Report 2021

Society for Cancer Research
Arlesheim • Switzerland

Society for Cancer Research
Hiscia Research Institute

Society for Cancer Research
The primary aims of the Society for Cancer Research are assuring, optimizing and developing holistic cancer therapy on the foundations of anthroposophic medicine and pharmacy.

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Editorial

Dear reader

In the past two years civil societies worldwide, each in their own way, have tried to cope with the effects of the new Corona virus on individual health and national health systems. Measures involving separation and isolation, which came to be known generally as «social distancing», have been implemented almost everywhere over long periods of time. For many of us this brought a first painful realization of how important free and unhindered interaction is, whether in the social domain or also with nature.

The anthroposophic view of the human being, with its fourfold division, takes account not only of outward nature but also of our inner human nature. In this outlook, our body's physical level corresponds to the inanimate mineral world while the level of life forces and vital energies corresponds to the living plant world, and the level of emotions and feelings to the animal world. The entity in us that can say 'I' to and of itself and makes each of us a distinctive individuality, is what mediates between inner and outer nature.

When I and inner nature are in harmonious interplay, conditions for a healthy life are present for body, psyche and spirit. But where these levels or aspects, also known as sheaths of our being, detach themselves from a harmonious interplay within the whole organism, the conditions are created for illness to develop – for instance, if the I no longer has any sense of the body's nutritional needs, or if ongoing depletion of the life forces leads to burnout. Anthroposophic integrative cancer treatment therefore not only directly targets the localised tumour but also always seeks to bring about a harmonisation and healthy interplay between body, life forces, feelings and the I as bearer of our individuality.

In the field of research, a similar view underlies the collaboration of different partners who bring diverse abilities and skills with them to joint projects, thus promoting creative exchange. In this context the present annual report highlights several research findings that have emerged in 2021 from various forms of collaborative partnership. Thus cell-culture trials conducted by a Ph.D student at Basel University, supervised by researchers at the Society for Cancer Research, provided a striking demonstration of the inhibiting action of moneywort and thyme on cancer cells – two herbal constituents of an ointment that has been newly developed in our laboratory, and which we are now preparing as clinical application for tumours. Then also, a further study has emerged from many years of collaboration with vets at the Research Institute for Organic Agriculture (FiBL), investigating the action of mistletoe on sick horses, now comparing injection delivery with oral administration. And in collaboration with a research institute in Berlin, analysis was undertaken of 41 published studies on the potential of picture-forming methods for recognizing

cancer, which showed that the patterns forming in drying body fluids achieve a diagnostic accuracy equal to that of mammograms and ultrasound.

Furthermore we have forged new ground in close collaboration with a Brazilian Professor by investigating what is known as the metabolome – the metabolic products of an organism – to ascertain what therapeutically relevant physiological differences can be found between mistletoes from different host trees. Finally, two further studies are founded on our collaboration with the University of Witten/Herdecke: one project investigates the robustness and reliability of biological testing systems in homeopathic potency research, thus strengthening an important methodological instrument for verifying sensitive pharmaceutical processes such as those used in anthroposophic medicine. The second project, conducted by a young physician as part of her doctoral thesis, focuses on interviews with 20 cancer patients at Klinik Arlesheim, with moving testimonies about their own inner experience of mistletoe therapy.

Following up on this innovative qualitative study, we will, in future, also investigate the therapeutic potential of the natural landscape and pursue the question of how outer experiencing of mistletoe on the trees can further enhance nature's already well documented salutogenetic action. It is part of our aim with this project also to overcome the present universal tendency towards separation, isolation and disharmony, or in other words, to again enhance people's connection with the world they live in.

We will be pleased and grateful if you too, dear reader, would like to accompany and support us in this endeavour.

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Can Cancer Be Diagnosed by Means of Patterns Formed in Drying Body Fluids?

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Findings of a Systematic Review and Meta-Analysis

To answer the question if cancer can be diagnosed by means of patterns formed in dried body fluids and, if so, how accurately, we undertook a systematic literature review and meta-analysis and analysed 40 scientific publications that describe a total of 41 diagnostic test accuracy studies. The publication dates of these papers ranged from 1939 to 2020; they were predominantly in English or German. For better comparison, the collected studies were subdivided into three different methodological approaches and six diagnostic tests [1]:

- Copper chloride biocrystallisation with copper chloride applied to (i) blood (15 studies) and (ii) serum (1 study);
- Exsiccation (drying) of (iii) blood-, (iv) serum- and (v) plasma-drops without addition of reagents (19, 3, and 1 study);
- and (vi) exsiccation (drying) of serum drops with addition of a reagent (1 study).

In the studies considered, samples from a total of 5,265 cancer patients and 10,704 control patients were analysed. From each study, data were extracted relating to the sensitivity (percentage of correct cancer diagnoses) and specificity (percentage of people correctly identified as not having cancer) of the diagnostic tests. In addition, for the purposes of more detailed analysis the data were subdivided into treated and untreated cancer patients, patients with diseases other than cancer, and healthy subjects. Two expert evaluators carefully assessed the quality of the studies. For this purpose a pre-defined index of questions was used, the QUADAS-2-TOOL, which evaluates decisive points of methodology that could involve a risk of bias and corresponding uncertainties in applicability.

Evaluation of the studies showed that diagnostic tests based on pattern-forming in drying body fluids achieve an accuracy comparable with that of traditional diagnostic tests. Overall values for sensitivity and specificity of the diagnostic tests reviewed in the 41 studies were 88.8% and 89.6% respectively. By comparison, mammography has a sensitivity and specificity of 86.9% and 88.9% respectively [2] while values for ultrasound imaging for thyroid cancer are 73% and 89% [3].

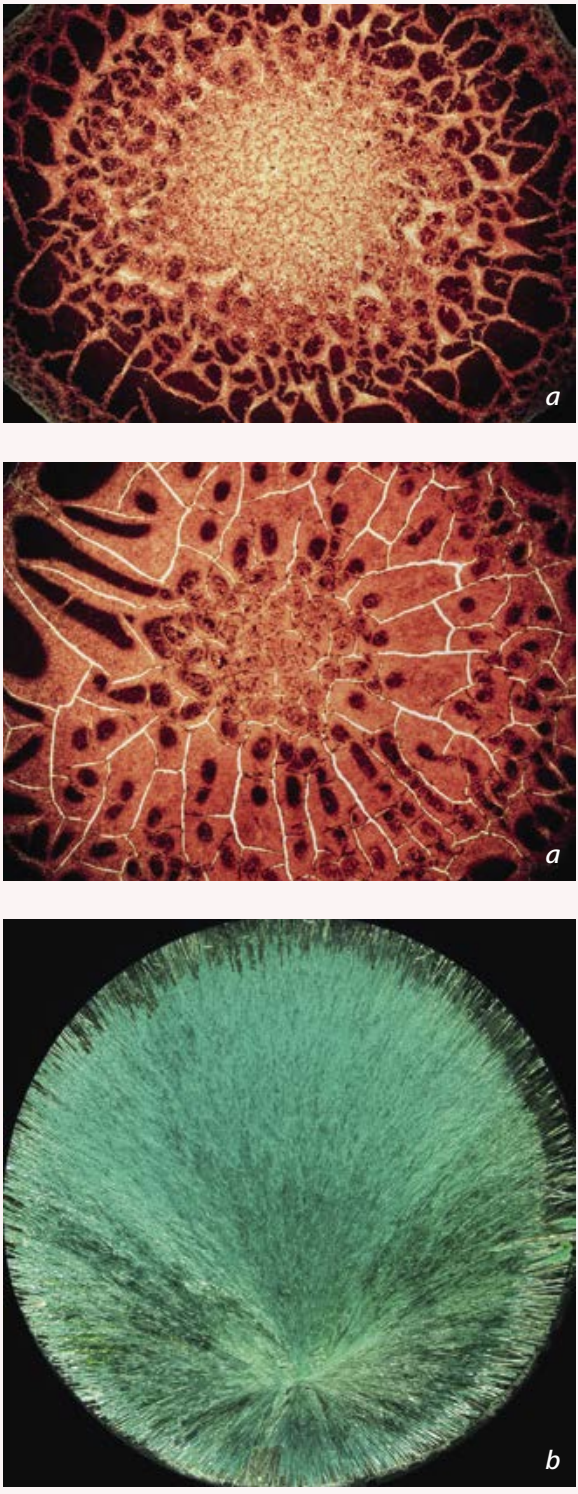

Figure 1: Examples of patterns that arise during evaporation of a blood droplet (a) and in copper chloride biocrystallisation applied to blood (b). Photographs: Maria Olga Kokornaczyk, SCR, Switzerland (a) and Paul Doesburg, Crystallab, Denmark (b).

Copper chloride biocrystallisation of blood proved to be a more accurate tool (92.8% and 92.6%) than evaporation of blood drops without added reagents (86.5% and 88.8%) (figure 1). Remarkably, both tests showed a greater accuracy with untreated than with treated cancer types. They would therefore appear to be particularly suitable for early cancer diagnosis. The copper chloride biocrystallisation test was also better able to distinguish between cancer patients and those with diseases other than cancer, whereas the desiccation of blood droplets showed the greatest accuracy when samples from cancer patients were compared with those from healthy donors.

Diagnostic tests based on pattern-forming in drying body fluids show several very promising characteristics in comparison with many classical diagnostic tests. Firstly, they appear to be sensitive to many different types of cancer (in the studies analysed here, over 50 different types of cancer were investigated). Secondly, they can be performed on samples of body fluids sent by post or by courier, i.e. there is no need for the patient to attend the laboratory in person. Thirdly, they require relatively few instruments, and are therefore more economically viable (cost-efficient).

In the great majority of the studies compiled here, the diagnostic test reading (pattern analysis) was done visually, and evaporation was undertaken under stable but uncontrolled conditions. In other words, the potential of this diagnostic test is far from being exhausted as yet. In our view, the methodology can be further optimised and, by using highly developed instruments for pattern analysis, could provide still better data and a greater degree of diagnostic accuracy.

The findings clearly show that methods based on pattern-forming in dried body fluids are very promising in several respects as diagnostic tests for cancer, and accordingly should be promoted and swiftly developed. ■

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Larch Resin-Lysimachia comp. Ointment: New Research Findings on its Active Constituents

ULRIKE WEISSENSTEIN

Exulcerating tumours (open cancer tumours) represent a major physical and psychological burden for patients, who will often isolate themselves due to the intense bad odour, pain and functional impairment. In turn this often leads to states of depression. [1,2]

Based on a suggestion by Rudolf Steiner [3], the Society for Cancer Research has developed an ointment containing larch resin, beeswax, thyme and moneywort (*Lysimachia*) as an effective means to treat open, exulcerating tumours and their consequences. In collaboration with the University of Basel, various master's theses were undertaken to support the development of this ointment and to characterize the pharmacological properties of its separate constituents. Thus information already available from the specialist literature was collected and compiled, an initial formula was elaborated and later further optimized [4, 5]. Finally, in 2020, it was possible to issue an optimized larch resin-Lysimachia cream to physicians at Klinik Arlesheim for selective use with affected patients, and this has already been found to provide clear help for pain and odour reduction.

Medicinal herbs used in phytotherapeutic wound treatment frequently possess several pharmacological properties and can therefore be used for a broad spectrum of conditions. It would be particularly advantageous if, alongside an antimicrobial and analgesic effect, an anti-tumoral action could also be achieved. This would help to suppress infiltrating cancer cells and thus directly tackle the cause of the developing wound.

In 2021, as part of her master thesis for the University of Basel, pharmaceutical student Kirthana Ganeshathas studied the question of whether larch resin-Lysimachia ointment can have a anti-tumoral effect. The aim of her study carried out in our tumour biology department was to investigate whether alcoholic extracts of two of the ointment's constituents, moneywort (*Lysmiachia nummularia* L., *Herba*, ethanol decoctum) and thyme (*Thymus vulgaris*, *Herba*, ethanol infusion 10%) act cytotoxically (cell-damaging) and cytostatically (cell-division-inhibiting) on cultivated tumour cells. For this purpose, using various experimental methods, three human breast-cancer cell lines were treated with

The components thyme and pennywort (top), larch resin and beeswax (middle) and their processing into Resina laricis/Lysimachia comp. cream on the ointment roller (bottom).

Kirthana Ganeshathas performing the apoptosis assay.

these extracts to investigate their effect on cell proliferation (cell division and growth), the type of cell death and the cell-cycle.

The findings from Kirthana Ganeshathas's experiments showed that both extracts had a marked cytotoxic and cytostatic action on all three breast-cancer cell lines[6]. They were able to induce tumour-cell death based partly on the process of apoptosis, thus of programmed cell-death. The cytostatic action delays or prevents the cell-cycle so that the cells can no longer divide. Due probably to their different biological properties, the three breast-cancer cell lines responded with differing degrees of sensitivity to this cell-division-inhibiting action of the Lysimachia and thyme extracts, in terms of both extract and dose. The demonstrated effects resemble those of a chemotherapy, which often displays both a cytotoxic and cytostatic action.

The pharmacologically active constituents of the extracts are likely to be responsible for the growth-inhibiting action on cancer-cell lines. Thus in the Lysimachia extracts one finds, for instance, flavonoids such as quercetin, kaempferol and myricetin[7]. Carvacrol and thymol are important phenolic monoterpenes in thyme oil known to have cancer-inhibiting effects[8].

The concentrations of Lysimachia and thyme extracts contained in the ointment are within the range of doses that demonstrated a cytotoxic or cytostatic action in the cell-culture trials. This leads us

to suspect that the same action can be achieved in clinical application. The condition for this, however, is bio-availability, that is, the active constituents of the extracts must also actually reach the tumour cells in a wound.

In a further master's thesis, the anti-tumoral properties of other constituents of the larch resin-Lysimachia ointment will be investigated. ■

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Oral Mistletoe Therapy? New Trials in Veterinary Medicine

OPHÉLIE CHRISTEN-CLOTTU, ULRIKE BIEGEL

More than ten years ago, the Research Institute for Organic Agriculture (FiBL), in collaboration with the Society for Cancer Research, successfully completed and published the highly regarded study on mistletoe therapy for equine sarcoid (a dissertation at Bern University)[1]. Equine sarcoid is the commonest skin tumour affecting horses (equids). Conventional treatment methods are often unsatisfactory and relapses (recurrences) are common. The study was a great success, showing significantly higher cure and improvement rates in horses treated with a 15-week mistletoe injection therapy[2] compared to a control group that received a placebo[1]. In a follow-up observation five years after the main study was completed, these figures markedly improved still further[3]. Remarkably it was apparent that the sarcoids went on slowly and consistently regressing, sometimes over many months, even after cessation of the 15-week treatment.

Following this study, which brought new findings but also – like every good scientific investigation – threw up a series of new questions, the following issues were considered:

- Can an extension of the 15-week course of treatment hasten or increase cure and improvement rates?
- Could oral therapy be used to spare animals frequent injections and thus increase a willingness to cooperate (compliance) both in the animals themselves and their keepers during mistletoe treatment?

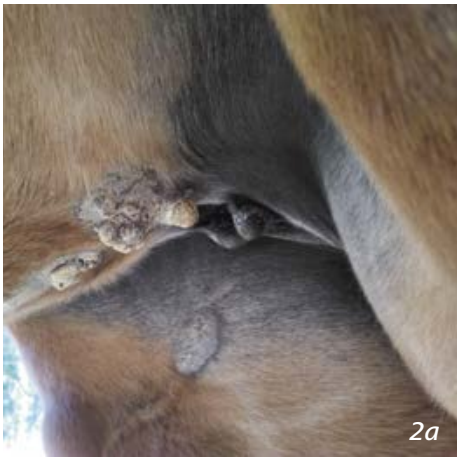
The practical experiences of author Dr. Christen-Clottu supported these new approaches. Where treatment did not lead to success, she repeated the 15-week injection therapy, and if the horses refused this due to the length of treatment and the

many injections, she changed over to an oral application. She gained the impression that clear improvements were achieved also with this oral administration.

In 2017, finally, she conducted a structured observational study with a group of ten horses with sarcoids, in which the horses received oral medication instead of injection, following the same protocol [2]. The course of the disease in this group was compared with the placebo control group from the study already published [1]. Here it became apparent that the horses treated orally with mistletoe responded astonishingly well to the therapy: six out of the ten horses could be cured. Pictures 1a-c and 2a-c present two examples of the regression of the sarcoids.

Based on these positive findings another study was initiated at the FiBL [4], once again in the context of a dissertation and in collaboration with Bern University (Vetsuisse) and the Society for Cancer Research. The aim of this study is to compare the efficacy

Picture 1: Pictures of a verrucose sarcoid on the head of a horse before 15-week oral mistletoe treatment (1a), after 9 months (1b) and after 18 months (1c). After cessation of the 15-week treatment, the sarcoid continued to regress slowly and continually.



Picture 2: Pictures of an occult sarcoid on the inner thigh and several verrucose sarcoids on the lower abdomen of a horse before the 15-week oral mistletoe treatment (2a), after 12 months (2b) and after 18 months (2c).

Picture 3: Ph.D student Anke Beermann examining the sarcoids. Since these are mostly located under the chest, the abdomen and in the inner thighs, data recording is often challenging and often not without danger. Fortunately most horses are very cooperative.

of oral and injected mistletoe therapies. In addition, to check if this could speed up cure of sarcoids, the length of treatment was doubled. This study is what is known as a placebo-controlled double-blinded study, that is, the treating veterinary doctors and animal keepers do not know until the end of the trial whether a horse is being treated with mistletoe or a placebo.

Ph.D student Anke Beerman was able to start the study in 2021. Thanks to good advance planning and the student's highly structured procedure, it was possible to include all horses needed to complete the study (3x15) by the end of 2021, and some of the treatment could already be completed[5]. Despite the risk that their horse might be assigned to the control group treated only with a placebo, keepers showed great interest in participating. Where a horse has received only a placebo, keepers will be offered free mistletoe treatment for their horses once the study has ended.

The results of the study are expected in 2023.

Postscript: Since human patients might experience what is known as 'injection fatigue', and there are also people with a basic injection phobia, an aqueous mistletoe preparation for oral administration that is as effective as an injection preparation would also be considered as very important in human medicine. ■

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4. The study is also supported by the Society for Clinical Research, the Pro Pferd Foundation, the Rudolf Steiner Fund for Scientific Research., Camvet.ch, and the Society of Veterinarians of Canton Neuchâtel.
5. 15 horses are treated with oral mistletoe extract and injected placebo, and 15 horses with injected mistletoe extract and oral placebo (control group).

How Patients Experience Mistletoe Therapy – A Qualitative Interview Study

ANNIKA MASCHER

How do cancer patients experience mistletoe therapy? This question arose for us three years ago and instigated a dissertation which investigates the qualitative effect of mistletoe therapy. [1] This is because, alongside numerous clinical (quantitative) studies on mistletoe therapy, there are astonishingly few in which the cancer patients themselves are asked about their first-hand experience of mistletoe treatment. We focused on investigating various experiential fields or perceptual levels, wishing to research patients' subjective experience – which is essential for a holistic and patient-centred cancer therapy – with a new depth and thoroughness.

In two conversations each, 20 cancer patients at Klinik Arlesheim were asked about their personal experience of treatment and their relationship to mistletoe as plant. They offered a moving diversity of insights at many different levels (table 1).

The qualitative analysis showed that such experience was primarily described at a non-physical level. In addition, the patient's character or life interests had a decisive effect on their individual experiences of the treatment. For instance, respondents with a good body awareness described more aspects of warmth and vitality whereas spiritually open patients also connected deeper spiritual experiences with their mistletoe treatment. On the other hand it was apparent that people who expressed no direct experience of mistletoe treatment were also those who did not engage more closely with their cancer.

From the wide range of responses at the levels investigated, we present here a few key points:

- Vitality level: patients described gaining more energy through mistletoe therapy, helping them function better in daily life, or having greater resistance to colds. [2]

- Feeling level: patients described a fundamental sense of security that mistletoe was supporting them and giving them ground under their feet. Mistletoe therapy promoted the trust and self-assurance of respondents, and their sense of being in touch with themselves.

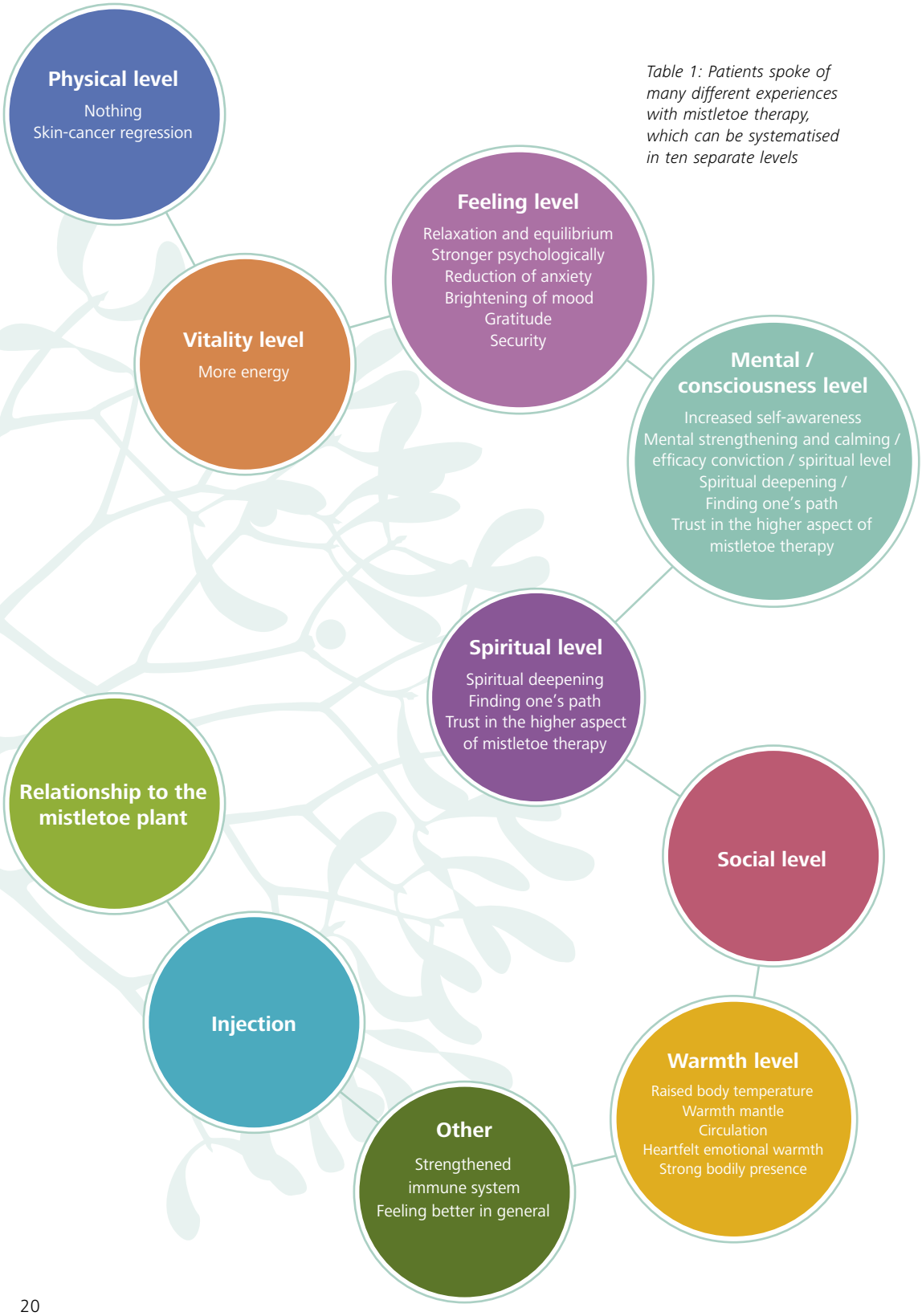

Table 1: Patients spoke of many different experiences with mistletoe therapy, which can be systematised in ten separate levels

- Consciousness level: Patients often described an increased self-awareness and experience of their own presence. Increased self-awareness and self-acceptance led to a loving attention for their own needs.

- Spiritual level: Accounts ranged from a vague inkling of inexplicable forces, like a 'sense of magic', something mysterious, through to an experience of connection with 'something higher', or the feeling of being 'embraced and protected' by the healing power of mistletoe. [3]

- Warmth level: It was especially fascinating to find warmth figuring as a multi-dimensional phenomenon, e.g. as mediator of a patient's own bodily presence, or as the feeling of 'circulation' or 'flow', or as bodily warmth or raised body temperature.

Qualitative research investigates the importance which patients assign to mistletoe therapy, and how this affects them and their relationship with the illness. It is not a matter of generalising or quantifying findings but rather of the subjective experience of rather few respondents, in this way reaching depths of personal insight that are not achievable with a quantitative approach. In consequence the qualitative approach makes it possible to study various levels of human experience. It also shows potential for a therapeutic effect through the posing of questions itself. Acknowledgement of the great diversity and depth of experiences which patients ascribe to mistletoe treatment leads to the questions, for future studies, to which degree guided self-observation during mistletoe treatment (or other therapies) can support processes of healing, and in what way cancer patients can best be accompanied in this process. ■

Notes:

1. How patients experience mistletoe therapy. A qualitative interview study. Ongoing dissertation at the University of Witten/ Herdecke.
2. «It protects me. It makes me strong. So I notice sometimes […] am I the only one who never gets ill in this school! Who, so to say, is always working. […] For heaven' sake, I'd also like to be at home sometimes. No. (laughs)» (Pat 537, t1).
3. «Well here I have to say that I do have an experience with mistletoe. […] This is something that touched me and strengthened my belief that there is certainly something. A – yes a spiritual world. So not heaven. No, an order of things we don't understand and do not have to understand.» (Pat 533, t2).

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Why are Mistletoe Preparations from Different Host Trees Suitable for Treating Different Cancers and Patient Groups? Metabolomic Trials

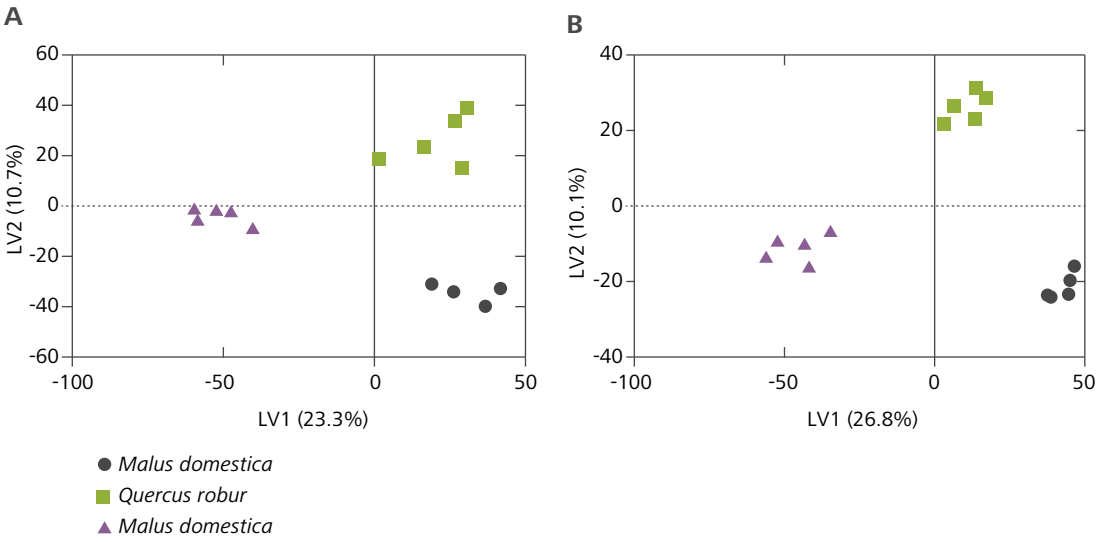
CARLA HOLANDINO, STEPHAN BAUMGARTNER

Mistletoe preparations from various host trees have long been used for treating different types of cancer and patient groups. It has proven effective, for instance, to treat women with lower abdominal cancers with mistletoe preparations from the apple tree, to treat men with tumours of the inner organs with oak preparations, and to use elm preparations for treating lung cancer. Back in the 1970s, first steps were taken to scientifically investigate their various modes of action. Using specific anthroposophic methods ('picture-forming' methods such as round-filter chromatography) it was possible to render differences between mistletoe preparations visible. However, these results were not easy to comprehend for non-anthroposophic scientists.

At the material-chemical level research into the use of different mistletoe extracts in integrative cancer therapy has so far focused primarily on the lectins and viscotoxins and their cytotoxic (cell-injuring) effect on cancer cells[1]. The action of mistletoe, however, cannot be limited to its viscotoxins and lectins for it assuredly contains over a hundred different chemical constituents that are not precisely identified, such as flavonoids, terpenoids, phenolic acids, sugars, amino acids and lipids. The question arose, therefore, as to where on the substance level are to be found the differences in mistletoe preparations emanating from the different host trees.

With the rise of metabolomics technology, it became possible to examine this question again more thoroughly. This approach allows us to investigate many different compounds simultaneously using extremely small quantities of plant sample (see box). In 2015, this led the Society for Cancer Research to enter into scientific collaboration with the Neuchâtel

Unlike other traditional medicinal plants, mistletoe (Viscum album) is a semi-parasitic plant since its growth, alongside its capacity for photosynthesis, draws primarily on the intake of water, sugars, amino acids and minerals from the host tree. Little is known as yet however about the host-tree-dependent chemical differences between mistletoes nor about the effect of metabolic products (the metabolome) on the biological action of mistletoe preparations. Metabolomics with plants has developed into an effective experimental strategy since it offers simultaneous analysis of many metabolites (products of mostly biochemical processes) and thus provides a quick and reliable picture of the plant's chemical properties.



Graph 1: Multivariate statistical analysis shows a clear distinction between mistletoe extracts from different host trees (apple (Malus domestica); oak (Quercus robur); elm (Ulmus carpinifolia)) [3]. The samples were harvested in 2016 (A) and 2017 (B).

Platform of Analytical Chemistry at the University of Neuchâtel (Switzerland) and the Metabolomics Laboratory of Rio de Janeiro University (Brazil), and launch a project to study in more depth and detail the constituents of mistletoe preparations from different host trees [2, 3]. This was one of the first projects in the world to use the metabolomics method in the field of medicinal plant research.

In 2016 and 2017, at exactly the same time and under the same conditions, mistletoe plants from different host trees were harvested and cooled immediately upon harvesting using liquid nitrogen, in order to stabilise sensitive constituents. These samples were then extracted. The Neuchâtel Platform of Analytical Chemistry then undertook measurements using the UHPLC-ToF-MS method [3]. Through matching with international chemical databases, the third partner, the Metabolomics Laboratory in Rio de Janeiro was then able to determine the spectrum of the most important differing constituents. Multivariate statistical analysis showed a clear distinction between mistletoe extracts depending on their host tree (see graph 1: apple tree – black symbol; oak – red symbol; elm – blue symbol). The findings of these research projects led to two publications in September 2020 and August 2021 [3].

If it subsequently proves possible to determine the clinical significance of the different identified constituents and to harmonise this with the areas of application of mistletoe preparations from different host trees, it might be possible to build a bridge

to conventional medicine, which limits its research predominately to the material level.

Steiner's originating idea was to introduce the life force of the host tree to the patients via mistletoe. The classification of mistletoe preparations from different host trees for the treatment of particular cancer types was also founded on this idea, and subsequently this approach has also been empirically substantiated through the experiences and observations of practising physicians.

With metabolomics we possess a scientific method capable of revealing the substance composition of medicinal plants at a deeper level. We can use it to better investigate how life forces come to expression on the level of substance. And this brings us a big step further towards our goal of rendering the effects of non-material phenomena (such as life forces) more scientifically comprehensible. ■

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Basic Research on the Potentisation Process

ANNEKATHRIN ÜCKER

A collaboration with Witten/Herdecke University, Germany

The focus of scientific work at the Society for cancer Research (SCR) is on anthroposophic oncology, which uses medicines produced by certain anthroposophic pharmaceutical procedures. Alongside special extraction procedures (e.g. fermentation), these do also include various methods of enhancing efficacy, such as potentisation.

Many anthroposophic medicines are potentised in a procedure that derives from homeopathy and is based on serial dilution and succussing of what is known as a 'mother tincture'. It has not yet been scientifically shown how highly diluted potencies can achieve effects which exceed those of a placebo (sham drug). Beyond a potency level of 24x or 12c any likelihood of still finding molecules of the originating substance in the preparation is low in statistical terms[1]. This leads to repeated criticism of the use of such medicines, and thus also of anthroposophic medicine and oncology.

To be able to undertake experiments on the possible modes of action of potencies, reliable testing systems are needed. Simple testing systems with plants have the advantage that a placebo effect can be excluded. I am currently working to develop a reliable testing system of this kind in the context of a project at Witten/Herdecke University, during which I can undertake research at the laboratories in Arlesheim thanks to collaboration with the SCR.

Our testing system uses arsenic-damaged duckweed (*Lemna gibba* L.) to investigate whether its growth rates change, in comparison with water-treated plants, through administration of Arsenicum album potencies (between 17x and 33x). The plants are pre-treated with a material dose of arsenic, thus representing a kind of 'sickness' model. The experiments are blinded and randomised, to exclude any unconscious difference in treatment of the potency group. To avoid false-positive results, environmental factors are also strictly controlled. For this purpose we use specially constructed growing chambers (see photos 3 and 4) that ensure constant temperature, air movement, and light intensity during the experiments.

Back in 2010, initial results with this testing system were published[2]. They showed a statistically significant increase in the growth rate of duckweed stressed with

Photo 1 «Lemna»: Duckweed is among the smallest flowering plants. Its very rapid growth (doubling of its mass in a day) and reactability to water-soluble toxins, leads to its use as test organism in various lab tests, primarily in the field of environmental toxicology and in potency research at the SCR. Duckweed is culitvated in the Arlesheim laboratories under strictly controlled conditions.

Photos 2+3 «Chamber exterior» and «Chamber interior»: For the experiments with duckweed and Arsenicum album potencies, special growing chambers were conceived to keep environmental conditions such as temperature and light intensity at an optimum.

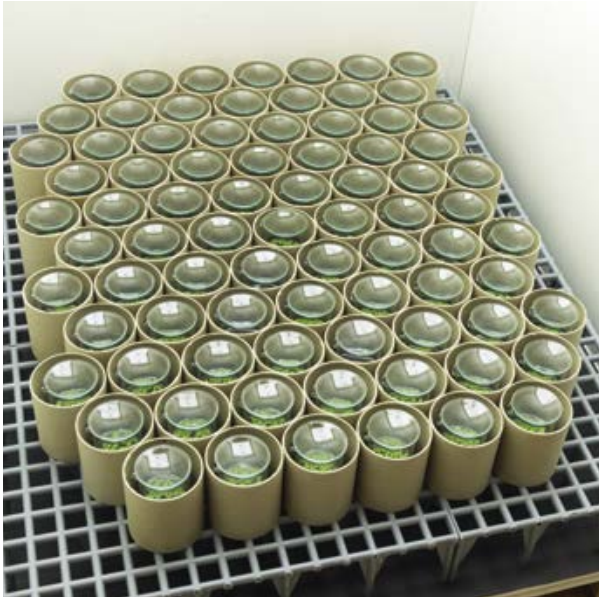
arsenic and subsequently treated with potencies, compared to the control group treated only with water. In my project I am working on the replicability of these findings.

External replication, thus using the same system to repeat the experiments in a different laboratory, is part of standard science. Currently in science there is talk of a 'replication crisis'. This means that the findings of replication trials are often different from those of the original study, which is attributable either to errors in managing the experiment or to influencing factors not hitherto considered.

I conducted two experimental series comprising, as in the original trials, five independent experiments. A major difference from the original trials was the shortening of the artificial lighting period from 24 to 16 hours so as better to imitate natural day-night rhythms. We suspected that the action of the potencies might be more apparent under more natural conditions.

The replication experiments showed, overall, a reaction by the duckweed to treatment with potencies[3] that was comparable to the 2010 trials[2]. However, the effect size, thus the numerical difference between the treatment and control groups, was smaller (not statistically significantly) in the first series. In the second series it was possible to enhance the difference by increasing the arsenic stress prior to the experiment.

These are promising findings towards the development of a reliable testing system with which, among other things, ques-



tions about the mode of action or the quality of potencies will be investigated. In follow-up projects the testing system is to be further optimised so that any effects of potentised preparations can be rendered still more visible and measurable. For this purpose we are currently seeking interested Ph.D students with a scientific training. ■

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