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**THE NON-TOXIC LONG-TERM THERAPY OF CANCER:** Necessity, State of the Art, Trends by Dr. Hans A. Nieper, M.D., Dept. of Medicine, Silbersee Hospital, Hannover FRG.

Hans A. Nieper was born at Hannover, Germany, May 23, 1928. After university training at Freiburg in 1951 he went on to demonstrate a creative and intelligent understanding of subcellular dynamics. In cooperation with the chemist who first developed the industrial synthesis of acrylic acid, Dr. Kohler, he pioneered in 1958 the development of a chemotherapeutical approach to subcellular cancer dysregulation dynamics. His earliest publication was a booklet in 1953 on a theory of cell growth regulation. He has since published more than 200 articles.

Dr. Nieper is the inventor of electrolyte carriers or mineral transporters, which are coming to play an increasingly important role in protective metabolic therapy which he calls eumetabolic therapy. In 1972 Dr. Nieper developed his de-shielding therapy employing enzymatic decomposition of mucoid shielding surrounding tumor cell membranes and observed how both proteolytic enzymes and glycolytic enzymes are required for this process. He also conducted extensive research work in the field of non-toxic anticancer agents such as thiruamederivatives, oncostatatic metal carriers and mandelonitriles.

Dr. Nieper is founder of the German Society of Medical Tumor Therapy, a life-time member of the prestigious Deutsche Ges. Fur Naturforscher und Arzte, of the American Association for the Advancement of Science, and a member of the Board of Trustees of the International Academy of Preventive Medicine.

His hobby for many years has been gravity theory and research, and his work in this field has attracted the attention of scientists with NASA and with many European and U.S. industries. This earned him a bibliography in the prestigious Two Thousand Men of Achievement. Data obtained from the Juniper and Venus probes seem to support Nieper's "Shielding Theory of Gravity." Dr. Nieper expects the extraction of abundant power from gravity field energy.

Dr. Nieper serves as an Associate Editor of the Journal of the International Academy of Preventive Medicine (JIAPM) and is also preparing an article for his Journal dealing with protective myocardiology to appear in a future issue.

## INTRODUCTION

Since 1955, when surgery achieved a high standard, hardly any progress in the cure of cancer has occurred. Better results in the treatment of lymphogranulomatosis, of certain leukemias in children, of sarcomas and of lymphomas are so small in number as to hardly affect the overall statistics.

Certain euphoric reports, embellished due to various motives, and results, and which concern more the outcome of short-term and intermediate treatment than the absolute decrease of mortality from cancer, cannot hide this grim reality.

This apparent conceptual and therapeutic cul-de-sac is particularly depressing for one who can see behind the scenes of this tragic arena. Practically no institute, official society or research group today offers us a way out of this sad reality.

Thus, the in-depth critical analysis presented in Krokowski's paper in this same issue of JIAPM is of special interest.

McGovern Committee Findings

Following a hearing in June of 1978 the McGovern Committee of the United States Senate concluded that the about 8 billion dollars, which was additionally spent since 1971 on the "war against cancer," had been in effect wasted because of "false priorities" in research. It would appear that the increased popularity of so-called "unorthodox" therapeutic methods and conceptual approaches (especially non-toxic, harmless ones) has become an almost inevitable consequence of this confused state of affairs (N.Y. Times, 1978). Indeed, NCI's reports of November 1978 reflect rather strongly this new focusing on host defense parameters in cancer, and clearly one of the several necessary new directions is increased attention to prophlylaxis of metastasis as urged by Krokowski's article (1978).

Orientation

By 1956 I relized that cytostatic therapy was programmed to reach a dead end. In this regard the reader is referred to my essay on the crisis of mechanistic which appeared in the last of this Journal (Nieper, 1979).

We have to acknowledge that the only "physician" who can heal a cancer process in the patient's own organism is Nature. This is true for any disease, and particularly so for cancer, which must be regarded as integrated into the mechanisms and natural laws of the organism itself. Approaches and concepts that are alien to this biological identity and which neglect this biological reality must fail. Furthermore, cancer is basically a chronic disease with a very long subclinical or latent stage and, according to physicians' observations, rarely exists with long stable phases. Consequently, it can only be successfully treated with a therapy which can be administered over an indefinite period of time and which must in no way damage the patient's defense system; but to the contrary, should improve it in every way and in every phase.

Finally, one must consider that the course of this disease, as well as the success of treatment, is undoubtedly determined by the relationship between agressiveness of the disease on the one hand and host defense capacities on the other hand. It is not simply the invasiveness of the cancer, but the host's vital, overall susceptibility and resistance ratio which must be considered. Thus, cancer must be treated continuously and as early as possible, namely, at the time when the relationship between these opposing forces has not yet shifted to the detriment of the organism. These general rules, which are so rational clinically and so obvious to the practitioners of preventive medicine, have nevertheless been scarcely applied in the therapeutic methods generally accepted so far in our war against cancer.

The Surgical Solution?

Surgery is still a modern treatment because it is eumetabolic and can free the patient's organism from the immuno-suppressive action of the tumor. This may explain the partial success of surgery in the treatment of cancer; however, this approach has two short comings:

1) There is fundamentally no radical surgery of cancer because the disease process involves the whole organism. A definitive cure of cancer by surgical measures is statistically due to the relationship between disease and host forces and not to the "radicality" of this intervention.

2) The surgical intervention is by necessity always a short term measure and is, therefore,

basically unable to cope with the chronic long-term problems of the disease involving systemic metabolic dysregulation.

The Radiological Solution?

Lasting successes following treatment with X-rays or radioisotopes are also due to the aforementined disease-host relationship rather than to the absolute or direct efficiency of these methods. From a biological standpoint, also, surgery and radiations are short-term applications which can in no way cope with the long-term biological nature of cancer dynamics. Moreover, radiation is likely to damage or destroy the immune system. The relative or absolute damage to the body's immune defenses can be prolonged, and in a surprising number of cases it can be so severe that a statistical comparison show irradiated patients, particularly with tele-cobalt, to fare worse than untreated patients. In this regard, critical analysis by the radiologist, Stjarnsward (1978), has caused worldwide excitement. His interpretation is shared by several other authorities in the field, and is especially applicable for radiotherapy of early breast cancer and of the chest region.

The Chemical Solution?

The cytostatic chemotherapy of cancer has proven disappointing, more than is generally admitted. Hidden in this approach are profound conceptual errors which have prompted me, since 1956, not to devote any further scientific interest to developing this approach.

Practically all groups of substances which play a role in the toximolecular therapy of cancer have an active principle which negatively affects the structure and dynamics of the cells. There is little or no therapeutic selectively for cancer cells on the basis of cell structure and only marginal selectivity on the basis of cell function. In my opinion, classes of chemical agents which affect the structure of cellular components are of little use for the long-term treatment of cancer. These properties make them systemically toxic and damaging to the host organism, which is the only "physician" able to heal cancer.

Due to the acute and chronic toxicity, the cytostatic, toximolecular therapy is not suitable for long-term eumetabolic therapy. Even more importantly, cytostatic therapy is not suitable for a preventive, protective approach, continued without time limitatation, namely the sort of therapy necessitated by metabolic dysregulation and biological breakdown at the core of the cancer process. Therefore, this therapeutic concept (the chemical or toximolecular solution) is not applicable for the early phase of cancer which would be particularly responsive to treatment. The arsenal of cytostatic therapies includes agents related to nitrogen mustard, ethylene amines and various antimetabolites, phytochromogens, and platinum compounds. Such cytostatic agents will possibly remain important for some time, but only as "emergency brakes" for short-term use, to reduce tumor volume or to achieve a slight tumor inhibition at a subtoxic dosage. Systemic toxicity is acceptably low for colchicine derivatives (Proresid) and for most forms of the carcinostatic hormone therapies. Ixoten (trophosphamide) can be useful at low dosage; e.g., 30-80 mg. per day, since it may inhibit suppressor cells and immune reactions against surface antigens but leaves intact, at the same time, the system of cellbound immune defense. This seems also to apply to Alkeran at a dosage of 0.5 - 1.0 mg. a day.

## The Dilemma

A chemotherapy with toxic consequences that shift the balance of tumor-host relationships to the negative side must sooner or later end in a metabolic cul-de-sac. The only therapeutic agents which can be considered as suitable for a true long-term metabolic therapy of cancer are those which affect the cell metabolism and also can be eliminated (detoxified) without lasting damage to cellular structures. Only a eumetabolic or biological, long-term therapy can be considered as the desirable protective therapy for the very early stages of this chronic disease pattern. This concept is operative in the contrasexual hormone therapy whose relative non-toxicity is certainly the reason for its high rank among the various therapeutic modalities despite its modest successes with limited indications. Similarly, thanks to the sound but all too often undervalued instinct of physicians practicing modern modes of alternative medicine, weak-acting but non-toxic biological substances such as mistletoe, colchicine derivatives, extracts of thymus, of spleen, nitrilosides from plants, and enzymes from plant and animal sources have performed better than many a powerfully promoted toxic chemotherapeutic agent.

## A biological Solution?

Our search over the past 20 years to develop a long-term, non-toxic therapy of cancer has become increasingly known in the medical community. Two years ago I reported on the development and on the results achieved with such methods (Nieper, 1977 a,b) and those findings remain valid. I anticipate that a follow-up report can be made about our current and improved treatment program in about two years.

## An Overview of Eumetabolic Approaches

I should like to offer an overview of our non-toxic, eumetabolic long-term therapy of cancer: our approach is to begin treatment as early as possible; at the latest, when a diagnosis ascertains the presence, localization or size of tumor. Basically, there is no rational argument to delay the therapeutic approach described here. Any combination with radical or palliative surgery, or with radiation or chemotherapy in a nonimmune-destructive range, is acceptable. In clinical reality such procedures have generally preceded our therapeutic efforts. The cancer treatment concept and program introduced by my associates and me is based on three measures: 1) direct treatment of the cancer cell or tumor; 2) activation of the body's defense system; 3) unblocking of the immunologic defense mechanisms of the body. Let us now consider these three measures in greater detail.

### 1. Direct Treatment of Tumor

Application of systemically non-toxic inhibiting substances like arbutine (diglucoside of hydroquinone), copper gluconate, colchicine derivates (Proreside), mistletoe extracts, and if indicated, hormone therapy would constitute a biological direct tumor treatment approach consistent with a eumetabolic treatment procedure. Hydroquinones have been studied by Gerhard Domagk as non-toxic cancer inhibitors. To this latter group may also belong the natural mandelonitriles which originated as cancer inhibitors in Chinese and Russian folk medicine and were brought to America and Europe. Rationally applied they can be used for decades of treatment without adverse side effects and have, under certain favorable conditions, a considerable carcinostatic long-term effect. Unfortunately, circumstances in the United States have made such approaches the object of an emotional political conflict. Their mechanism of action and possible future value will be discussed below.

Zinc Orotate

A very simple, though in my opinion indispensible, method for direct tumor treatment is high-dosage zinc therapy with carrier molecules having affinity for cancer cells, such as zinc orotate. This principle was orginally discovered by Duncan and Dreosti (1976).

High intracellular zinc concentrations inhibit thymidine-kinase activity and paralyze tumor agressiveness and progression while at the same time activating the immune system. The daily dosage is 350-1000 mg. of zinc orotate or aspartate, which should be given alternatingly. The requirement for this treatment is that the tumors do not exceed a volume of up to 1 ml. And are limited in number. Otherwise, the zinc concentration in the tumors apparently cannot be boosted to sufficiently high levels. This high dosage zinc therapy is to be used at the early stage of the disease since it is also very important for the normalization of immune parameters.

Conventional Cytostatic Agents

Out of the group of conventional, systemically toxic cytostatic agents, we use, as a rule Alkeran (3-8 mg. week) or Ixoten (trophosphamide being the generic name-Ixoten has officially been on the market in Germany for 12 years, being a successor to cyclophosphamide), (40-100 mg daily). In cases of mammary carcinoma and liver metastasis, injections of 5 FU can be given, but a dosage not exceeding 250 mg. every 7-10 days.(Note: We have found that trophosphamide (Ixoten) given 100 mg/day for more than 700 consecutive days does not result in any negative effect on anti-cancer immune parameters, provided a supportive immuno-therapy (as outlined here) is carried out. We find this an important observation which is paralleled by important therapeutic results, especially in ovarian carcinoma. This has to be understood as a subtoxic long-term chemotherapy and not a toxic chemotherapy.)

Infusion of Ozonide

A special measure for short-term efforts to reduce tumor volume (e.g., in the management of threatened ileus) is intravenous infusion of a lipid ozonide. For this purpose 0.7-1.2 mg ozone is added under pressure to 100 cc "Intralipid-Kabi." The clinical effect is evident only for some days or weeks. In addition, it is possible with this method to diminish the oncogenic immune blocking as can be measured by the increased reaction to BCG or tuberculin.

Natural Mandelonitriles

The natural mandelonitriles, which occur mostly as nitrilosides such as amygdalin, prunasin, cassavin, dhurrin, and many others, are not only part of ancient folk medicine, but, contrary to opposing statements, are effective in experimental models: e.g., Ehrlich carcinoma of mouse, lung metastases from spontaneous mammary carcinoma of Swiss mice, Walker carcinoma in the rat, Guerin tumor in the rat (Metianu, 1977/78), tumor in the dog (Summa, 1972), as well as other animal models. It is not so much the degree of activity that is decisive, but the observation that these substances are apparently representative of specific carcinostatic active principles which can be given in reasonable amounts for an unlimited length of time since they are non-toxic: I have observed this in 14 years of continuous use (Nieper, 1977a,b) in humans.

The active principle of the mandelonitriles has not yet been fully elucidated which has had a negative effect on the work with these substances. The following hypotheses are being currently discussed.:

A. Cyanide is set free in tumor cell due to increased activity of beta glucosidase or beta glucuronidase. Many findings appear to contradict this hypothesis.

B. Tumor cell specific degradation of L-glucose isomer from natural nitrilosides. Casati (1973) has shown that only tumor cells can utilize L-glucose.

C. The degradation of nitrilosides results in the formation of thiocyanate which, according to work of De Saussure, can dissolve immune complexes, generally, and blocking immune complexes on tumor cell membranes, specifically.

D. Neunhoeffer (1976) and Klemke (1978) assume that nitrilosides react with the typical oncogenic hydroxylamine impurities of malignant peptides and thus eliminate a specific oncotoxic principle. Several as yet unpublished findings strongly support this interpretation which also explains why cyanobenzyl groups are essential for the action as against other nitriles. The outstanding, very interesting clinical action of mandelonitriles on plasmacytoma can only be explained by this hypothesis, particularly since the action is initially not a companied by an equivalent normalization of the electrophoretic findings. Hydroxylamine impurities at the amino groups are marked features of plasmacytoma. The interested reader is referred to the studies of Neuhoeffer (1976) and Klemke (1978) concerning the central oncogenic significance of hydroxylamine formation. Peptides contaminated with hydroxylamines become alien to the organism metabolically and immunologically since their biological information has become "illegible." Moreover, the very important direct pain killing effect of nitrilosides in cancer can, at the earliest, be explained by hydroxylamine inactivation.

## Future Therapeutic Orientations

Based on our clinical experience we renounce in many respects, the attempted destruction of the tumor cells by toxic therapy. The non-toxic long-term agents that are presently at our disposal are aimed at paralyzing the tumor cell and its host - damaging, aggressive mechanisms so that the body's potential defense system, as discussed below, can dominate and possibly eliminate the invasive cancer processes.

Concerning future positive therapeutic orientations, I attribute considerable significance to the concept of a substance called Tumosterone first defined by Klemke (1978). Tumosterone is chemically an endiol steroid connected to a thymosterine, which, with the assistance of thymosine, is probably converted to tumosterone as defined by Klemke who worked in New Jersey and New York several years ago. Tumosterone is thought to repair nucleic structure and errors in tumor cells and to normalize the readout of genetic information. There appears to be a growing body of evidence supporting the likelihood of this concept which makes it one of the most dramatic developments in recent times in this field. Possibly not only malignant "misinformation" can be corrected in part, but also the breakdown in genetic code control accompanying the aging process and immuno-diseases may be treated by this approach. In the future I will prepare a manuscript for the JIAPM where I will review this literature and expand on this metabolic approach to dysregulation disease control.

## 2. Improvement or Restoration of the Body's Defense Against Cancer

This eumetabolic approach requires at the outset a determination of immune profiles or status which give a measure of the defense capacity of the body, its reserve capacity and its proneness to immune exhaustion.

### Immune Status Assesment

For this purpose it is necessary to have a whole blood analysis for zinc, copper, magnesium, potassium, phosphate, calcium, and also an analytical evaluation of lymphocyte behavior (See Appendix-Table 4). Infraseparation of lymphocytes according to their size (e.g., naked-nuclear, small forms, younger forms with more cytoplasma) proved to be more valuable and more practical to give an insight into cellbound anticancer host defense than is noting rosette-formations of T-and B-lymphocytes. This same examination of the cellular immune system is to determine whether or not it interacts with the cancerous disease factors. Occasionally, this is not the case, particularly with blood groups A or $A_1$. According to our findings about eight percent of all cancer patients are totally non-reactive.

### BCG-Pasteur

(0.1 mg BCG Pasteur in 5 ml. Of Ringer solution) is injected in several large subcutaneous depots to test the immune reaction. Subsequently, a reddish halo of about 5-9 cm. Diameter should develop around each of 6-10 subcutaneous injection sites; moreover, some temperature may develop (up to 39° C.). What has often been observed in connection with BCG vaccination is the activation of cell-bound immunity against cancer, especially of the macrophages. However, T-cell activation has also been observed. The BCG procedure at the same time, of course, is the first measure in the activation of the immune system apart from the biological "feeding" of this system prior to its use.

### Zn/Cu Ratio

The relative levels of copper and zinc in whole blood and the results of the lymphocyte infraseparation throw light on the tumor aggression and on the contrasting availability of the immune reserves. The legends accompanying the figures given further expand on the meaning of the Zn/Cu ratio. The procedures are simple and adequate for this purpose.

### Thymus Activation

Subsequent to the establishment of an immune status profile, it is necessary to activate thymus function with zinc and vitamin A or beta-carotene. These agents are indispensable for adequate thymus function. Since moderately large doses of zinc can feed the tumor by activating protein synthesis, zinc should be given either at a very low dosage (at which immune system is activated) or at a very high dosage (which inhibits tumor cells by blocking thymidine-kinase activity.)

For immune system activation therapy in cases of advanced cancer, I recommend 0.2-0.5 mg. zinc gluconate and zinc aspartate (350-1000 mg. daily) is only suitable when the tumor size is very limited. Vitamin A and beta-carotene both activate the thymus lymphocyte (T-cell) system. Beta-carotene is preferable and one to three glasses of carrot juice daily with 5-7 cc. cream per glass for better gastrointestinal absorption (or capsules containing beta-caroten) is recommended.

Magnesium supplements are also important, even in those exceptional cases when the whole blood analysis indicates no magnesium deficiency. The function of the macrophages and the formation of properdin (which is again commanding the interest of oncologists) are dependent on the magnesium supply. Magnesium chloride (1-3 g/day) and injections of magnesium ascorbate (Magnorbin) are suitable.

Finally, to prevent immune exhaustion, it is advised to give gamma globulin; e.g., 2-5 cc. "Beriglobin" per week. Even at the lower limit of 2 cc., the action is occasionally spectacular clinically as well as causing reactivation of BCG injection sites. Gamma globulin apparently contains a factor which activates the T-lymphocytes.

3. Active Measure to Overcome the Blocking or Shielding Phenomenon

Investigations have confirmed many times that tumor cells produce an HCG-like shielding substance which makes the tumor cell membrane antigens unrecognizable to the immune system defenses and, after having spread in the body fluids, blinds lymphocytes that have already been transformed. This malignant, immune-blocking HCG apparently acts by its electric (i.e., "resonance-diminishing"), repellent properties and not by a definable chemical reaction-a fact that we regard as very important.

Acevedo and his-coworkers (1978) have recently provided the same interpretation, independent of our work. The oncogenic HCG production may be understood as a trophoblastic cell atavism, for it will be recalled that the blastula is immunologically protected in the same way from the mother. Hydroxylamine contamination of the malignant HCG unfortunately prevents, to a large extent, the application of the immunological HCG pregnancy detection test in the diagnosis of cancer.

Degradation of the shielding mucoid of cancer cells can be archived with enzymes that have at the same time proteolytic and glycolytic activity. Crude bromelain extract, papain and papayotin are very effective in vivo, whereas trypsin has only little efficacy. This continious treatment requires from 600 to 1000 mg. bromelain daily with a bromelain activity of 1240 gdu (gelatin digesting units employed in the testing of bromelain activity). I call this treatment the "enzymic de-shielding therapy" of cancer. (Nieper, 1976)

Specially stabilized crude bromelain (Anavit CCI) contains an enzyme factor which inactivates prostaglandin $E_2$ and thromboxanes. Oncogenic prostaglandin $E_2$ inhibits the tumor-killing function of macrophages while thromboxanes lead to platelet aggregation and certainly favor the nidation of castaway tumor cells as shown by Schultz (1978). Therefore, the enzymic de-shielding therapy is also necessary to prevent metastasis as urged by Krokowski in his article apppearing elsewhere in this issue of the JIAPM.

In addition to the program already outlined, we obtain an active immunization with BCG, gernerally in the form of BCG-Pasteur, 0.1-1.2 mg in 5-10 cc. Ringer solution for subcutaneous injection in 8-12 different sites followed by rubbing of the injection site: we prefer this procedure to scarification. Any subsequent temperature elevations which last up to 48 hours can be easily controlled at any time. Such temperature elevation is desirable for therapeutic success. This point has also been stated emphatically by Mathe (Cancer-Immune Conference, Hannover), and we fully confirm this finding and regard it as the reason for the relative success of the subcutaneous injection approach over scarification (Nieper, 1979).

Whenever possible. We strive to initiate the above-mentioned eumetabolic program as early as possible in treatment. In cases of relatively advanced cancer, where the immune system is greatly stressed or even exhausted, our suggested measures are relatively ineffective, and BCG vaccination can even accelerate exhaustion. We consider it basically inadmissible to conduct a BCG-therapy without "feeding" the immune system at the time, thus making prior determination of immune status essential.

Treatment Observations

The following observations seem to us to constitute important development growing out of recent years of experience largely involving out-patients (94 percent).

First, concerning pretreatment of accessible tumors with iridium 192 (prior to undergoing the treatment program outlined and conceived by us): in this group we have inoperable mammary tumors as well as tumors in the oral region. In both indications the findings suggest that the achievable results are unusually good. This is particularly true for the mammary cacinomas. The better overall results of this method may be due to the fact that, unlike tele-cobalt treatment, needling with iridium 192 does not destroy the immune system. Furthermore, this method is excellent to control carcinomas with the known risk potential of inflammatory spreading over the skin. It appears that this treatment route, which combines iridium 192 needling with a non-toxic, carcinostatic long-term regimen, should be intensively pursued further.

Second is a point of fundamental important which concerns a substantial extension of our knowledge about the causes of the weak immune defense in cancer:

Consider the definition of life as a process determined by: a) organic matter (structure) and b) electric or electromagnetic rhythmic activity (behavior or function). Without the latter the organism would not function. Likewise, the immune defense system appears unable to function without specific electric resonance or behavior characteristics.

We definitely know that an electrically neutral material such as oil, plastic or neutral metal is tolerated by the organism for a practically unlimited length of time without being rejected. This is well known in plastic surgery. In this case the immune tolerance results from the lack of electrical resonance and not so much from a lack of potentially antigenic structures.

Electrical Resonance and its Restoration

In the past years we have put together evidence indicating that the cancer cell can avoid immune interceptin by the host organism due to its lack of electrical resonance. There is rather strong evidence that this constitutes the decisive principle in the neutralization of immunity. It is remarkable that neither the immunologically suppressive HCG, nor its counterpart in cancer, act by a special chemical constitution but rather by a principle which neutralizes electro-chemical interactions. Acevedo (1978) and his co-workers appear to have independently arrived at the same conclusions. By comparison we know, for example, that the broad spectrum antibiotic effect of apicillin, obtained from the propolis of honey bees, derives from its electrical properties and not its chemical structure.

Resistance / Capacitance Ratio

To measure resistance (k-ohm) and capacitance (microfarad) in conduction we use the Biotonometer which functions on the principle of a Wheatsone Bridge. Such measurements give an approximate although not consistently reliable, insight into the resonance of the organism itself. As a rule the ratio of resistance to capacitance increases with increasing immune neutralization.

Recall the halo phenomenon in melonoma with a sudden regression of skin tumors leaving a depigmented zone. In two such cases we measured a drastic decrease in the ratio of R/C during this halo phase. Accordingly, we suspect that the halo phenomenon is due to immune activation from increased electrical resonance. Recall also the fact that individuals with an apparently high electrical resonance either rarely have cancer or have a slowly progressing type. Such individuals are patients with hyperthyroidism or hypertension and an accompanying article in this issue by Schwartz provides interesting evidence relating to the former.

An intercurrent, essential hypertension can apparently cause complete remissions of an established metastatic malignancy. It has been reported, furthermore, that a level of over 20 mg. carbon disulfide per cubic meter of air induces essential hypertension in industrial workers, occasionally with renal involvement. According to my own findings, these workers have very low incidence of cancer. These observations and relections, together with the extremely important conclusions of Popp (1978) in this field, have prompted us to focus on the restoration of normal electric resonance in our treatment.

One of the practical means of achieving restoration of resonance is again through the use of proteolytic enzymes (such as bromelain) to accomplish a de-shielding of the mucoid layers of cancer cells that blind the killer lyphocytes and macrophages. Another means is the application of acetaldehyde in alcohol at a dosage of 200-600 mg. acetaldehyde in about 20 g. alcohol daily. This therapy appears to be particularly effective in the treatment of melanoma and will be the subject of a later report.

The method of choice, however, remains the supplementation with beta-carotene which has substantial resonance capacity, in contrast to vitamin A itself (Lewis & Pethig, 1977). The blood level should reach values of 6-8 mg. beta-carotene per liter. This results in deposits of beta-carotene in the skin, particularly in the palms of the hands, which is a desirable phenomenon. It also promotes activation of the thymus, as noted previously. Furthermore, we may no that the P=0 principle in the thymus gland appears to be a significant resonance carrier for the electro-activation of the immune system.

Beta-Carotene Deposits

Meanwhile we have made a very interesting finding: all patients who deposit beta-carotene in the skin and turn yellow are characterized by a good prognosis and respond well to treatment. Those patients who do not turn yellow, even with a large beta-carotene intake (e.g., 0.6-0.7 liter carrot juice with some cream daily), clearly have a poorer prognosis though that may initially not be evident. Mutual competition and inactivation of deposited beta-carotene and oncogenic immunosuppressive shielding by HCG (Hogan-Ryan, 1978) may explain this very important phenomenon. As a matter of fact, Hogan-Ryan (1978) recently reported that in Landschutz Ascites tumor, vitamin-A-alcohol has a deshielding property "like neuraminidase." Since beta-carotene is not an enzyme, like neuraminidase or bromelain, the inactivation of the oncogenic HCG-like

shielding and mucoid blocking by beta-carotene is possibly due to an electrical and not an enzymatic phenomenon.

Selenium

In the context of the aforementioned report by Lewis and Pethig (1977) on the presence of hopping charges in a glass-state (the glass-like condition in a deep freeze state). In this state only charges which are very "loose" will move. This may indicate that in normal temperature the respective substances such as beta-carotene will more easily give off charges or interfere electrically: frozen beta-carotene at 36 K is significant. Moreover, such a particular, photon-assisted, electrical excitability is also found in selenium. Interestingly, the intake of selenium in the human diet is known to be negatively correlated with cancer frequency. An extensive paper by Schrauzer, White and Schneider (1978) indicates a drastic lowering of cancer incidence merely by supplying selenium and that the addition of selenium to table salt is considered as a possible cancer-prophylactic measure which would, in addition, also lower the incidence of sudden myocardial arrest. In my own program of cancer therapy I prescribe selenium tetrachloride ($SeCl_{4,0}$ 1 % in syrup simplex, 1-2 tsp. Daily) and have been doing so for several years now.

Some Final Considerations

In the fight against the cancer cell only the cellular immune defense, together with lymphocytes and macrophages, play a significant role; whereas, antibodies against surface antigens can even increase the shielding effect and thus undesirably protect the cancer cell (the enhancement phenomenon.)

Immune Capacity and Membrane Polarization

The observations with the HCG shield and certain other findings suggest that the acceleration of lymphocytes and macrophages towards the antigen system of a cancer cell under attack is seen by me as a likely expression of a form of gravitational acceleration. This would mean, in other words, that without membrane polarization (which under normal conditions in man is about 50-80 mv), there will be no migration of white blood cells onto a target. Belbet in France called this "cytophlaxie" in 1917 and in those early days was able to show magnesium-dependent enzymes as increasing both cell membranes charge and WBC-migration.

We know that such Feinberg-interceptive momentums depend on the tension of a condenser charge: in other words, the polarization of cell membranes should be as large as possible for the cellular immune defense to function optimally. Indeed, such conditions (as found in hypertension and hyperthyroidism ) are negatively correlated with cancer incidence. Thus, to activate the mobilization of ATp remains one of several possibilities in accomplishing an increase in the polarization of the condenser-like cell membranes. This may be achieved by the action of potassium-magnesium-aspartate (Trophicard, Tromcardin). Physical influences from Earth, Cosmos, or Technology, which are apt to discharge regulatory biological condenser systems, are to be absolutely avoided by healthy individuals as well as by cancer patients: e.g., electric blankets, blind springs from the Earth (detectable by dowsing or by the accelerated discharge of an electrometer), electrically discharged atmosphere in concrete buildings, in airplanes, in submarines or in shelters, etc.

Conclusions

I am convinced that the subject of electroresonance holds much promise for the future, particularly with respect to the control of cancer. Just recall the earlier experiments by Priore who was able to cure tumors induced in rodents by means of cardiorhythimically intermittent magnetic fields.

The successful realization of long-term eumetabolic medical tumor therapy requires the fullest cooperation of the patient. The efforts to gain the patient's cooperation must include education by means of clearly written instructions including a suitable diet program which does not promote cancer and the additional recording of all consultations on tape cassette, which the patient then take home.

We know from our particular, international patient population that the group of patients who learn easily and are most cooperative have about 220 percent higher success with respect to the 18-month cure rate than the less cooperative educable patients.

The patients who have survived 18 months of this treatment program well, and with a tendency for improvement, enter a phase in which their age-adjusted life expectancy remains relatively constant, statistically speaking. That is not the case with patients on chemotherapy who can expect a continued drop of life expectancy after 18 month of survival. Apparently a "decision" is reached after about 18 months whether or not the host organism will be dominant over the disease. (Completely independent from us, Mathe has also reported, in his immune-therapeutic program with BCG, a transition into a phase of relatively assured survival after 18 months (Nieper, 78).

Two years ago I reported a quasi-cure of 45-48 percent according to the 18th month criterion among incurable out-patients (Nieper, 1977a,b). Among the incurable patients who had to be hospitalized we achieved a quasi-cure rate of hardly 18 percent. This group included still some patients who were hospitalized mainly for diagnostic reasons.

For a group of patients who can be considered to be in very early stage of cancer, but still at risk (judging from tumor anamnesis, slight reduction of naked nucleus forms in the blood and from other immune criteria), the non-toxic long-term therapy program achieves a quasi-cure in 75-80 percent of the cases. Of course, these values are subject to criticism in several ways and should be regarded only as pointers. However, they do indicate an important basic insight: the earlier the stage in which this eumetabolic therapy is begun, the better the chance of lasting success.

Conventional medical approaches, embedded as they are in mechanistic concepts and strategies, have proven by now quite incapable of solving the cancer problem and its therapeutic management. The verdict of the United States Senate of June 1978 would appear to seal this conclusion although not much has happened since that 3 day Kennedy hearing; although, it would appear that all cancer research institutes are directly or indirectly being called upon to present non-toxic, long -term treatment proposals as well.

In Germany the collision between modern cancer therapy and the traditional health legislation of the government at Bonn could also lead to the end of prevailing "mechanistic" approaches here. In health legislation, having little preference for and no scientific education concerning metabolic-oriented, biological and preventive medical action, we can hardly expect the bureaucratic initiation of a modern biological cancer therapy. Progressively rational therapeutics can thrive just as poorly on any soil of tradition-bound, collectivistic bureaucracy anywhere in the international medical establishment.

Finally, we need the developed education and understanding of the potential patient to fight malignant disease and its treatment in the widest sense. A philosophy of society oriented to what I like to define as "ethical individualism" gives sufficient freedom to men to develop a degree of responsibility and initiative which is essential for the profiting from a sophisticated, protective health care. I would propose that we introduce the basic knowledge of protective and preventive medicine (and this also affects cancer disease very much) into the program of biology lessons in schools. It was with great personal joy that I learned of a group of 250 Danish schoolteachers who gave this idea a most favorable consideration.

People look for an alternative to today's narrowminded mechanistic understanding of health care, disease and therapy. This is what makes it most rewarding to follow new leads and avenues in helping to pioneer a new concept of health care generally a new approach to cancer specifically.

In closing, I should like to refer my readers to the Appendix of this paper for additional relevant information.

Acknowledgments

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## APPENDIX

Table 1

### Non-toxic Long-term Cancer Therapy Program

A list of the comprehensive eumetabolic program for the basic treatment of cancerous disease (Nieper Regimen).

In general a program of this kind should be carried out for an unlimited time. It can be combined with any kind of surgical intervention, or with chemotherapy or radiotherapy in subtoxic ranges.

However, it must be understood that a comprehensive therapeutic program of this kind must be a must be adapted by the art of the physician to his respective patients. The various parameters of diseases-host-relationship many vary drastically. As a matter of fact, there is not one patient like another. The deviations of the various factors and vectors are too important to fit into commonly applied biostatistics. R.J. Williams' work provides us with ample evidence of this reality of biological individuality.

A. Begin at once after first diagnosis, after surgery. Regardless of stage.

Combination with surgery, radiotherapy, toxic chemotherapy, and continued therapy thereafter for an unlimited length of time.

B. Methods:

1. Tumor inhibition without systemic toxicity:
   a. Subtoxic doses of conventional chemotherapy, e.g., 1-PAM (Alkeran) 1 mg. daily, Ixoten, 5-FU
   b. Hydroquinones, e.g., arbutin 0.5 g. daily
   c. Mandelonitriles, e.g., 1-isom.0am., dhurrin, cassavin
   d. Copper gluconate, zinc orotate at high dosage (Duncan)
   e. Hormone therapy

2. Activation of immune defense system:
   a. Zinc gluconate, beta-carotene (to activate lymph and thymus system)

b. Magnesium chloride (or orotate) to activate macrophages
c. Potassium, magnesium-aspartate to increase energy rich phosphates, to improve membrane polarization
d. BCG vaccination (or C. parvum), e.g., Pasteur-BCG sc. 0.1-1 mg. in 5 cc. Ringer solution, 6-8 sc. Injections
e.. Gamma globulin

3. Enzymic degradation of shielding/blocking factors (HCG-like mucoids):
   a. Anavit F3, or Ananase 100, Traumanase forte, Bromelain Nadrol, Extranase
   b. Beta-carotene (carrot juice with cream), acidification, ozone 30 mcg. ED lactic acid, mistletoe (?)
   b. Raising of resonance (acetaldehyde, rubidium, selenium), removal from alternating field

4. Additional measures include recalcification with calcium orotate, calci-retard, Minalka, Vigantol Therapy for heart and liver, etc.

Table 2

Results of a Program from 1974-1977

These results concern patients who came for ambulatory treatment still in a state to walk about two miles, but, by their findings and their respective history of disease, belong to the group of "uncurables."

In those years (1974-77) we did not have the enzymatic factors present in "Anavit" and we had a far less developed understanding of the mechanism of action of the nitrilosides, a lesser development of the BCG vaccination technique, and no knowledge of the Tumostrone-like effect of Prednisone.

The understanding oncologist will realize that this eumetabolic therapeutic program has to be taken as a proposal which may be modified as our knowledge and experience progress. However, the fundamental concept of a long-time treatment which has to be started immediately after the establishment of a malignancy diagnosis, whatever the kind, and the conduction of such a therapy for an unlimited time, stays the same.

| * Positive response means 18 month survival with considerably improved health. | Ratio of Pos. Response* |
|---|---|
| Cylindroma, transient cell, recurrent after neck dissection | |
| - Reginal metastasis | 3/3 |
| - Lung metastasis | 0/4 |
| - Liver metastasis | 0/1 |
| Mixed tumors of the parotis gland | 5/5 |
| Skin cancers | 6/6 |
| Carcinoma of tonsils, metastasis | 1/5 |
| Carcinoma of tongue (cigar smoker) | 1/3 (with Geigy GP) |

| | |
|---|---|
| Skin cancers | 6/6 |
| Carcinoma of tonsils, metastasis | 1/5 |
| Carcinoma of tongue (cigar smoker) | 1/3 (with Geigy GP) |
| Collum carcinoma of uterine wall, recurrent | 2/5 (plus Geigy GP: 1/1) |
| Corpus carcinoma in endometriosis | 1/2 |
| Colon cancer (carcinosis, polyposis) | 2/3 |
| Lung carcinoma | 3/13 (with C. parvum:1/1) |
| Pancreas carcinoma | 0/7 |
| Stomach carcinoma | 3/9 (1 inoper., 2 recur.) |
| Lymphomas | 19/23 |
| Sarcomas | 11/16 ("early Ewing": 2/2) |
| Mammary carcinomas, including Lymphangioma disease | 14/37 (lymphangioma:0/12) |
| Prostate carcinoma | 6/8 |
| Primary brain tumors | 6/9 |
| Ovarian carcinoma | 5/8 (2/3 after ileus opening by Intralipid-ozonide) |
| Colon-rectum carcinoma, recurrent | 7/10 |
| Colon carcinoma with liver metastasis | 1/16 |
| Kidney carcinoma, hypernephroma | 0/8 |
| Bladder carcinoma | 5/7 (0/2 penetrating) |
| Seminoma | 2/4 (0/2 with lung metastasis) |
| Esophagus carcinoma | 0/2 |
| Total | 103/214 |

Table 3

Non-Toxic, Eumetabolic, Long-time Therapy Partly in Combination with Subtoxic Radiation or Chemotherapy

This table show data which can only be taken as an orientation. It makes evident however, that the chances increase the earlier the therapy is commenced.

Survival with quasi-cure, after 3 years of observation:

| | | |
|---|---|---|
| In-Patients: | Less than 16% | (of over 80 Patients) |
| Out-Patients: | More than 48% | (of over 240 patients) |
| Out-Patients, early stages | More than 78% | (of over 78 patients) |

Characteristic feature:

After 18 months the survival curve levels! (Mathe, Paris: After 20 months) N = 277

Conclusion: Begin protective therapy as early as possible, for an unlimited length of time.

Table 4

Selection of Laboratory Tests Which Can Be Performed Easily in a Physicians' Office

The significance of these tests is discussed in the following tables

It is essential to compile immune defense parameters which give an insight into the disease-host resistance-balance of the patient. However, whatever the testing program, it needs the important experience of the physician to interpret, an ability that takes years to develop.

1. Enzymes: LDH, gamma-GT, Apase, Spase, and other enzyme substrate tests.

2. Sed. Rate, Heitan test (lat. hemolysis and inhibition of fibrin formation).

3. Lymphocyte separation into 3 sizes, evaluation of turnover and of the total number of naked nucleus forms and small lymphocytes.

4. Whole blood analysis: Evaluation of increase of sodium and calcium, copper extrusion, magnesium deficiency, zinc deficiency, decreased levels of phosphate and iron.

5. Test of resonance potential by measurement of resistance (k-ohm) and capacitance (micro-farad), cardial electrogensis (so-called biotonometry).

6. Skin reaction to BCG, or tuberculine.

TABLE 5

TREND OF THE RATIO BETWEEN PROTEOLYTIC AND PHYSIOL. ACTIVITY OF BROMELAIN DURING ITS DEACTIVATION.
(Prepared by Dr. S. Taussig, CCI, Honolulu, HI)

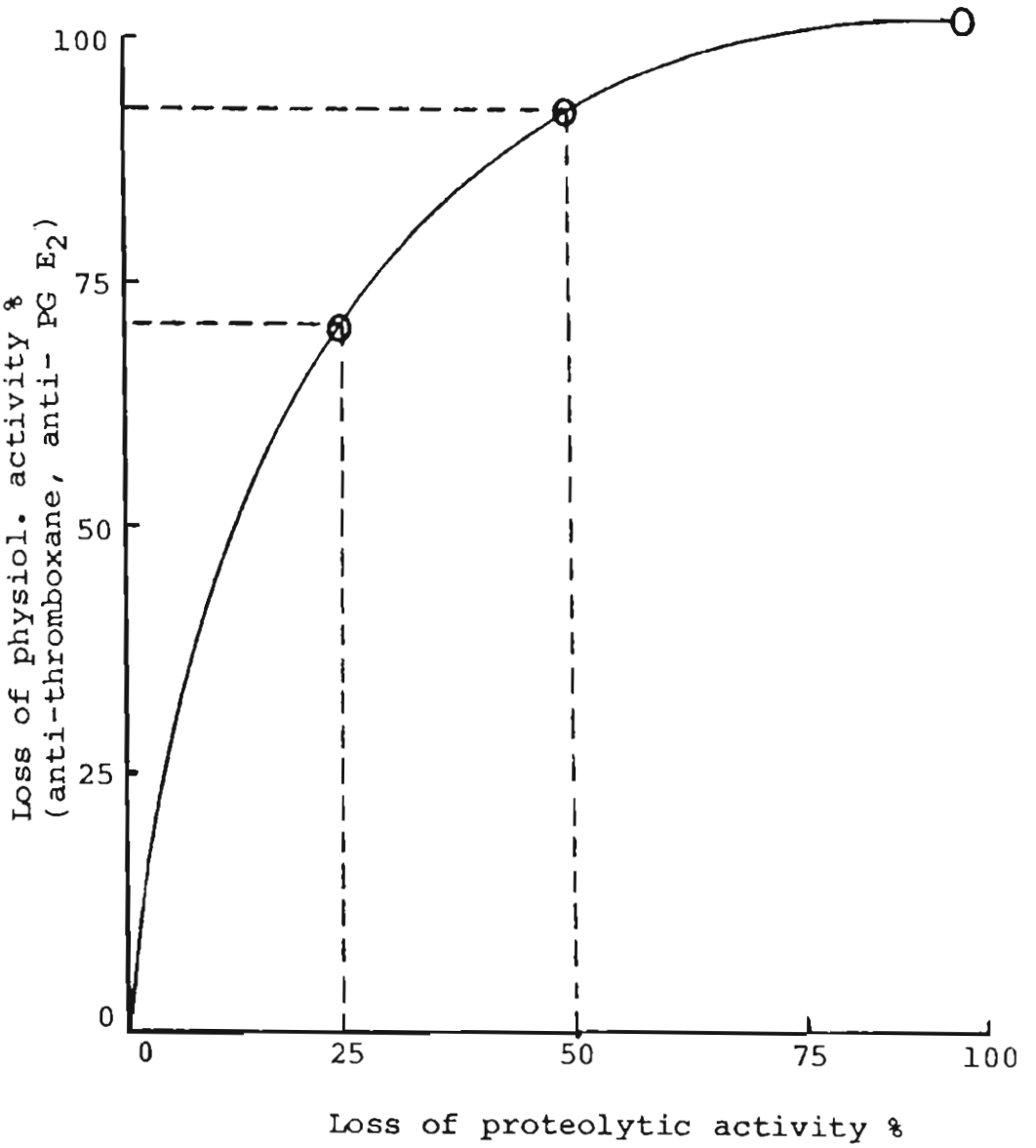

TABLE 6

Separation of Lymphocytes for Size in a White Blood Cell Differential

A lack of naked nucleus forms and a decrease of the small forms of lymphocytes combined with a low leukocyte count indicate an imminent exhaustion in cell-bound immunity in cancer patients. In cancer patients having blood type A or $A_1$ the lymphocyte infraseparation can be normal despite advanced malignancy. This indicates a tolerating of the malignancy due to the similarity of the malignant A-like antigen with the patient's proper blood type.

| Normal | Malig. $A_1$ | Imm. Exhaust (Ca) | Improvement | Imm. Dominance |
|---|---|---|---|---|
| Hb:.....14.1. | Hb:.....13.8. | Hb:.....9.4.. | Hb:.....11.9. | Hb:.....12.8. |
| Ery:.....4.2. | Ery:.....3.9. | Ery:.....3.0.. | Ery:.....3.6. | Ery:.....3.4. |
| Leuko:....6300... | Leuko:....3400... | Leuko:...2800.... | Leuko:....4200... | Leuko:....8400... |
| basoph:..... | basoph:..... | basoph:..... | basoph:..... | basoph:..... |
| eosinoph:..... | eosinoph:..... | eosinoph:..... | eosinoph:....2... | eosinoph:....3... |
| Jugendf:..... | Jugendf:..... | Jugendf:..... | Jugendf:..... | Jugendf:..... |
| stabk:..... | stabk:..... | stabk:..... | stabk:..... | stabk:..... |
| segmk:..... | segmk:..... | segmk:..... | segmk:..... | segmk:..... |
| Lympho:.....42... | Lympho:.....41... | Lympho:....16.... | Lympho:.....36... | Lympho:.....42... |
| nacktk.:.....7... | nacktk.:.....8... | nacktk.:....-.... | nacktk.:.....-... | nacktk.:.....6... |
| klein:.....12... | klein:.....10... | klein:.....3.... | klein:.....12... | klein:.....14... |
| mittl.:.....23... | mittl.:.....23-.. | mittl.:....13.... | mittl.:.....24... | mittl.:.....22... |
| Mono:.....2... | Mono:..... | Mono:..... | Mono:.....3... | Mono:.....6... |
| Promyelo:..... | Promyelo:..... | Promyelo:..... | Promyelo:..... | Promyelo:..... |
| Myelo:..... | Myelo:..... | Myelo:..... | Myelo:..... | Myelo:..... |
| Meta:..... | Meta:..... | Meta:..... | Meta:..... | Meta:..... |
| Blasten:..... | Blasten:..... | Blasten:..... | Blasten:..... | Blasten:..... |

TABLE 7

Result of Whole Blood Spectrographic Analysis

A decrease to less than 5.8 mg/l of zinc in the whole blood analysis is mostly correlated to an extensive paralysis of cell-bound immunity. Our observations suggest that the decrease of zinc is due to both (a) waste by immune challenge, and (b) consumption of zinc by growing tumors.

The increase of copper is correlated to both the growth speed and the extent of the tumor. In lymphomas the increase of copper is even more important than in epitheliomas.

| VOR-BEFUND | ELEMENT | NORM. BEREICH | ER-MITTELTER WERT | B. ---. 69 J. Hypopharynx Ca. Squam.Cell | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Na | 1920-1980 | 2139 | 1650 | 1750 | 1850 | 1950 | 2050 | 2150 | 2250 |
| | K | 1770-1830 | 1646 | 1500 | 1600 | 1700 | 1800 | 1900 | 2000 | 2100 |
| | Ca | 59,0-61,0 | 63,6 | 54 | 56 | 58 | 60 | 62 | 64 | 66 |
| | Mg | 34,0-36,0 | 30,8 | 29 | 31 | 33 | 35 | 37 | 39 | 41 |
| | Cu | 1,10-1,20 | 1,39 | 0,85 | 0,95 | 1,05 | 1,15 | 1,25 | 1,35 | 1,45 |
| | Fe | 460-480 | 388 | 350 | 390 | 430 | 470 | 510 | 550 | 590 |
| | P | 360-380 | 300 | 250 | 290 | 330 | 370 | 410 | 450 | 490 |
| | Zn | 7,30-7,70 | 5,36 | 6,30 | 6,70 | 7,10 | 7,50 | 7,90 | 8,30 | 8,70 |
| | Sr | 0,1-0,2 | 0,18 | 0 | 0,03 | 0,09 | 0,15 | 0,21 | 0,27 | 0,33 |
| | Ti | 0,02-0,03 | 0,026 | 0 | 0,005 | 0,015 | 0,025 | 0,035 | 0,045 | 0,055 |
| | Cr | 0,02-0,03 | 0,019 | 0 | 0,005 | 0,015 | 0,025 | 0,035 | 0,045 | 0,055 |
| | Mn | 0,1-0,2 | 0,12 | 0 | 0,03 | 0,09 | 0,15 | 0,21 | 0,27 | 0,33 |
| | Ni | 0,1-0,2 | 0,10 | 0 | 0,03 | 0,09 | 0,15 | 0,21 | 0,27 | 0,33 |
| | Cd | 0,01-0,02 | 0,015 | 0 | 0,003 | 0,009 | 0,015 | 0,021 | 0,027 | 0,033 |
| | B | 0,15-0,25 | 0,28 | 0 | 0,04 | 0,12 | 0,20 | 0,28 | 0,36 | 0,44 |
| | Pb | 0,2-0,3 | 0,19 | 0 | 0,05 | 0,15 | 0,25 | 0,35 | 0,45 | 0,55 |

Alle Werte beziehen sich auf mg/1000 ml.

## TABLE 8

### Metastas. Breast Cancer

Severe damage of the organism expressed by the results obtained by whole blood analysis. This is not only the consequence of the malignant disease alone but also of highly toxic chemotherapy (Adriamycin in high doses, followed by cis-platinum). Severe neural, vestibular, emetogenic, and myocardial side effects. Hopeless prognosis: therapeutically uninfluenceable.

| VOR-BEFUND | ELEMENT | NORM-BEREICH | ER-MITTELTER WERT | D. ... Mamma-Ca. 53 J. Cis-Platinum follow. 3 courses of Bonadonna. | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Na | 1920-1980 | 2360 | 1650 | 1750 | 1850 | 1950 | 2050 | 2150 | 2250 |
| | K | 1770-1830 | 1500 | 1500 | 1600 | 1700 | 1800 | 1900 | 2000 | 2100 |
| | Ca | 59,0-61,0 | 75,9 | 54 | 56 | 58 | 60 | 62 | 64 | 66 |
| | Mg | 34,0-36,0 | 33,7 | 29 | 31 | 33 | 35 | 37 | 39 | 4 |
| | Cu | 1,10-1,20 | 2,19 | 0,85 | 0,95 | 1,05 | 1,15 | 1,25 | 1,35 | 1,45 |
| | Fe | 460-480 | 216 | 350 | 390 | 430 | 470 | 510 | 550 | 590 |
| | P | 360-380 | 250 | 25 | 290 | 330 | 370 | 410 | 450 | 490 |
| | Zn | 7,30-7,70 | 5,79 | 6,30 | 6,70 | 7,10 | 7,50 | 7,90 | 8,30 | 8,70 |
| | Sr | 0,1-0,2 | 0,1 | 0 | 0,03 | 0,09 | 0,15 | 0,21 | 0,27 | 0,33 |
| | Ti | 0,02-0,03 | 0,029 | 0 | 0,005 | 0,015 | 0,025 | 0,035 | 0,045 | 0,055 |
| | Cr | 0,02-0,03 | 0,018 | 0 | 0,005 | 0,015 | 0,025 | 0,035 | 0,045 | 0,055 |
| | Mn | 0,1-0,2 | 0,13 | 0 | 0,03 | 0,09 | 0,15 | 0,21 | 0,27 | 0,33 |
| | Ni | 0,1-0,2 | 0,11 | 0 | 0,03 | 0,09 | 0,15 | 0,21 | 0,27 | 0,33 |
| | Cd | 0,01-0,02 | 0,013 | 0 | 0,003 | 0,009 | 0,015 | 0,021 | 0,027 | 0,033 |
| | B | 0,15-0,25 | 0,26 | 0 | 0,04 | 0,12 | 0,20 | 0,28 | 0,36 | 0,44 |
| | Pb | 0,2-0,3 | 0,19 | 0 | 0,05 | 0,15 | 0,25 | 0,35 | 0,45 | 0,55 |

Alle Werte beziehen sich auf mg/1000 ml.

## TABLE 9

### The Eumetabolic Approach

Breast cancer with repeated local metastisation in the first three years after incomplete mastectomy. Local recurrences were surgically removed (Lumpectomy) or regressed by themselves. Patient now free from recurrence for three years (cosmetic build-up of the breast in 1978, Silbersee Hospital). The high zinc-copper ratio is practically always related to a static or regressive behavior of malignant tumors. In this case the eumetabolic Nieper Regimen was applied for more than six years without any interruption. This program also included the zinc-carotene therapy.

| ELEMENT | NORM. BEREICH | ER-MITTELTER WERT | D | J..., 49 J. | | Mamma-Ca., Rezid., cured | | | |
|---|---|---|---|---|---|---|---|---|---|
| Na | 1920-1980 | 190[illegible] | 1650 | 1750 | 1850 | 1950 | 2050 | 2150 | 2250 |
| K | 1770-1830 | 17[illegible] | 1500 | 1600 | 1700 | 1800 | 1900 | 2000 | 2100 |
| Ca | 59,0-61,0 | 5[illegible],9 | 54 | 56 | 58 | 60 | 62 | 64 | 66 |
| Mg | 34,0-36,0 | 36,1 | 29 | 31 | 33 | 35 | 37 | 39 | 41 |
| Cu | 1,10-1,20 | 1,02 | 0,85 | 0,95 | [illegible] | 1,15 | 1,25 | 1,35 | 1,45 |
| Fe | 460-480 | 474 | 350 | 390 | 430 | 470 | 510 | 550 | 590 |
| P | 360-380 | 4[illegible] | 250 | 290 | 330 | 370 | 410 | 450 | 490 |
| Zn | 7,30-7,70 | [illegible],[illegible] | 6,30 | 6,70 | 7,10 | 7,50 | [illegible] | 8,30 | 8,70 |
| Sr | 0,1-0,2 | 0,1[illegible] | 0 | 0,03 | 0,09 | 0,15 | 0,21 | 0,27 | 0,33 |
| Ti | 0,02-0,03 | 0,021 | 0 | 0,005 | 0,015 | 0,025 | 0,035 | 0,045 | 0,055 |
| Cr | 0,02-0,03 | 0,01[illegible] | 0 | 0,005 | 0,015 | 0,025 | 0,035 | 0,045 | 0,055 |
| Mn | 0,1-0,2 | 0,16 | 0 | 0,03 | 0,09 | 0,15 | 0,21 | 0,27 | 0,33 |
| Ni | 0,1-0,2 | 0,13 | 0 | 0,03 | 0,09 | 0,15 | 0,21 | 0,27 | 0,33 |
| Cd | 0,01-0,02 | 0,014 | 0 | 0,003 | 0,009 | 0,015 | 0,021 | 0,027 | 0,033 |
| B | 0,15-0,25 | 0,27 | 0 | 0,04 | 0,12 | 0,20 | 0,28 | 0,36 | 0,44 |
| Pb | 0,2-0,3 | 0,22 | 0 | 0,05 | 0,15 | 0,25 | 0,35 | 0,45 | 0,55 |

Alle Werte beziehen sich auf mg/100 ml.