

Multiple Sclerosis - Best Bet Treatment

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Introduction

The formulation of an effective treatment for MS clearly depends on knowing the cause of the disease. The treatment which is suggested in this essay assumes that dietary factors are the main cause of MS onset and progression because such a cause best fits the extensive epidemiological data base and is theoretically plausible. The data and reasoning for interpreting a dietary cause for MS are presented in the companion essay, Multiple Sclerosis and Food Hypersensitivities.

The basic elements of a dietary model for MS are the escape of intact food proteins through a leaky gut and subsequent activation of the immune system. The immune system is activated against tissue in the central nervous system due to molecular similarities between the food proteins and self-proteins in the CNS. Access to the CNS through the blood-brain barrier (BBB) may be aided by type 1 and type 3 hypersensitivity reactions also precipitated by foods.

The keys to combating MS are thus halting the activation of the immune system and healing and strengthening various systems including the gut, the BBB and the immune system.

Halting Autoimmune Reactions

There are two main strategies for halting the immune reactions which result in an attack on CNS tissue. These are

1. healing a leaky gut to slow down and ideally prevent intact food proteins from entering circulation and
2. stop eating foods which contain proteins which can potentially mimic self-proteins in the CNS.

The best review of the causes and cures for a leaky gut are in an essay on the world wide web by [Dr. L. Galland](#) . A leaky gut refers to increased permeability of the intestinal tract and such a condition allows food protein fragments to pass between intestinal cells into the circulatory system. Laboratories offer intestinal permeability tests (see appendix) although it may be easier to assume you have a leaky gut and to take steps to heal it.

Increased intestinal permeability has various causes such as ingestion of allergenic foods, candida overgrowth, alcohol consumption, infection, parasites, trauma and usage of non-steroidal anti-inflammatory drugs such as Aspirin. Notably lectins (a type of protein) found in grains and legumes also increase gut permeability. It is critical to eliminate the source of the problem (e.g. candida overgrowth). In some cases this is straight forward but for food allergies it can be more difficult. There are various methods used to test for food hypersensitivities (Bateson-Koch, 1994) and each has advantages and disadvantages. The three most reliable methods, which are scientifically based, are described and evaluated below.

For IgE-mediated, immediate hypersensitivity, the cheapest and most easily accessible method is skin testing. The main drawback to this method is that it only looks at one component of hypersensitivity (IgE) and thus, at best, it provides only very limited data for identifying one's offending foods. If only such a test is used many major food hypersensitivities may well be overlooked.

A second method for identifying immune-reactive foods is a blood test using either a RAST (Radioallergosorbent) or ELISA (enzyme-linked immunosorbent assay) methodology. Both of these methodologies measure the amounts of various antibodies produced when a blood sample is challenged with a given food protein. The ELISA methodology is somewhat more sensitive than the RAST (Elgert, 1996) and is cheaper to do. Usually both IgE and IgG4 (a subclass of IgG, the most common antibody type) are measured. In some tests all four subclasses of IgG are measured. The advantages of this type of test is that it is non-invasive ("in vitro"), easy to administer, relatively cheap and can cover most common foods. Also, by measuring IgG4, foods which cause delayed hypersensitivity (e.g. Type III reactions), are also uncovered. The disadvantages of such blood tests is that they tend to be only about 80% accurate and false negatives can occur. A few laboratories which do these tests are listed in the appendix.

A third method is the use of an elemental diet followed by individual food challenges. Foods which cause a reaction and result in a symptom (e.g. headache, stomach ache, numbness, etc.) are readily identified as being hypersensitive. This methodology, because it involves the body's reactions ("in vivo") to foods, is perhaps the most reliable method for identifying foods which cause hypersensitivity reactions. Also foods which result in all three types of hypersensitivity reactions can be identified. The drawbacks are that it is very time consuming and potentially expensive. Also there is some question if MS symptoms consistently become apparent on food challenges.

Other blood tests which may help uncover foods which cause damaging immune reactions are the cytotoxic test and a test which measures the level of immune complexes in the blood. The relationship of the results of these tests to food hypersensitivities is somewhat debatable but such data are undoubtedly of some value.

There are a number of unconventional tests available such as muscle tests and pulse tests. It is difficult to evaluate the reliability of these tests because there is no theoretical basis for the relationship between food hypersensitivities and the measured effects and they have never been scientifically validated. I would suggest such tests not be used in place of the above scientific tests until more data on their reliability and scientific basis are obtained.

Once the source of the gut irritation has been removed (e.g. food allergens) then it is important to take supplements which help to heal the gut. Galland lists a number of supplements which are of value. Some of these include acidophilus, glutamine, glutathione, grape seed extract, evening primrose oil, fish oil, fiber and enzymes.

The second and perhaps most important strategy for halting autoimmune reactions is to stop eating foods which potentially contain proteins which can mimic self proteins. Unfortunately there is no test which can be administered to establish which foods may be problematic for a given individual. Thus it is essential to eliminate all foods which have the potential to mimic self. These foods include all dairy products, all grains, all legumes (e.g. beans), eggs and yeast. For grains the most problematic ones are glutenous ones which include wheat, rye, barley and oats. These must be avoided without fail. Rice seems like the safest of the non-gluten grains but even it can be problematic for some. The ELISA test can help guide decisions on the safety of non-glutenous grains although such grains must always be regarded as potentially problematic. Also one should always be aware of how a given food affects them and eliminate foods which consistently result in discomfort and minor symptoms (fatigue, tingling etc.).

The role of fats and oils in promoting or controlling inflammatory immune reactions has been discussed by Erasmus (1993) and Graham (1989). In general saturated fats and trans-fatty acids (altered unsaturated fatty acids) seem to promote inflammatory reactions whereas polyunsaturated fats modulate such reactions. Thus it is important to keep the daily intake of saturated fat to less than 15 grams a day. This essentially necessitates the avoidance of all red meat and dark meat from chicken and turkey. Monosaturated oils (extra virgin olive oil) and polyunsaturated oils (unrefined sunflower and safflower oil) can be used with a maximum consumption of about 60 g a day. All margarines should be avoided.

Omega three essential fatty acids tend to be deficient in many and these are mainly derived from fish and flax oil. Notably fish oil has been found to be very beneficial in controlling another autoimmune disease, Crohn's disease (Belluzzi et al., 1996)

Strengthening the BBB and the Immune System

The first disease process in the inflammation in the CNS is the breach of the blood-brain barrier (BBB). This is usually accomplished by an activated immune system which damages the BBB in passage.

There is very little literature on possible ways to strength the BBB. Recently an essay on this subject was posted on a web site by T. Stout. Much of the information in this section is taken from this excellent contribution.

Experiments with animals have shown that there are three related chemicals, anthocyanosides, proanthocyanidins and procyanidolic oligomers, which strengthen the BBB (Robert et al., 1977; Detre et al., 1986). These chemical are found in blueberries, cherries, blackberries, grapes and the bark and needles of certain pine trees. They are currently available as encapsulated supplements called bilberry, grape seed extract and pycnogenol. These supplements and/or substantial quantities of the above fruits should be ingested daily to help strengthen the BBB.

The anthocyanosides and proanthocyanidins act as very powerful anti-oxidants, block enzyme actions and bind with the BBB and it is these properties which likely result in their beneficial effect on the BBB (see Stout essay for details). Other supplements which are anti-oxidants (much less powerful) include vitamin A (cod liver oil), vitamin C (with bioflavonoids) and vitamin E. These, along with vitamin B complex and vitamin D, should be taken daily.

Because MS is basically caused by a malfunctioning immune system, it is worthwhile to strength the immune system such that it operates in a more normal fashion Most important in this regard is the healthy functioning of the suppression side of the system which is programmed to shut down harmful autoimmune reactions as soon as possible.

Minerals such as zinc and selenium, help strengthen the immune system, and also may well have value in warding off viral infections (Macknin et al., 1996). It has also been suggested that herbs such as goldenseal and echinacea have value in strengthening the immune system (Balch and Balch, 1996). One problem with these herbs is that they may cause hypersensitivities (goldenseal is closely related to ragweed) and questions still remain concerning the wisdom in taking these herbs over a long time period. I would suggest caution in their use for MS treatment with echinacea perhaps being the safest herb to use to strengthen the immune system.

Supplements

Based on the above considerations, the following list of supplements is suggested for daily ingestion. The indicated amounts are well below any toxicity levels but should not be exceeded except on a physician's advice. Graham (1989) provides detailed rationales for their therapeutic value for MS:

1. up to 300 mg grape seed extract (use pycnogenol or bilberry if you are sensitive to grapes)
2. 2 grams cod liver oil (includes 5,000 IU vitamin A and 400 IU vitamin D)
3. 4 grams salmon oil
4. 2 B-50 complex pills
5. 100 mcg of B-12 (have your B-12 level routinely checked)
6. up to 3 g of vitamin C

7. up to 800 IU of vitamin E
8. up to 1500 mg of calcium depending on dairy consumption (I strongly suggest no dairy consumption ever)
9. up to 750 mg of magnesium (a good Ca/Mg ratio is 2:1)
10. 25 mg of zinc
11. 2 mg of copper
12. 50 mcg of selenium
13. up to 5 g of evening primrose oil or borage oil
14. up to 10 g of flax oil (make sure you are not hypersensitive to flax!)
15. 4 capsules of acidophilus
16. 6 capsules of enzymes (see Bateson-Koch, 1994 for use of enzymes for relieving food hypersensitivities)
17. 2400 mg of Lecithin

Summary

The key elements of diet revision for MS are:

1. Avoid all dairy, grains, legumes, eggs and yeast.
2. Avoid all allergenic foods which are identified by skin and ELISA tests.
3. Avoid all red meat and margarine
4. Eat fish and skinless breast of chicken and turkey, for protein fruits and vegetables for carbohydrates and micro-nutrients and extra virgin olive oil and unrefined sunflower oil for fats.
5. Take as many of the 17 recommended supplements as your budget allows.

This diet is essentially a "Paleolithic Diet" (Eaton and Konner, 1985) and is the one which our genetic structure evolved in concert with over 2 million years. Thus it is very compatible with our genetic makeup and results in few if any biochemical failures.

Other Environmental Factors and Potential Treatments

I believe it would be naive to think that every single case of MS had the same cause and that most cases have only a single cause. MS is basically "an effect", a chronic inflammation and demyelination of the CNS, and it seems to me a number of environmental factors can in combination, result in such a condition. For example, it is known that a bacterial infection can cause chronic inflammation and demyelination but, because the cause is known, it is called Lyme Disease rather than MS. Furthermore, in rare cases, measles vaccination has also resulted in chronic demyelination and once again, because the cause is known, it is not referred to as MS but rather as chronic rubella encephalitis. Thus MS is basically a catch all term for chronic demyelination of unknown cause.

As I have discussed in the companion essay, dietary factors are most probably the main (but not the only) cause of most (but not all) cases of MS. Given this, it is essential to find out through testing if indeed your MS is caused mainly by food hypersensitivities and high saturated fat intake. If you avoid dairy, cereal grains, eggs, yeast, legumes and other hypersensitive food and follow a low fat diet with supplements and the progression of MS is not abated, then it is likely your MS is mainly caused by another environmental factor. The factors discussed below are other likely contributors to MS and, although in most cases they are subsidiary to hypersensitive foods, they may be major factors in some cases.

Inhalants

Another possible cause of immune reactions which damage the BBB and possibly activate T-cells are hypersensitivities (type I, III, IV) to inhalants. IgE, immediate sensitivity reactions to inhalants seem relatively rare in persons with MS (Oro et al., 1996) but IgG reactions may be more common and problematic. Once again a blood-allergy ELISA or RAST test which measures IgE and IgG4 production on antigen challenge for a variety of inhalants is a reasonable way of determining if this is a major contributing factor to your MS. If the test is positive for a number of inhalants then once again it is essential to avoid or greatly lower the exposure to these substances. This may be more difficult than for foods but allergists should be able to advise on various methods of avoidance and reduction. Extreme measures such as moving to another part of the country may be necessary in rare cases.

Viruses and Bacteria

Common viral and bacterial infections undoubtedly can affect the BBB and activate T-cells against the CNS through molecular mimicry. It is very doubtful if common viral and bacterial infections are the main cause of MS onset and progression as revealed by the epidemiological data but, in a few cases, such occurrences may play a major role in progression. Strong antibiotics are useful in cases where bacteria play a significant role in MS. In general, strategies to avoid infections should be adopted and any common bacterial infection should be treated with standard antibiotics as soon as possible.

Heavy Metals

Heavy metals can be very toxic to the CNS and thus, in some cases, may play a significant role in MS onset and progression. One of the most obvious sources of heavy metal toxicity is mercury in dental fillings. Currently there is considerable debate on this point and it is difficult to separate the data from the hype. Current scientific data do not support the concept of mercury amalgams being a major cause of MS. Such data include (1) PwMS do not have abnormal amounts of mercury in the CNS. (2) Many persons with MS have no fillings. (3) Professions which are exposed to abnormal amounts of mercury do not have abnormal rates of MS. Furthermore, replacement of mercury amalgams is very expensive and may itself cause problems. However there is enough theoretical and anecdotal data available to indicate that mercury fillings may possibly contribute to MS progression. If diet revision does not result in an effective halt of MS progression then it may well be worth the trouble and expense to have the fillings replaced.

An interesting and insightful study of the effect of toxins on the CNS concerns the response of 26 women with failed, silicone breast implants (Shoab and Patten, 1996). "All patients had evidence of disseminated CNS lesions" and 80% had oligoclonal bands (IgG antibodies) in their spinal fluid. All the women had "systemic, inflammatory, autoimmune disease with CNS involvement" which was "triggered by the foreign material (silicone) in their body". This example clearly indicates that foreign, "antigenic" material can cause BBB failure and demyelinating immune reactions.

It is worth having a blood test and perhaps even a hair analysis for levels of heavy metals (see appendix). Chelation therapy can be valuable for detoxifying when anomalously high levels of heavy metals are detected.

Vaccinations

Poser (1986, 1993) has stated that vaccinations may be an important factor in MS onset and progression. Given the fact that vaccinations cause immune reactions it is clear that they may well affect the BBB and cause CNS inflammation (not necessarily an exacerbation). Poser (1986) provides references for a number of incidences where vaccinations resulted in MS. The most reasonable explanation of such occurrences is that the vaccination provided the final stress on an already embattled immune system. Also

the hepatitis B virus has similar molecular structures to myelin basin protein and thus could cause molecular mimicry. Overall I would suggest that vaccinations (including the flu shot) be avoided unless they are absolutely necessary.

Beta-interferon Drugs

Currently three different, but very closely related, drugs which consist of beta-interferon, a protein (cytokine) secreted by immune cells, are available for MS therapy (Betaseron, Avonex, Rebif). Clinical trials have demonstrated that these drugs reduce the number of exacerbations and lesion forming activity and thus are beneficial for treating MS. A number of immediate side effects (flu-like symptoms, site reactions) are often associated with these drugs but in most cases are not intolerable or dangerous. Depression can be a troublesome side effect and notably 3% of the study group on Betaseron attempted or committed suicide whereas no one in the placebo group attempted or committed suicide. One major concern in the use of Betaseron is that up to 40% of those taking it for up to 3 years develop neutralizing antibodies to the injected beta-interferon (Thompson and Noseworthy, 1996). The immediate result of this is that the drug no longer will have any beneficial effect. Of more concern is the possibility that the produced antibodies will cross-react with and neutralize the individual's natural beta-interferon. If this happens the individual's immune system will be severely compromised with likely catastrophic results. There have been no confirmed reports of such disastrous cross reactions having occurred. Thus the decision to take these drugs is a bit of a gamble and I suggest that the pros and cons be thoroughly considered before deciding to accept such drug therapy.

Copaxone

The latest drug available for treating relapsing-remitting MS is Copaxone which is a synthetic chemical (amino acid copolymer) that resembles myelin basic protein. It was in development for about 30 years. It is not certain how the drug works to reduce the number of exacerbations and lesion activity but the most likely explanation is that it acts as a "decoy" for the T-cells and antibodies which are activated against myelin. Thus, instead of attacking the myelin, many immune cells react against the Copaxone (Wolinsky, 1995). The drug seems to be most effective in individuals in the early stages of MS (minimum disability). A clear understanding of the short and long term side effects of Copaxone has not been achieved. Initial data indicate the side effects and risks are less than those for the beta interferon drugs.

Other drugs

The one therapy method, for which MS societies, MS clinics and many neurologists provide reasonably up to date information, is drug therapy (Carter, 1995; Bansil et al., 1995; Van Oosten et al., 1995). A variety of immunosuppressive drugs is being used to fight MS although results are mixed. Betaseron and possibly Cladribine and Methotrexate appear to hold some promise for CPMS. For those who prefer drugs to diet revision and supplements I suggest you discuss the options and the various side effects with a neurologist.

Alternative Treatments

Numerous "alternative" therapies have been suggested to relieve MS symptoms and to alter the progression. These are all listed and discussed in Graham (1989) and Thomas (1995). Much anecdotal data are available to indicate that various alternative therapies have value and are worth investigating. Of course common sense approaches to health such as adequate rest, exercise and a reduction of stress are undoubtedly very beneficial.

Current Problems In MS Research

Perhaps after you have read all the preceding information you are wondering if any definitive research has been done on MS and diet. Unfortunately no such research is currently being done and very, very little has been done over the past 25 years. The complete lack of research in this field is not in the best interests of persons with MS given the obvious and plentiful theoretical, empirical and anecdotal evidence which has been available for many years linking MS and diet. Furthermore, this dearth of research is inexcusable given the great interest the MS community has in the possible benefits of diet in MS treatment. When this topic is voiced, as it frequently is, the same line is quoted by medical personnel "There is no proof diet affects the course of MS". It comes as no surprise that there is no proof one way or the other because the necessary research has not been done or even promoted. Due to this neglect the MS community has been left in limbo with the agonizing dilemma of "to diet or not to diet - that is the question". Thus the concerns and questions of the persons with MS regarding diet are going unheeded and this must be rectified.

I would suggest if you really want to know beyond a reasonable doubt if diet is a significant cause of MS and significantly affects its progression, then you must lobby the elected officials and directors of your national MS society. It is essential to realize that the research which is currently being supported by your MS Society, with money raised on your behalf, will have very little, if any, impact on your health. This research is almost exclusively long term, fundamental research (molecular immunology, genetics, etc.) which will result in no practical applications for decades, if ever. Such academic research is fine up to a point but the almost complete lack of research of practical value (e.g. diet research) is not a reasonable balance (50-50 would be reasonable). For example, here in Canada 90% of research funds are for molecular and genetic research.

In conclusion, it would seem that the MS community is not being well served from a research point of view. The main reason for this appears to be that the officials of the societies are not aware of the large and varied data base supporting the relationship between diet and MS. It seems only reasonable that the societies should be promoting and supporting research which could quite possibly benefit the members in the next five to ten years. Diet research is of course one area which desperately needs a serious research effort and I am sure there are others. I urge you to become proactive and write your Society soon. Let them know you want hard data as to whether or not diet influences MS and whether or not other alternative therapies are of value. You may also want to support DIRECT-MS, the charity which is raising money to fund a clinical trial to test the effectiveness of diet.

Conclusion

The diverse data sets for MS are all compatible with the hypothesis that diet is the main environmental factor in the cause of the disease. Only diet is compatible with the extensive and varied epidemiological data base. It appears that the activation of T-cells against the CNS by molecular mimicry initiated by food proteins and the constant irritation and weakening of the blood- brain barrier by immune reactions caused by food hypersensitivities eventually result in the onset and progression of MS. On this basis the best treatment for MS is to remove the foods which activate the T-cells and which damage the BBB and to add supplements which strengthen the CNS, the immune system, the BBB and the gut. One should avoid all dairy, cereal grains, eggs, yeast and legumes, identify all food hypersensitivities by an ELISA test and remove these offending foods from one's diet, reduce saturated fat intake to less than 15 g a day, increase polyunsaturated fat (unrefined oils) intake and take a variety of supplements including vitamins, minerals and anthocyanosides. Substantial evidence indicates that a faithful adherence to this dietary regime will greatly reduce, and may well eliminate MS exacerbations. Unfortunately, no research is being done on the relationship between MS and diet despite the very obvious links between the two. The MS community must become proactive and lobby National MS Societies to promote and support research which will

decide beyond a reasonable doubt if diet affects the progression of MS. The community must adopt a comrade-in-arms approach in fighting against MS and insist on substantial research initiatives which will possibly benefit them in the near term.

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This essay is dedicated to the memory of Roger MacDougall who defeated MS through logic, intuition and dedication to his dietary program.

Appendix

Books

1. An absolute must-read is *Multiple Sclerosis - a self-help guide to its management* by Judy Graham 2nd edition 1989. Published by Healing Arts Press. One Park Street, Rochester, Vermont 05767. A 3rd edition (1993) is available only in England, Contact MSRC 4a Chapel Hill, Stansted Essex, UK CM24 8AG.
This book contains excellent discussions of various therapies used to combat MS.
2. *The Multiple Sclerosis Diet Book* by R.L. Swank and B.B. Dugan, 1987. Published by Doubleday & Co. Garden City, New York. This book promotes the ultra-low fat diet and has much useful general information.
The data demonstrate the lack of decline of numerous patients who were on the ultra-low fat diet for 35 years.
3. *MS Something Can Be Done and You Can Do It* by R.W. Soll and P.B. Grenoble, 1984. Contemporary Books, Chicago.
A good book for the role of food allergens and MS.
4. *My Fight Against Multiple Sclerosis* by R. MacDougall, 1980. A pamphlet available from Regenics Inc., Rt. 10, 2660 Touby Road, Mansfield Ohio 44903, Telephone (419) 756-2994 (Cost \$2). An excellent account of the permanent remission (40 years) achieved by using an allergy-free, ultra low fat diet.
5. *New Hope Real Help for those who have Multiple Sclerosis* by John Pageler, 1987. A booklet available from the author 6200, 102 Terrace N., Pinellas Park, FL 33782 (cost \$9).
Another inspiring personal account of avoiding MS progression through diet revision.
6. *Fats that Heal, Fats that Kill* by Udo Erasmus, 1993. Alive Books, 7436 Fraser Park Drive, Burnaby, British Columbia, Canada V5J 5B9.
A comprehensive account of the relationship between saturated fats and lifestyle diseases such as multiple sclerosis.
7. *Allergies-Disease in Disguise* by C. Bateson-Koch, 1994, Alive Books, Burnaby, B.C., Canada.
An excellent review of allergy with suggestions for reversing the condition.

Web Sites

There are numerous valuable web sites which contain an abundance of information on MS. Many are linked and thus, with only a few to start with, one can end up visiting many sites. Below are a few excellent sites which are worth the visit. They will also lead you to many other connected sites. Notably, by far the best sites have been set up by persons with MS.

- <http://www.helsinki.fi/~ahalko/ms.html>
- <http://www.msnews.org>
- <http://www.nutramed.com/>

The last site is especially useful because it contains a great deal on information on the relationship between food hypersensitivities and disease as well as much general information on other causes of hypersensitivity.

Also of great value is the Internet newsgroup alt.support.mult-sclerosis

Tests

1. **Blood Allergy Test by ELISA or RAST for IgG4**

Absolutely essential for establishing your food sensitivities.

Available from

Meridan Valley Clinical Laboratory
515 W. Harrison St.
Kent, Washington 98032
Tel: (206) 859-8700
Fax: (206) 859-1135

Immuno Laboratories, Inc.
6801 Powerline Road
Ft. Lauderdale, FL 33309
Tel: (954) 691-2500
Fax: (954) 691-2505
Toll Free: 1-800-231-9197 x6555
Web: www.BetterHealthUSA.com

Mast Immunosystems
Mount View, California
Tel: (415) 961-5501
Fax: (415) 969-2745

If you have trouble finding a doctor who will do the test for you, phone or fax one of the laboratories and they will likely be able to give you the name of a physician in your area who will arrange the test.

2. **Intestinal Permeability**

Increased permeability can result in macromolecules, toxins and antigens crossing the intestinal barrier into lymph and circulatory systems. These particles trigger an immune response. It is very useful for MS patients to determine if they have a "leaky gut" and if so, take the proper

steps to reverse the condition.

Available from

Great Smokies Diagnostic Laboratory
18A Regent Park Blvd.
Asheville, North Carolina 28806

3. **Candida Analysis**

Candida overgrowth can result in greatly increased intestinal permeability and food hypersensitivities and is very common in MS patients. This condition should be reversed if present.

Available from

Antibody Assay Laboratories
1715E Wilshire #715
Santa Ana, California 92705
Tel: (714) 972-9979

4. **Whole Blood Elements**

Heavy metals can, although rarely, play a role in MS. Mercury from dental fillings may cause severe problems. Iron deficiency has also been implicated in MS.

Available from

Doctor's Data Laboratories
170 W. Roosevelt Rd.
West Chicago, Illinois
Toll free: (800-323-2784)
Fax: (708) 231-9190
Hair Multielement Analysis also available.

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