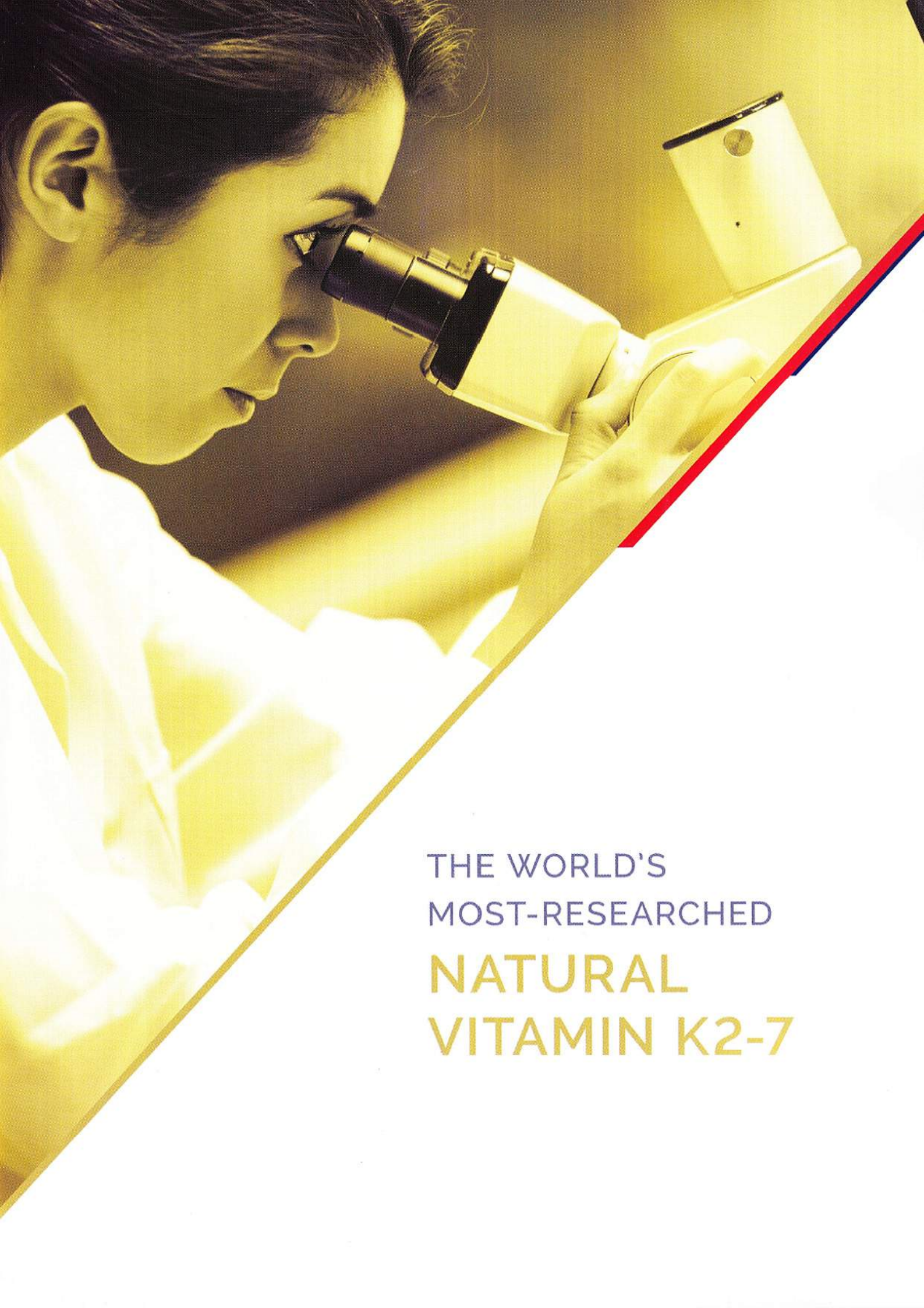


A silhouette of a woman in a yoga pose, standing on a cliff edge. She is in a Warrior II pose, with her right leg forward, left leg back, and her right arm raised. The background is a bright, warm sunset or sunrise, with a gradient from yellow to orange. The woman's silhouette is dark against the bright background. The text 'APPLIK<sub>2</sub>ATIONS' is overlaid on the image, with the '2' in a subscript font.

# APPLIK<sub>2</sub>ATIONS

The many  
ways in which  
MenaquinGold®  
can improve  
your health



THE WORLD'S  
MOST-RESEARCHED  
**NATURAL**  
**VITAMIN K2-7**



# ***MenaquinGold***<sup>®</sup>

*Natural Vitamin K2-7*

## **MenaquinGold<sup>®</sup> is vitamin K2-7**


K2-7 is a long-chain form of menaquinone that has better bioavailability and bioactivity than other forms. It has a longer half-life, which results in more stable serum concentrations. With prolonged intake, K2-7 accumulates to 7- to 8-fold higher levels than other forms of vitamin K.

**MenaquinGold<sup>®</sup> thus induces more of the benefits conferred by vitamin K2.**

# The benefits of vitamin K2 include

- More complete carboxylation of osteocalcin – an essential process which leads to better deposition of calcium into the bone matrix; less calcium deposition in the arteries; and better regulation of glucose homeostasis
- Improvement of the body's oxygen uptake
- Energy enhancement
- Improvement of insulin sensitivity
- Slowing the progress of insulin resistance
- Relief from and prevention of idiopathic muscle cramps
- Improvement in blood perfusion and micro-capillary action
- Improvement in the balance of the autonomic nervous system

## Vitamin K2, by itself or in combination with other nutrients, can address many therapeutic areas:

- Bone health
  - Cardiovascular health
  - Diabetes management
  - Muscle health
  - Aerobic fitness
  - Balance of the autonomous nervous system
  - Control of peripheral neuropathy
- 




Vitamin K2 is an essential addition to formulations that contain calcium and vitamin D3.

***MenaquinGold***<sup>®</sup>  
Natural Vitamin K2-7

# Health applications of MenaquinGold®


## BONE HEALTH



K2 helps bind calcium from the bloodstream to the bone matrix. The job is actually done by proteins called osteocalcin and matrix gla protein (MGP). To function properly, these proteins need to undergo a process called carboxylation, which is dependent on the presence of vitamin K2. Various studies in Japan<sup>1,2</sup> found that levels of under-carboxylated osteocalcin—as well as the risk of fractures—decreased significantly in groups that received vitamin K2, while bone mass density increased.

Vitamin K2 is thus an essential addition to formulations that contain calcium and vitamin D3.

## CARDIOVASCULAR HEALTH



One of the leading causes of heart disease is atherosclerosis, where the arteries thicken with fatty plaque. Plaque formation begins when calcium from the bloodstream is deposited along the walls of the arteries instead of going into the bone matrix. Arterial calcification is now regarded as a major concern, leading to heart attacks and strokes.

Vitamin K2 helps to prevent this from happening. When it activates MGP and osteocalcin through carboxylation, calcium, which might otherwise have been deposited in the arteries, gets deposited in the bone where it belongs. Low levels of vitamin K2-7 mean less carboxylation, which means more calcium deposition in the arteries instead of the bones. With adequate levels of the vitamin, however, things tend to work as they should.<sup>3,4</sup>



Vitamin K2 helps  
bind calcium to the  
bone matrix and  
also helps prevent  
arterial calcification.

***MenaquinGold***<sup>®</sup>  
Natural Vitamin K2-7

## DIABETES MANAGEMENT

Vitamin K2-7 plays a role in improving the body's oxygen uptake. This also helps improve the body's ability to fight diabetes. Poor physical fitness results in improper oxygen utilization, leading to hypoxia and inadequate tissue perfusion. This disturbs the microcirculation, hampering the delivery of glucose and insulin into cells and reducing insulin sensitivity. Studies<sup>5,6,7,8</sup> show that people with a higher dietary intake of vitamin K2 are significantly less likely to develop Type 2 diabetes. The vitamin

- Reduces progression of insulin resistance.
- Improves insulin sensitivity.
- Activates osteocalcin, a protein known to regulate glucose homeostasis

MenaquinGold® also addresses a number of complications in patients with diabetes, including cardiovascular events, peripheral neuropathy, muscle cramps and low energy levels, as an effective biofactor.

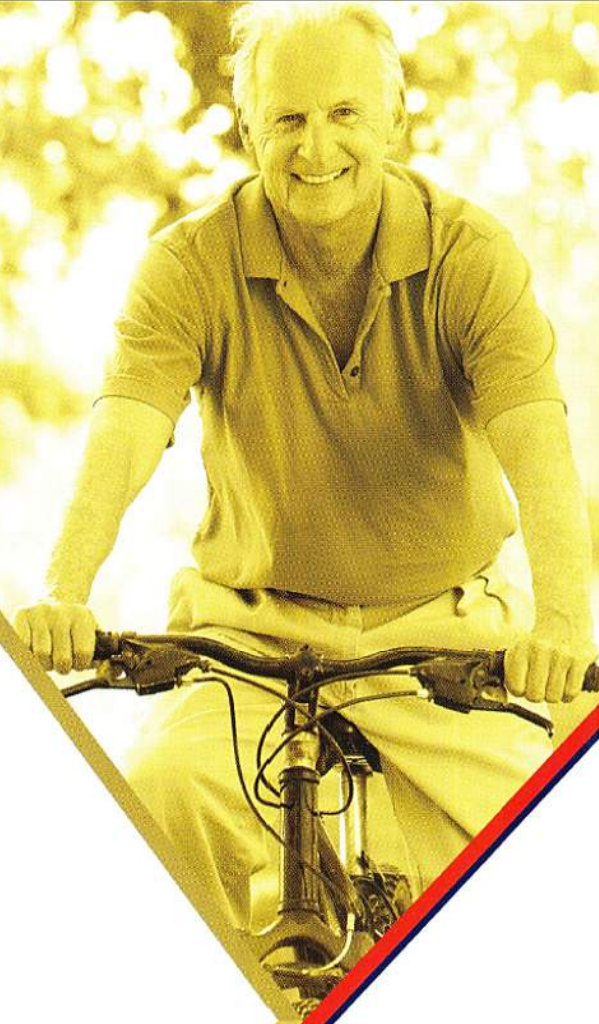
## MUSCLE HEALTH

MenaquinGold® appears to be useful in preventing idiopathic cramps—that is, cramps with no determinable cause. A study<sup>9</sup> by Mehta, et al. observed that a daily administration of vitamin K2-7 provided relief from the severity and frequency of cramps.

## BALANCE OF THE AUTONOMIC NERVOUS SYSTEM

The autonomous nervous system (ANS) plays an important role in the functioning of the heart. Disturbances in the ANS can lead to sympathovagal imbalance and could result in sudden cardiac death. Vitamin K2-7 shows promising results in the correction of the sympathovagal balance.






Vitamin K2 improves  
oxygen uptake—  
good news for both  
diabetics and athletes.

***MenaquinGold***<sup>®</sup>  
Natural Vitamin K2-7


## AEROBIC FITNESS



All the cells in the body depend on a chemical called Adenosine TriPhosphate (ATP) to store and use energy. The body's ability to generate ATP depends primarily on the amount of oxygen in your system. Low oxygen levels are associated with lifestyle-related disorders like diabetes, hypertension, obesity and arteriosclerosis.

Studies<sup>10</sup> show that vitamin K2-7 is associated with improved oxygen uptake and aerobic fitness through increase in  $VO_2$  max levels. It ameliorates the conditions of hypoxia and improves blood perfusion and micro-capillary action. This has a positive effect on athletic performance and reduces the incidence of lifestyle-related diseases.

## CONTROL OF PERIPHERAL NEUROPATHY




Peripheral neuropathy (damage to the nerves of the peripheral nervous system) is a common problem faced by a large number of patients. It can be caused by multiple etiological factors. The most common are vitamin B12 deficiency, folate and diabetes mellitus with symptoms of sensory and motor defects. Even with good glycaemic control and vitamin B12 supplements, some residual neuropathy can remain. The ability of vitamin K2-7 to improve blood perfusion and micro-capillary action plays a role here. Studies<sup>11</sup> show that the therapeutic impact of vitamin K2-7 is considerable in patients with peripheral neuropathy, being well tolerated and effective in relief of symptoms.



The ability of  
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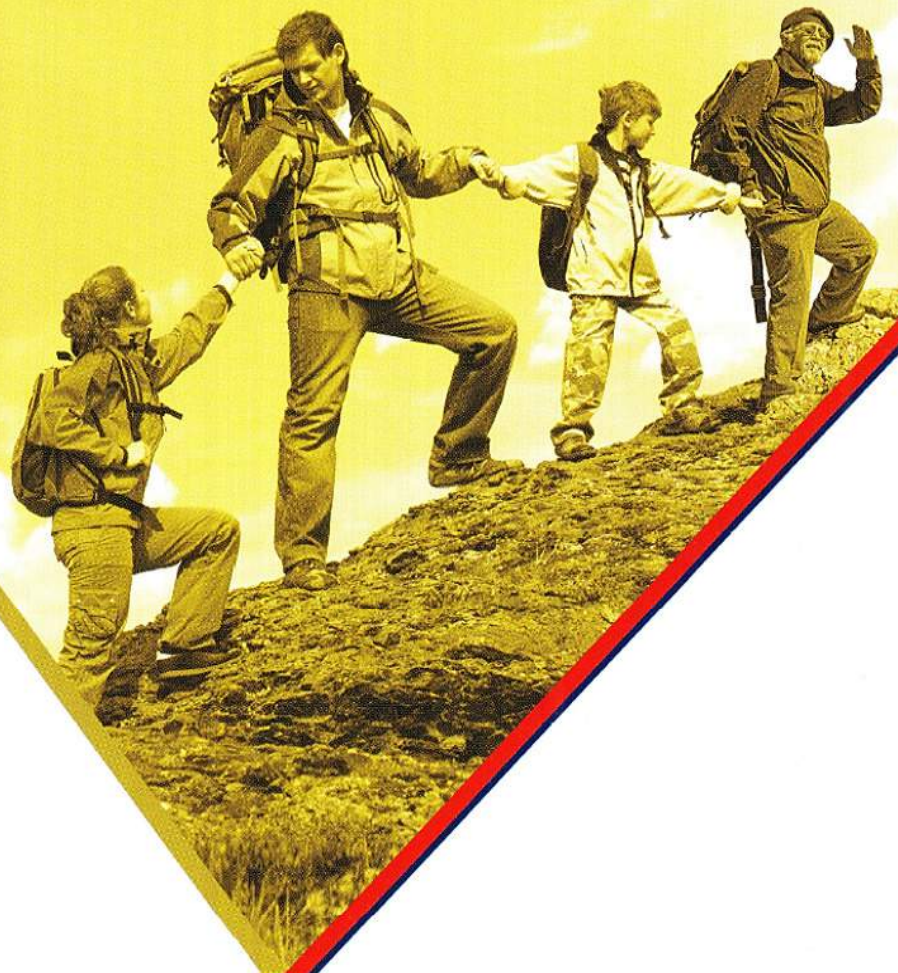
## The vitamin K2 market is getting bigger

As a raw ingredient, vitamin K2 has experienced steady growth over the last few years, especially after the publication of several studies from research institutes that highlight its benefits. Awareness is also growing rapidly through articles in the press and health shows on TV.

Much of the credit for this growth must also go to Viridis BioPharma.

We have been researching, developing & marketing vitamin K2—as MenaquinGold®— for years.

With our development of several grades of K2-7, such as a water-soluble powder form, the market is poised for exponential growth.



Every day, the world  
is becoming more  
aware of the benefits  
of vitamin K2-7.

***MenaquinGold***<sup>®</sup>  
Natural Vitamin K2-7

# Where to use MenaquinGold®

MenaquinGold® can be formulated as a stand-alone or in combination with other functional ingredients. It can be incorporated in a tablet, capsule, softgel or even sachet. MenaquinGold® is extensively documented with an equivalent Drug Master File, thus allowing its incorporation into foods and beverages, pharmaceutical formulations and therapeutic regimens as a dietary supplement. Here are some possibilities:

GRADE	STRENGTH	POSSIBLE APPLICATIONS <small>(Applications include but are not limited to the ones given below)</small>	
		Pharmaceuticals/ Nutraceuticals	Foods and beverages
<b>GRANULE</b>	2500 PPM	Tablets, capsules	<ul style="list-style-type: none"> <li>• Dairy products</li> <li>• Vegetable oils and spreads</li> <li>• Fruit juices</li> <li>• Breads</li> <li>• Confectionery &amp; chocolates</li> <li>• Soy milk</li> <li>• Sports beverages</li> <li>• Energy bars</li> </ul>
<b>POWDER</b>	1000 PPM	Tablets, capsules	
<b>OIL</b>	1500 PPM	Softgels	
<b>WATER-SOLUBLE</b>	1000 PPM	Sachets	
	2000 PPM		

Ingredients for pharmaceutical or nutraceutical applications that can be combined with MenaquinGold® include:

- Calcium salts
- Chromium salts
- Vitamin D3
- Carotenoids
- Vitamin E
- Tocotrenols
- Vitamin C
- Co-enzyme Q10
- Omega 3 fatty acids
- Phytosterols
- Zinc salts
- Boron salts





MenaquinGold®  
can be formulated  
as a stand-alone  
or in combination with  
a wide variety of  
other ingredients.

***MenaquinGold***®  
Natural Vitamin K2-7

# End-to-end solutions from Viridis BioPharma

The solutions and services we offer our partners include:

- Assistance in developing new product formulations using MenaquinGold<sup>®</sup>
- Assistance in Analytical Method Development and Validation
- Assistance in finding innovative application areas
- Reference articles and brochures for promotional material
- Product samples for R&D trials
- Presentations for customer use
- Updated scientific and regulatory information



There are many  
ways we can help you  
incorporate the world's  
most researched vitamin  
K2-7 into your product.

***MenaquinGold***<sup>®</sup>  
Natural Vitamin K2-7

# Patents

Viridis BioPharma has advanced the science and understanding of vitamin K2 with extensive research on its production and applications. We have discovered several novel and critical functions of Vitamin K2 in the body and now have 3 PCT patent applications filed, as well as 2 process patents.

## **TREATMENT OF HUMAN DISEASE CONDITIONS AND DISORDERS USING VITAMIN K ANALOGUES AND DERIVATIVES**

(PCT/IN2008/000465)

The present invention is related to the therapeutic uses of vitamin K, its analogues and derivatives and vitamin K activity synthesized molecules to improve blood perfusion and ameliorate hypoxia for the prevention and/or treatment of chronic venous insufficiencies and consequent diverse complications such as venous and lymphatic oedema, melanization, paper money skin, desquamation, restless leg syndrome, muscle cramps, purpuric petechiae, spider-web phlebomegaly, heaviness of legs, paresthesiae and lower limb nerve pain, pooling of blood in inferior limbs and reduced venous return, venous stasis, orthostatic intolerance, thrombophlebitis and thrombus formation in veins and embolism thereof resulting in cardiovascular pulmonary vascular events.

## **METHOD OF USE OF VITAMIN K AS ENERGY ENHANCER IN DIVERSE DISEASE STATUS**

(PCT/IN2010/000143)

The invention relates to vitamin K, its derivatives and combinations to increase the energy levels in diverse disease states and life style disorders, which are characterized by low energy level due to inadequate  $VO_2$  max and  $pO_2$  and low availability of ATP molecules.  $VO_2$  max, peak oxygen uptake, is intimately connected to several diseases and life style disorders such as Metabolically Obese but Normal Weight (MONW), Overweight/Obese, diabetes mellitus, coronary artery disease, hypertension, cerebral vascular insufficiency, immune deficient states, cancer, aging-related disorders, reduced cardiopulmonary reserves and muscular fitness in athletics, high altitude climbing and exercise.

**DYNAMIC BALANCING OF  
AUTONOMIC NERVOUS SYSTEM  
THROUGH VITAMIN MK-7**  
(PCT/IN2011/00751)

The invention provides method of improving sympathovagal balance in mammals by administering effective amounts of vitamin MK-7 or other vitamin K analogues and their derivatives.

**A NOVEL, ECONOMIC AND  
ECO-FRIENDLY PROCESS FOR  
EXTRACTION OF MENAQUINONE-7  
(VITAMIN K2-7)** (2329/MUM/2007)

The present invention is related to an economical and eco-friendly process of supercritical fluid extraction, for the extraction and purification of vitamin K2-7 from the microbial fermentation broth, involving the sequential steps of (a) culturing and harvesting *B. subtilis natto*; (b) concentrating the broth containing K2-7 cells by cross-flow procedure; (c) mixing the

concentrate with an adsorbent; (d) subjecting mixture to supercritical fluid extraction (SFE) and (e) separation by expansion of gas/solute mixture.

**PROCESS FOR IMPROVED  
RECOVERY OF FERMENTATION  
PRODUCTS FROM INTRACELLULAR  
AND EXTRACELLULAR PRESENCE**  
(US2011/0201054A1)

The present invention increases yield of the target fermented molecules by spray drying the fermentation broth and reducing the process volume to nearly one tenth the original. Thus, none of the target molecules are lost and requirements of the solvent and the other conventional method process equipments and processing materials are reduced considerably. Product recovery is improved. A major saving in the waste water treatment offsets spray drying and offers better process economics.

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Natural Vitamin K2-7



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Manufactured by :

 **SYNERGIA LIFE SCIENCES PVT. LTD.**  
(A Viridis Group Company)

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THE ACTIVE Edge

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