

## OPTICAL MAGNETOMETRY AND APPLICATION TO IMAGING: A SIMPLE SOLUTION TO THE PATTERN RECOGNITION PROBLEM

E. Cali,<sup>1</sup> C. Marinelli,<sup>1</sup> E. Mariotti,<sup>1</sup>  
L. Marmugi,<sup>2</sup> V. Millucci,<sup>1</sup> F. Renzoni,<sup>2</sup>  
L. Stiaccini,<sup>1</sup> N. Papi<sup>1</sup>

<sup>1</sup>Department of Physical Sciences, Earth and Environment University of Siena, Italy; <sup>2</sup>University College London, UK

A new branch of recent laser spectroscopy is given by Optical Magnetometry, where the sensor is an atomic sample interacting with laser light in such a way that it becomes extremely sensitive to the magnitude of the local magnetic

field. This technique has been applied from geomagnetism to very low – level field ranges, being able to measure and track tiny signals, as for example in NMR, MRI, relaxometry, magnetocardiography, magnetoencephalography. In this paper, as a result of the collaboration with a group of the University College, London, a brief survey of a possible application of an optical magnetometer to Magnetic Induction Tomography will be given. MIT is based on the excitation of eddy currents in the object of interest, and in the detection of the weak magnetic field generated by them. One of the main problem in this kind of experiment is the exact reproduction of the shape of the object. We will present a post – analysis algorithm, as requested by our collaborators, allowing for a better performance in the pattern recognition.

**Key words:** Optical Sensors, Laser Spectroscopy, Alkali atoms, Photonics, NMR, Magnetic Induced Tomography.

## ANTI-AGING AND WOUND HEALING ACTIVITIES OF *SEDUM TELEPHIUM* L.

M. Biagi,<sup>1</sup> G. Baini,<sup>1</sup> P. Governa,<sup>2</sup>  
V. Borgonetti,<sup>3</sup> A.R. Magnano,<sup>1</sup> E. Miraldi<sup>1</sup>

<sup>1</sup>Department of Physical Sciences, Earth and Environment, University of Siena, Italy; <sup>2</sup>Department of Biotechnology, Chemistry and Pharmacy, University of Siena, Italy; <sup>3</sup>Neurofarba, University of Florence, Italy

*Sedum telephium* L. (ST) has a long popular tradition of use in Italy as skin repair herbal medicine; the fresh juice has been clinically used as skin healing agent for four decades in Florence at San Giovanni di Dio Hospital by Dr. Sergio Balatri.

Despite this, mechanism of action of ST is still unclear. We performed phytochemical analyses on the ST fresh juice as well as biological tests on human keratinocytes and fibroblasts. A scratching wound healing assay was conducted, followed by cytokines, filaggrin and sirtuin-1 dosages on keratinocytes treated with ST. Collagen-I e sirtuin-1 were dosed on fibroblasts. ST was found to mainly contain polysaccharides and glycosylated flavonoids. Sirtuin-1 levels resulted upregulated by ST treatment both in keratinocytes and in fibroblasts and this could be linked to the positive effects recorded on keratinocytes in the filaggrin levels increase, cell proliferation and migration and on fibroblasts in increased collagen-I synthesis. ST possesses an effective protective and stimulant action on skin cells, specifically acting on molecular targets that regulate the barrier function and tissue renewal mechanisms.

**Key words:** *Sedum telephium* L.; wound healing activity; fresh juice.

## “BASTARDA ROSSA” CHESTNUT LEAF EXTRACT FROM MOUNT AMIATA CHESTNUT AS A NOVEL ANTI-PHOTOAGING AND SKIN CARE AGENT

G. Baini,<sup>1</sup> E. Miraldi,<sup>1</sup> P. Governa,<sup>2</sup>  
V. Borgonetti,<sup>3</sup> A.R. Magnano,<sup>1</sup> M. Biagi,<sup>1</sup>

<sup>1</sup>Department of Physical Sciences, Earth and Environment, University of Siena, Italy; <sup>2</sup>Department of Biotechnology, Chemistry and Pharmacy, University of Siena, Italy; <sup>3</sup>Neurofarba, University of Florence, Italy

Modern cosmetics is approaching medicinal plants with ethnobotanical importance, tradition and pre-validated use. We studied the Italian chestnut from Monte Amiata's forests, Tuscany (*Castanea sativa* Mill., Fagaceae, var. *bastarda rossa*), focusing

on its byproducts, such as leaves. In different Italian regions, fresh leaves of chestnut have a long history of use by local people for dermatologic and cosmetic applications. In addition, the inhibitory activity against *Staphylococcus aureus* of refined European chestnut leaf extracts has been reported, with possible applications for treatment of skin and soft tissue infections. Driven by recent studies reported in literature, suggesting a scavenger and antioxidant activity of chestnut leaf extracts, our experimental protocol was focused on a 75% V/V ethanol extract obtained from “Bastarda Rossa” chestnut leaves, proposing its possible topical application as functional product in skin aging. Antioxidant and antiradical agents are, in fact, a useful strategy for the prevention of skin photoaging and oxidative stress-mediated skin diseases.

“Bastarda Rossa” leaf extract contains flavonoids and hydroxycinnamic derivatives, with hyperoside being the most abundant constituent of the extract. Biological tests conducted on human keratinocytes showed that the extract protects cells from chemical (hydrogen peroxide) and physical (UVA irradiation) oxidative damage. The extract activity seems to be primarily related to free-radical scavenging, since cell levels of malondialdehyde, carbonylated proteins and reactive oxy-

gen species decreased when cells were treated with 0.1% V/V extract, while superoxide dismutase activity and Nrf-2 mRNA expression were not affected by the extract at the same concentration. The extract, incorporated in an oil/water emulsion exhibited sun protection factor booster activity. Given these results, the "BastardaRossa" chestnut leaf extract

could be an efficient opportunity in the treatment of extrinsic aging, in which one of the main targets is the neutralization of free radicals.

**Key words:** *Castanea sativa* Mill.; anti-photoaging agent; leaf extract.

### CALLUNA VULGARIS (L.) HULL: IMMUNOMODULATORY EFFECT IN HUMAN MONONUCLEAR CELLS

P. Governa,<sup>1</sup> V. Borgonetti,<sup>2</sup> A.R. Magnano,<sup>3</sup>  
G. Baini,<sup>3</sup> E. Miraldi,<sup>3</sup> M. Biagi<sup>3</sup>

<sup>1</sup>Department of Biotechnology, Chemistry and Pharmacy, University of Siena, Italy; <sup>2</sup>Neurofarba, University of Florence, Italy; <sup>3</sup>Department of Physical Sciences, Earth and Environment, University of Siena, Italy

*Callunavulgaris* (L.) Hull. (Ericaceae) is a perennial shrub common in Italy and in many European countries, found both in plains and in hilly and mountainous areas. In ethnobotany and in phytotherapy *C. vulgaris* aerial parts decoction is used for urinary complaints and as antimicrobial; furthermore *C. vulgaris* is also one of the 37 Bach Flowers and it is used to treat selfish and oppressive people.

The aim of this work was to chemically characterize a water

extract of Italian *C. vulgaris* aerial parts and, for the first time, to investigate its immunomodulatory effect.

Phytochemical analyses were carried out combining enzymatic, colorimetric and HPLC-DAD-MS methods. Immunomodulatory effects of the *C. vulgaris* extract were evaluated using an *in vitro ex vivo* model with human peripheral blood mononuclear cells (PBMC) incubated with the extract for 24 hours. IL-2, IL-4, IL-6, IL-8, IL-10, IL-12, IL-17, TGF- $\beta$  and TNF- $\alpha$  levels was evaluated by ELISA.

The extract was found to contain mainly phenolic acids, flavonoids, polysaccharides and triterpenes.

*C. vulgaris* water extract exhibited a strong immunomodulatory effect from 5  $\mu$ g/ml: IL-6, IL-2, IL-10, TGF- $\beta$  and TNF- $\alpha$  after 24 hours of incubation were significantly increased respect to basal levels and IL-6 resulted the mostly upregulated cytokine. *C. vulgaris* water extract was found to be a novel immunomodulatory agent, being able to regulate innate and adaptive immunity, by targeting cytokines release by monocytes and macrophages such as IL-6, TGF- $\beta$  and TNF- $\alpha$  and activating lymphocytes subpopulation by IL-2 upregulation.

**Key words:** *Calluna vulgaris* (L.) Hull.; immunomodulation; PBMC.

### EFFECTS OF A STANDARDIZED EXTRACT OF NON-PSYCHOTROPIC CANNABIS SATIVA L. ON CENTRAL AND PERIPHERAL INFLAMMATORY RESPONSE

V. Borgonetti,<sup>1</sup> P. Governa,<sup>2</sup> A.R. Magnano,<sup>3</sup>  
G. Baini,<sup>3</sup> E. Miraldi,<sup>3</sup> M. Biagi<sup>3</sup>

<sup>1</sup>Neurofarba, University of Florence, Italy; <sup>2</sup>Department of Biotechnology, Chemistry and Pharmacy, University of Siena, Italy; <sup>3</sup>Department of Physical Sciences, Earth and Environment, University of Siena, Italy

Recently, the interest toward the role of the endocannabinoid system in the regulation of several physiological function has raised. In fact, the modulation of cannabinoid receptors (CB<sub>r</sub>) leads to the activation of a plethora of intracellular pathways, which are involved in physio-pathological condi-

tions, such as inflammation, neurodegeneration and oxidative stress. Recent studies highlighted the anti-inflammatory role of cannabidiol (CBD), even if the exact mechanism of action are still to be clarified. However, the role of other components and of the whole *Cannabis sativa* L. phytocomplex in the inflammatory process remains controversial.

In this experimental work, the effect of a standardized extract of non-psychoactive *Cannabis sativa* L., which contains CBD (21%) and sesquiterpenes (7.06%, of which 34% b-Caryophyllene) in an *in vitro* model of central and peripheral inflammation. Two cell lines were used: BV2 as a model of microglia and PBMC as a model of peripheral immune system.

The extract was able to reduce the release of TNF- $\alpha$ , IL-6 e IL-1 $\beta$  with a non CB<sub>r</sub>-mediated mechanism in BV2. Differently, in PBMC the extract modulated the transcription of CB<sub>r</sub>, but without influencing cytokines release.

Finally, the anti-inflammatory activity of the extract was always stronger compared to its main constituents alone and seems to involve typical intracellular pathways.

**Key words:** *Cannabis sativa* L.; inflammation; cannabinoid receptors.

**THE NEW COMBINATION  
BETA-CARYOPHYLLENE  
(BCP)-DOCOSAHEXAENOIC ACID  
(DHA) INDUCES IMPORTANT  
ANALGESIC EFFECT IN MALE RATS  
IN A PERSISTENT PAIN MODEL**

***I. Ceccarelli, J. Pinassi, P. Fiorenzani,  
A.M. Aloisi***

*Department of Medicine, Surgery and Neuroscience, University of Siena, Italy*

Pain (especially chronic pain) has finally achieved worldwide acceptance as a disease (and not only a symptom) with huge personal and social costs. The discovery of specific cannabinoid receptors (CB1, CB2) and their endogenous ligands has led to a better understanding of the

pharmacological actions and use of cannabinoids as therapeutic agents in various pain conditions. Beta-caryophyllene (BCP, a FDA-approved food additive) selectively bind to peripheral cannabinoid receptors (CB2) and act as full agonists. The omega-3 PUFAs eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) (found in salmon and seaweed) have well-known beneficial activities. In the present study, in vivo tests were carried out to evaluate BCP and DHA anti-inflammatory and analgesic effects, alone or in combination. The behavioral effects of BCP and BCP+DHA were determined in male rats subjected to a model of persistent recurrent pain (three repetitions of the formalin test once a week) to mimic recurrent pain. Both substances were administered per os in almond oil for 2 weeks by oral gavage. Pain responses were significantly decreased in the BCP and BCP+DHA groups with respect to OIL after 1 and 2 weeks of treatment. In conclusion, BCP alone or in combination with DHA was efficacious in modulating pain, showing a clear analgesic activity.

**Key words:** Persistent Pain, cannabinoid receptor, Omega-3.