendix B

Forthcoming: **Binge Eating and the Addictive Concept Revisited: An Argument for Adding “Food” as a Substance Use Disorder in the DSMV of the APA.**

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Chart I

Normal Eater, Emotional Eater, Food Addict

NORMAL EATER (with problems of obesity [i])	EMOTIONAL EATER (eating disorders [ii])	FOOD ADDICT (Chemical dependency on food [iii])
The problem is ***physical:*** • Excess weight	The problem is ***physical and mental-emotional:*** • Binge eating, restricting, and/or purging over feelings • Unresolved trauma • And possibly weight (sometimes overweight and sometimes underweight)	The problem is ***physical, mental-emotional and spiritual:*** • Physical craving (false starving) • Mental obsession (false thinking) • Self-will run riot (false self) • And often trauma and weight

The solution is ***physical:***	The solution is ***mental-emotional:***	The solution is ***spiritual:***
• Medically approved diet • Moderate exercise • Support for eating, exercise and lifestyle change	• Develop skills to cope with feelings other than with restricting, purging and bingeing • Resolve past emotional trauma and irrational thinking (healing trauma) ***. . . and physical*** • And those to the left	• Abstinence from binge foods and abusive eating behaviors • Rigorous honesty about all thoughts and feelings • A disciplined spiritual program, e.g. the 12 Steps ***. . . and mental-emotional and physical*** • And all those applicable to the left

What works:	What works:	What works:
• **Willpower**	• **Moderation** (along with feeling your feelings)	• **Surrender**

Footnotes:

i) The disease of Obesity - and recovery from it - is defined entirely by physical measures. The current medically accepted standard is the Body Mass Index.

ii) The eating disorders - Anorexia Nervosa, Bulimia Nervosa, and Binge Eating Disorder - are defined by their behavioral and emotional characteristics in *Diagnostic and Statistical Manual IVR* of the American Psychiatric Association.

iii) Chemical dependency on food is best defined as having the characteristics of a Substance Use Disorder, that is, physical craving, loss of control, withdrawal, tolerance and denial.

Chart II

Science Data Compared With Clinical Evidence

Scientific Research Recovery Experience

General Addiction Gene: The D(2) dopamine gene was first discovered as markers for alcoholism. It then showed up as a marker for addiction to morphine and streets drugs. It was most recently shown to be a marker for those who were obese and binged on simple carbohydrates, most likely food addicts. Who did not have a current problem with alcohol or drugs.	**Food Addiction as Cross-Addiction:** Heavy smokers who quit often have problems with eating soon afterwards. There is a large group of recovering alcoholics in A.A. who start to have problems with food "just like they had with alcohol." A survey of the members of OA found that over 80% had direct blood relatives who had issues or was an alcoholic.
Sugar Addiction: While there is not yet one gene which marks the difference between those who are hyper-sensitive to sugars and those who are not, there are many studies which show the brains of those who binge on sweets have defects in serotonin brain receptors, rapid spikes in their blood sugar and a hyper-insulin reaction to food high on the glycemic index. Eating sugar has also been found to stimulate the same opioid brain receptors as morphine.	**Sugar Abstinence:** Without doubt sugar is the "food" which the most self-assessed food addicts see as an addictive substance. There are many food addicts who abstain from flour; most do this because highly refined foods break down into sugar quickly during digestion. Probably 90% of those who are abstinent in OA and all FA, CEA-HOW and FAA eliminate sugar and report that physical craving is removed or significantly reduced.
Fat Addiction Gene: The most recently identified gene marker is H (2), which is related to biological breakdowns of the biological mechanism for digesting fats. There is also an abundance of evidence that cravings for fat are connected to the same part of the brain (opioid receptors) that are stimulated by morphine and that give athletes what is often called a runners high.	**A Separate Craving for Fats:** There is a whole group of food addicts who have cravings for fat, some of whom – mostly from Mediterranean and African heritages – have little or no problem with sugar. These and many other food addicts need to include specific surrender guidelines regarding fats in order to find and maintain a stable abstinence and recovery.

Celiac Disease: Celiac disease is a condition in which the celia in the intestine stops working when they come in contact with gluten. Wheat is the grain with the most gluten, followed by corn, then barley and rye. It would not be surprising for certain celiacs to experience extreme hunger if the digestive system shut down completely. About 2% of the U.S. population is celiac to at least some degree.	**Wheat as an Addiction:** There is a significant group of recovering food addicts who have found out they cannot be abstinent until they eliminate wheat entirely from their food plan. Since much flour is milled from wheat, this often looks like the sugar addicts who abstain from flour because it turns quickly to sugar. But some sugar addicts eat wheat that has not been refined and some wheat addicts eat non-gluten flours safely.
Caffeine and Alcohol Addiction: Health professionals have long recognized that caffeine and alcohol have addictive properties of themselves. Some food addicts can use them safely.	**Raised Sensitivity to Sugar Addiction**: Besides being addictive itself, caffeine raises adrenalin; insulin and blood sugar properties thus can exaggerate and complicate sugar addiction. Alcohol is also addictive and it often contains a high level of sugar. Thus, it is a contributor to sugar addiction. Approximately 6-8% of those undergoing bariatric surgery for obesity have a severe drinking problem within a year.
The "Hunger" Gene: At first, the *ob* and *ab* genes were only found in obese mice, but more recently they have been found as markers of a few humans who exhibit uncontrollable hunger for all foods. This has been linked to several ways that satiety signals are blocked, diminished or simply don't fire at all.	**Volume Addiction:** There is a major group of food addicts who report that they often – or always – want more food. This is after eating a full meal, even after binging out of control while still active in their disease. It is common for volume food addicts to have to surrender to weighing and measuring their food. Others do not.

All of the above is scientific evidence that specific foods - and sometimes food in general - can create a chemical dependency. In fact, the evidence for a physical component of food addiction is now overlapping with the evidence for alcoholism and drug addiction*, and* there is additional evidence, particularly regarding addiction to "volume", that is distinct from that of other addictive

drugs.

What this also suggests is the possibility that food addiction is not one disease but – like drug addiction and other diseases like cancer – it is really a cluster of very similar but bio-chemically distinct problems. Thus, some who become chemically dependent on food have just one of these physical ailments while others have several or all.

Moreover, by studying the histories of recovering food addict, we find that each of these “types” of food addiction can develop in different intensities and on a different timetable. While there are several clear patterns in the food plans of recovering food addicts, there are still a vast number of subtle but often critical differences in the food plans and recovery processes even of those who are in many ways have an identical disease.

From a practical point of view, this suggests that health professional – doctors, dietician, therapists and addiction counselors – need continuing education about the latest scientific research and clinical experience; while some with eating disorder do not seem to have an addiction to food as a substance, many do, and this means abstinence is essential for them before therapy or treatment for secondary illnesses and diseases. Just as important, those who are already treating themselves – or being treated by professionals - as food addicts, need be aware and sensitive to the fact that all food addicts are not alike, and, thus, one food plan does not fit all. For now, because food dependency is a primary disease, it would seem prudent to error on the side of caution or, as they say in Twelve Step fellowships, “if in doubt, leave it out.”

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Chart III

Dosages of Medications and Levels of Food Dependency

Psychotropic Drugs Food Addiction

If the diagnosis is depression, for example, the first problem is to identify one anti-depressant medication from the possible – tricyclites, Prozac, Paxil, Effexor, etc. – that might help. Once one is selected, the next issue is to experiment to find an appropriate dose. As an example, if the medication being tried is Prozac, possible doses could be in the following range:	If the assessment is food dependency then the first problem is to identify which food or foods – e.g. sugar, flour, caffeine, fat, wheat, volume, etc. – are addictive. Once this is known, the next issue is to identify the degree of sensitivity. For example, if one needs to eliminate sugars, there are levels of abstinence in the following range.
20 milligrams per day	No “added sugar”, e.g.- no sugar sprinkled on cereal
40 milligrams per day	No “sweets”, e.g.- no desserts like ice cream or frosted cake
60 milligrams per day	No sugar in processed food, e.g.- up to the 5th ingredient
80 milligrams per day	No sugar or “hidden sugars” e.g.- dextrose, barley malt, fructose – up to the 5th ingredient.
100 milligrams per day	No sugars or hidden sugars or artificial sweeteners at all
120 milligrams per day`	No sugar, hidden sugars or very sugary natural foods, e.g. dates, ripe bananas, etc.

If psychotropic medication can be seen as adding a micronutrient to balance brain chemistry, abstinence from food addiction can be understood as eliminating a psycho-active food to

balance brain chemistry. In part it is science, and we will become better educated with further study. In part, it is an art, and recovering food addicts can often tell when someone else is food dependent - and what food plan might be appropriate - just from their own experience getting abstinent. Sometimes there simply is not yet an ideal food plan for a food addict yet – just as there are continuing and substantial problems in finding appropriate psychiatric medication for some people. Similarly, sometimes the suggestion of one food addict to another is limited because the abstinent food addict has only experienced one food plan that works for them.

Most important, though, if there is a particular food that a food addict needs to eliminate or a certain level of abstinence needed to make it unlikely that they will be triggered into physical carving, this is not a matter of choice. This is an issue of bio-chemistry, just like the issue of which psychological medications and which doses will work – and which will not work – regarding other mental health problems caused by aspects of the brain which do not work normally. For food addicts, the idea that they can learn to “control foods in moderation” to which they have become chemically dependent simply never works in the long run. This also is a matter of bio-chemistry. The only *real* choice is for food addicts to accept that they have this disease and to abstain from the foods – and in the level of abstinence – which eliminates the triggering of the physical addictive process.