



# Nutrition & Immunity

Meeting evolving consumer needs  
with science-based solutions

EU Webinar June 30th, 2020

 **BASF**

We create chemistry



# Presenters and moderators

**Dr. Natalie Glube-Hooff**

Global Marketing/  
Marketing Europe



**Natalie-devi.glube-hooff@basf.com**

**Dr. Ute Obermueller-Jevic**

Global Scientific Marketing



**Ute.obermueller-jevic@basf.com**

**Dr. Thorsten Schmeller**

Technical Sales/  
Application Labs



**Thorsten.schmeller@basf.com**

# What we will speak to you about today



## What is the state of consumer behavior?

Insights into consumers needs, priorities, purchasing behavior



## How is the market developing?

What trends are going to pave the way for new opportunities, to differentiate in an already crowded space



## How can we approach the immune health space in the 'new normal' ?

Formulating with ingredients founded in science to meet consumer needs  
Trusted micronutrients and emerging ingredients




## What product solutions to meet the specific needs of target consumers?

Some concepts to help inspire product innovation with the consumer in mind

**Building a strong  
immune system should  
start early in life**







**Allergens are a major  
seasonal challenge for our  
immune system with an  
impact on the quality of life**



A photograph of a crowded train car. In the foreground, a man in a grey suit and blue shirt looks down at a newspaper. Next to him, a woman in a grey blazer looks forward. To the right, a man with glasses and a black sweater talks on a mobile phone. Other passengers are visible in the background, some looking towards the camera. A yellow warning sign is visible on the train wall.

**Living in dense populations  
exposes us to pathogens  
and makes it difficult to  
stay healthy**





**Aging people have a natural  
decline in immune defense  
& require additional support**





**2020 has been an  
extraordinary year**

**Bringing lasting  
changes to our lives**



# Consumer behavior changes drastically with the pandemic...

- 1 Eating healthy, doing exercise & the environment are of higher priority for consumers around the globe
- 2 Consumers in most countries expect to spend more on healthcare products & in-home food items
- 3 Immunity is a key health concern & sales of dietary supplements surges as consumers seek to proactively care for their immune health



# Opportunity 1: Trusted ingredients pave the way for emerging ingredient combinations

- Micronutrients form base of **science** backed immune health solutions
- Within the category of micronutrients and beyond Vitamin C, consider other ingredients which have authorized immunity claims globally, for example: **Vitamins A, B<sub>12</sub>, B<sub>6</sub>, C, D**, Zinc, Folate, Copper, Iron, **Carotenoids**
- **Rising stars** with no official health claims can benefit in combi with trusted ingredients e.g. prebiotics, probiotics, protein, fibres



## Opportunity 2: Functional foods & beverages plays a key role, on top of dietary supplements

- Dramatic increase in global searches for the word 'food' and 'immune system' in between Feb & March 2020
- Consumers are looking more to 'real food' to get their nutrients daily, in line with **holistic health trend** and consumers taking ownership of their health
- An **opportunity pocket** exists for immune health in **functional nutrition**



## Opportunity 3: The interface between the gut and immune system

- **Consumers are becoming more and more aware** of the importance and benefits of a healthy gut and the microbiome
- We see **numerous new product launches** with digestive and immunity messages on the market
- **Prebiotics are on the rise** to positively impact the microbiome and the immune system
- **Mucous membranes** and the **gut microbiome** play important roles
- Clear positionings can be made for consumers groups such as the **elderly** and **athletes**

# The immune system:

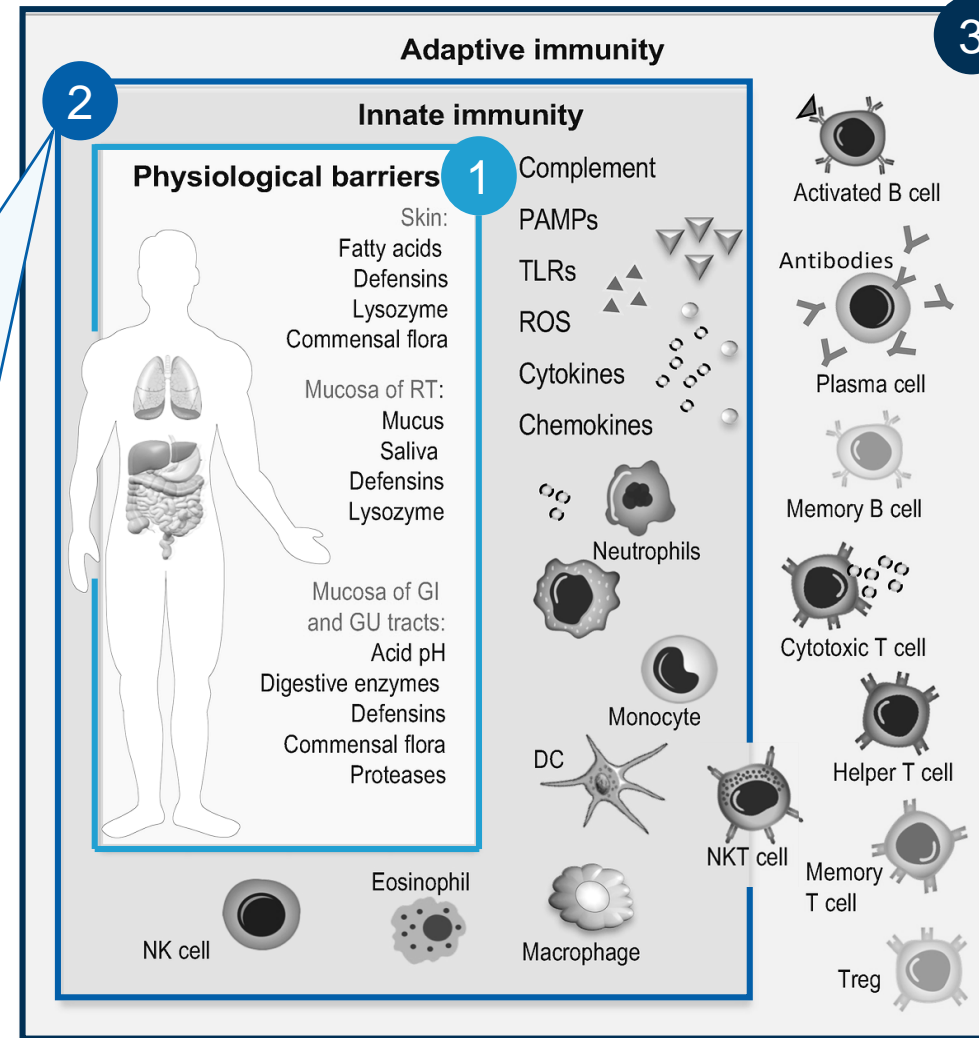
## What is immunocompetence? The role of nutrition



# The immune system functions along three main lines of defense

## 2 Innate immunity:

- Available at birth
- Reacts quickly in an unspecific manner
- Key defense during first-time exposure to pathogens
- Not adaptable, does not change during lifetime



## 3 Adaptive immunity:

- Builds up during lifetime
- Reacts quickly with pathogen-specific antibodies
- Antibodies produced after vaccination or first exposure to pathogens; available for lifetime or certain period
- Pathogens are bound by antibodies and destroyed by immune cells before symptoms of disease occur

# Health ingredients have specific functions & strengthen the immune system

Specific micronutrients work together to reduce the **risk, duration and severity** of infections.

## Vitamin A



- Strengthens skin, eye, lung, and gut barriers inhibiting pathogen intrusion
- Precursor of retinoic acid, key regulator in the immune system
- Improves effectiveness of vaccinations

## Vitamin D



- Strengthens skin, eye, lung, and gut barriers inhibiting pathogen intrusion
- Increases anti-microbial defense proteins
- Inhibits pro-inflammatory cytokines & cytokine storm

## Carotenoids



- Beta-carotene: same effects as vitamin A
- All carotenoids: antioxidant function, strengthening barriers & tissues

## 2'-Fucosyllactose



- Promotes growth of healthy bacteria in the gut
- Inhibits pathogens in the gut
- Modulates immune system in the gut & systemically

## Vitamin E



- Strengthens skin, eye, lung, and gut barriers inhibiting pathogen intrusion
- Anti-inflammatory function
- Stimulates immune cells, particularly in elderly people

## Vitamin B<sub>12</sub>



- Strengthens skin, eye, lung, and gut barriers inhibiting pathogen intrusion
- Required for antibody production
- Modulates immune cells

## DHA/EPA



- Anti-inflammatory function
- Stimulation of immune cells



**Overall strengthened immune system. Lower risk of infections, allergies, autoimmune diseases, and chronic inflammation.**



# Health claims on immunity are permitted for several micronutrients

## EU 28

- **Vitamin A** contributes to the normal function of the immune system
- **Vitamin A** contributes to the maintenance of normal mucous membranes
- **Beta-carotene:** vitamin A contributes to the normal function of the immune system
- **Vitamin B<sub>12</sub>** contributes to the normal function of the immune system
- **Vitamin D** contributes to the normal function of the immune system
- **Vitamin D** contributes to the normal function of the immune system in children
- **Riboflavin** contributes to the maintenance of normal mucous membranes
- Further health claims on antioxidant function for **Vitamin E, Riboflavin, Lutein, Lycopene**

## Russia & CIS

- **Vitamin A** contributes to the normal function of the immune system
- **Vitamin B<sub>12</sub>** contributes to the normal function of the immune system
- **Vitamin D** contributes to the normal function of the immune system
- **Vitamin B<sub>2</sub>** contributes to the protection of cells from oxidative stress

## Turkey

- **Vitamin A** contributes to the normal function of the immune system
- **Vitamin B<sub>12</sub>** contributes to the normal function of the immune system
- **Vitamin D** contributes to the normal function of the immune system

## South Africa

- **Vitamin E** is an antioxidant for the maintenance of good health OR a factor for the maintenance of good health
- **Beta-carotene** can be converted to vitamin A in the body OR Beta-carotene functions as a tissue antioxidant and so keeps cells healthy
- **Vitamin E** contributes to the protection of cells from oxidative stress OR a factor in the maintenance of good health

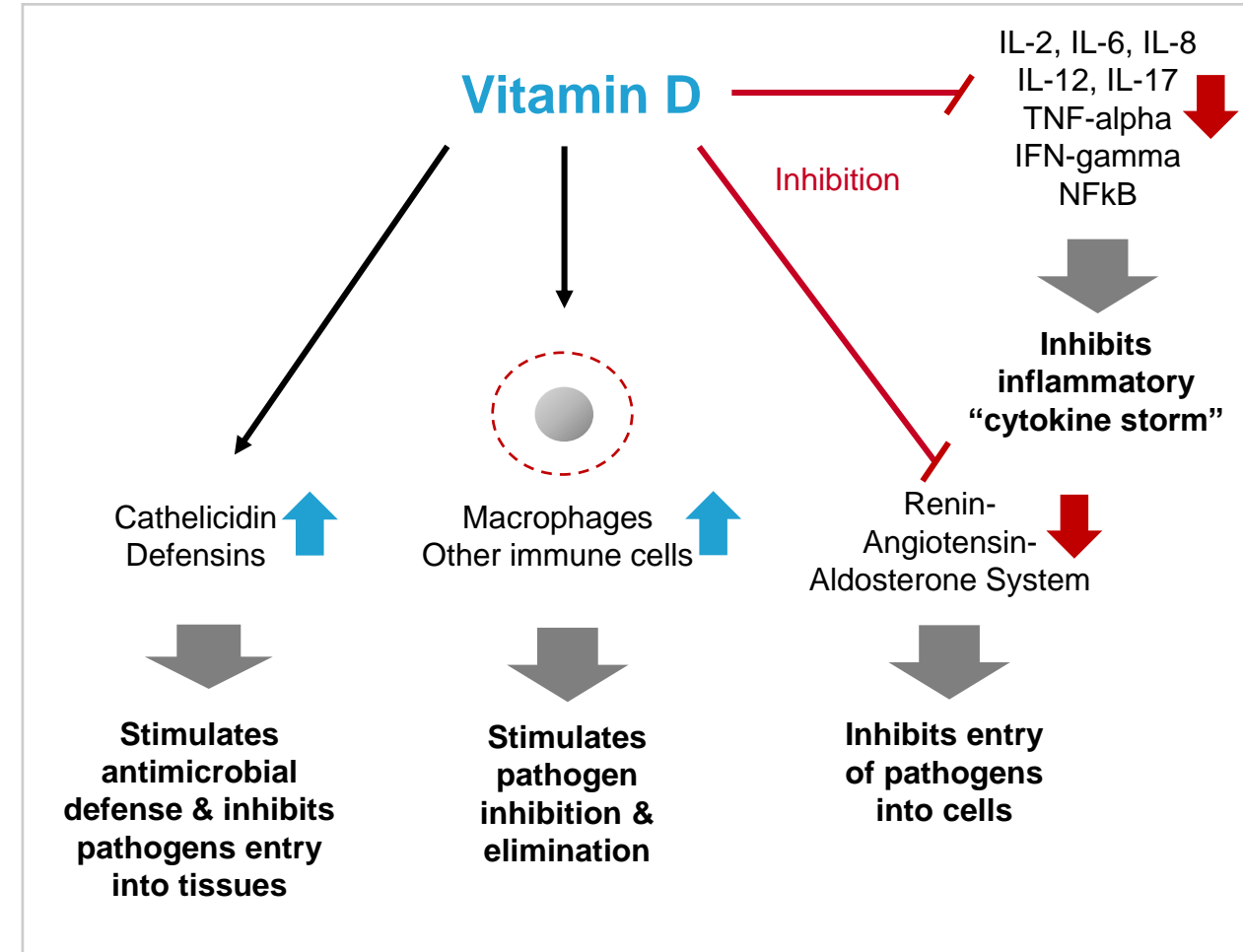
Please note: country-specific NRV requirements to be met for claims to be made

Further information on claims is available at  
<https://myapps.basf.com/CLARA/>

# Vitamin D directly modulates nearly all immune cells

- Vitamin D plays a strong regulatory role in the immune system (**innate & adaptive immunity**).
- Immune cells have Vitamin D receptor and CYP27B1 enzyme (converts Vitamin D to active hormone)
- Multiple effects shown for Vitamin D:
  - Supports production of **antimicrobial peptides**
  - Stimulates function of macrophages and other **immune cells**
  - Negative regulatory factor of the **Renin-Angiotensin-Aldosterone-System (RAS)**
  - Inhibits release of pro-inflammatory cytokines
  - Inhibits antigen-presenting cells increasing tolerance

**Vitamin D impacts key functions required for defense against pathogens**





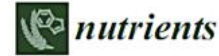
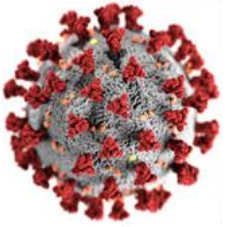
# Vitamin D and COVID-19

- Benefits of Vitamin D have been suggested based on **known functionalities** and **observations**.
- Controlled trials from the past showed Vitamin D **inhibits acute respiratory infections**.
- Testing positive for COVID-19 was **associated with likely being Vitamin D deficient** (Meltzer DO et al, 2020; D'Avolio A et al, 2020).
- Clinical studies with COVID-19 patients are underway. In the meantime, Vitamin D supplementation has been suggested to strengthen immune system and lower the risk of severe disease outcomes.
- ***“Vitamin D treatment may decrease the risk of incidence of the COVID-19 infection (...), as well as decrease the mortality and severity of patients with COVID-19.”*** (Aygun H, 2020)

Aging Clinical and Experimental Research  
<https://doi.org/10.1007/s40520-020-01570-8>

SHORT COMMUNICATION

The role of vitamin D in the prevention of coronavirus disease 2019 infection and mortality



Review

## Evidence that Vitamin D Supplementation Could Reduce Risk of Influenza and COVID-19 Infections and Deaths

William B. Grant <sup>1,\*</sup>, Henry Lahore <sup>2</sup>, Sharon L. McDonnell <sup>3</sup>, Carole A. Baggerly <sup>3</sup>, Christine B. French <sup>3</sup>, Jennifer L. Aliano <sup>3</sup> and Harjit P. Bhattoa <sup>4</sup>

<sup>1</sup> Sunlight, Nutrition, and Health Research Center, P.O. Box 641603, San Francisco, CA 94164

<sup>2</sup> 2289 Highland Loop, Port Townsend, WA 98368, USA; hlahore@vitamindwiki.com.

<sup>3</sup> GrassrootsHealth, Encinitas, CA 92024, USA; Sharon@grassrootshealth.org (S.L.M.); carole@grassrootshealth.org (C.A.B.); Christine@grassrootshealth.org (C.B.F.); jen@grassrootshealth.org (J.L.A.)

<sup>4</sup> Department of Laboratory Medicine, Faculty of Medicine, University of Debrecen, Nagyer H-4032 Debrecen, Hungary; harjit@med.unideb.hu

\* Correspondence: wgrant@infionline.net; Tel.: +1-415-409-1800

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**Abstract:** The world is in the grip of the COVID-19 pandemic. Public health measures to reduce the risk of infection and death in addition to quarantines are desperately needed. This review examines the roles of vitamin D in reducing the risk of respiratory tract infections, the epidemiology of influenza and COVID-19, and how vitamin D supplementation is a useful measure to reduce risk. Through several mechanisms, vitamin D can reduce risk. Those mechanisms include inducing cathelicidins and defensins that can lower viral rates and reducing concentrations of pro-inflammatory cytokines that produce the damage that injures the lining of the lungs, leading to pneumonia, as well as increasing certain anti-inflammatory cytokines. Several observational studies and clinical trials reported supplementation reduced the risk of influenza, whereas others did not. Evidence supporting vitamin D in reducing risk of COVID-19 includes that the outbreak occurred in winter. 25-hydroxyvitamin D (25(OH)D) concentrations are lowest; that the number of cases in the Northern Hemisphere near the end of summer are low; that vitamin D deficiency has been found to be associated with acute respiratory distress syndrome; and that case-fatality rates increase with age and disease comorbidity, both of which are associated with lower 25(OH)D concentration. It is recommended that people at risk of influenza and/or COVID-19 take 10,000 IU/d of vitamin D<sub>3</sub> for a few weeks to rapidly raise 25(OH)D concentration.



Our aim was to propose a hypothesis that there is a potential link between vitamin D status and the risk of COVID-19. The mean 25(OH)D concentration and mortality caused by COVID-19 were acquired. Negative correlation was observed between 25(OH)D concentration and mortality (mean 5.96, STDEV 15.13) were observed. Vitamin D deficiency was observed in Spain, Italy and Switzerland. This is also the most vulnerable population to perform dedicated studies about vitamin D levels.

In Focus

## Vitamin-D and COVID-19: do deficient risk a poorer outcome?

Despite difficulties in comparing data across nations, mortality from COVID-19 is clearly higher in some countries than in others. Many factors could have a role in this disparity, including differences in proportion of elderly people in a population, general health, accessibility and quality of healthcare, and socioeconomic status. One mostly overlooked factor that could influence outcome of COVID-19 is the relative vitamin D status of populations. Because people are advised to stay at home as much as possible, the government health agencies of Great Britain have recommended that people take vitamin D supplements through summer and autumn during this pandemic. Vitamin D supplementation could be especially important for older people as they are at high risk of poor outcome from COVID-19 and of vitamin D deficiency.

Vitamin D has a well-characterized role in calcium and phosphate balance, affecting bone growth and turnover. Low vitamin D status is also associated with other non-communicable diseases and with increased susceptibility to infectious disease; notably, upper respiratory tract infections. However, whether low vitamin D levels are a cause or consequence of disease has remained a point of heated debate. Intervention trials have rarely shown benefits of vitamin D supplementation as treatments or preventive measures. However, one important exception

links outcomes of COVID-19 and vitamin D status. SARS-CoV-2, the virus responsible for COVID-19, emerged and started its spread in the Northern Hemisphere at the end of 2019 (winter), when levels of 25-hydroxyvitamin D are at their nadir. Also, nations in the northern hemisphere have borne much of the burden of cases and mortality. In a cross-sectional analysis across Europe, COVID-19 mortality was significantly associated with vitamin D status in different populations. The low mortality rates in Nordic countries are exceptions to the trend towards poorer outcomes in more northerly latitudes, but populations in these countries are relatively vitamin D sufficient owing to widespread fortification of foods. Italy and Spain are also exceptions, but prevalence of vitamin D deficiency in these populations is surprisingly common. Additionally, black and minority ethnic people—who are more likely to have vitamin D deficiency because they have darker skin—seem to be worse affected than white people by COVID-19. For example, data from the UK Office for National Statistics shows that black people in England and Wales are more than four times more likely to die from COVID-19 than are white people.

A role for vitamin D in the response to COVID-19 infection could be twofold. First, vitamin D supports production of antimicrobial peptides in the respiratory epithelium, thus making infection less likely. Second, vitamin D downregulates expression of ACE2, vitamin D promotes expression of this gene. Rose Anne Kenny (Trinity College Dublin, University of Dublin, Ireland) led the cross-sectional study into mortality and vitamin D status and is the lead investigator of the Irish Longitudinal Study on Ageing (TILDA). She is adamant that the recommendations from all public health bodies should be for the population to take vitamin D supplements during this pandemic. “The circumstantial evidence is very strong”, she proclaims regarding the potential effect on COVID-19 outcomes. Adding, “we don’t have randomized controlled trial evidence, but how long do you want to wait in the context of such a crisis? We know vitamin D is important for musculoskeletal function, so people should be taking it anyway”. Kenny recommends that, at the very least, vitamin D supplements are given to care home residents unless there is an extremely good reason not to do so. Adrian Martinez (Institute of Population Health Sciences, Barts and The London, Queen Mary University of London, UK), lead author of the 2017 meta-analysis, has joined with colleagues from universities around the UK to launch COVIDENCE UK, a study to investigate how diet and lifestyle factors might influence transmission of SARS-CoV-2, severity of COVID-19 symptoms, speed of recovery, and

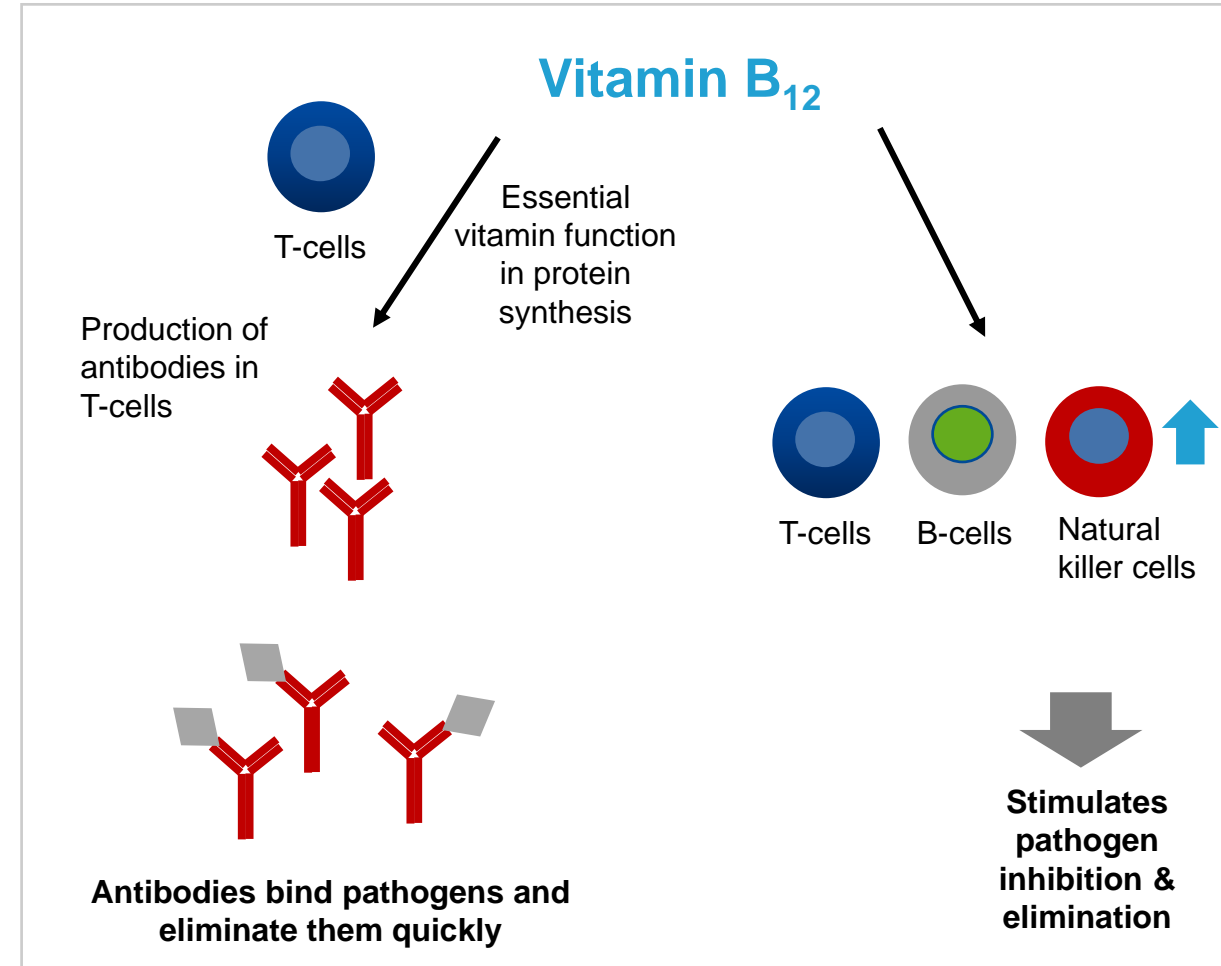


New topic in 2020,  
~80 publications in Pubmed

# Vitamin B<sub>12</sub> is needed for production of immune cells & antibodies

- Vitamin B<sub>12</sub> is required for the **production of immune cells** including B-cells, T-cells and natural killer cells.
- It may **act as an immunomodulator** and enhance the number of cytotoxic T cells, which attack antigen-presenting cells.
- Furthermore, Vitamin B<sub>12</sub> is **essential for the production of antibodies from amino acids** (in concerted action with Vitamin B<sub>6</sub> and folic acid).

**Vitamin B<sub>12</sub> plays a fundamental role in safeguarding production of immune cells and antibodies**

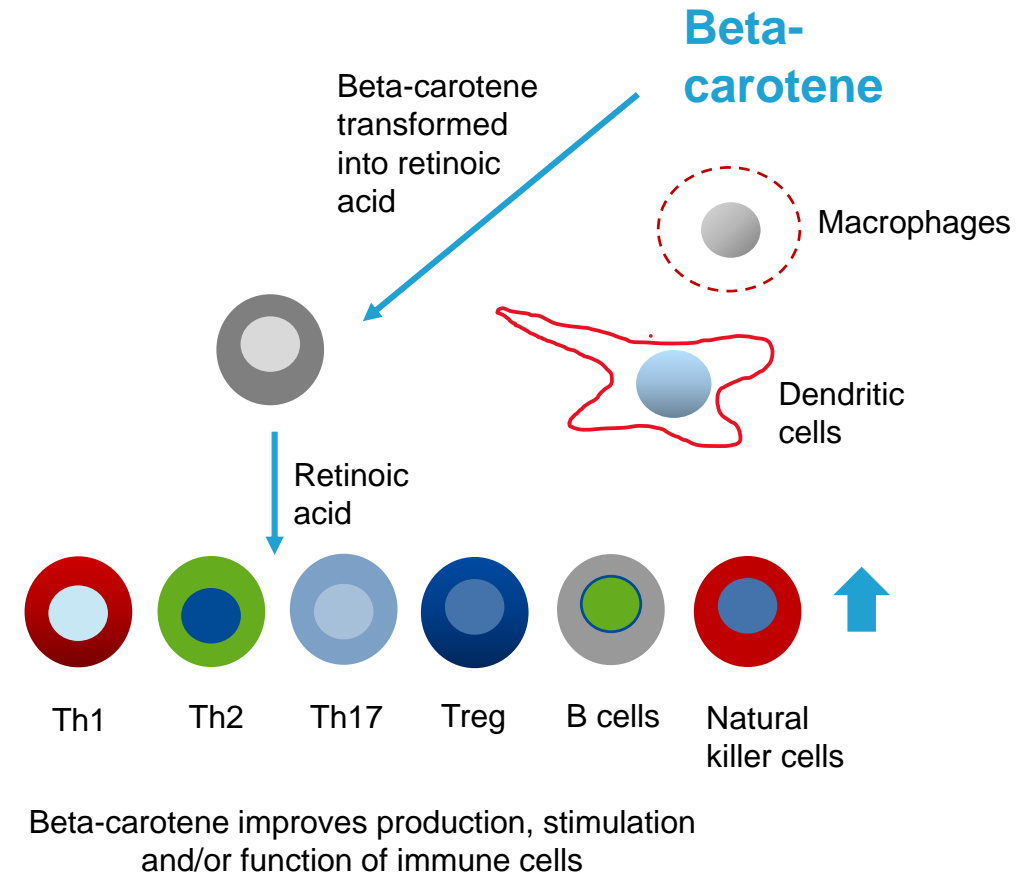




# Beta-carotene is a precursor of retinoids, which are key regulators in the immune system

- Beta-carotene is a **precursor of retinoids**
- Retinoids activate & modulate the innate as well as acquired immune functions
  - For example, retinoids regulate cytokine and antibody production, migration and maturation of B- and T-cells
- Moreover, as an **antioxidant**, beta-carotene like other carotenoids helps protect tissues and strengthens barrier function in skin, lungs, eyes, and the gut.

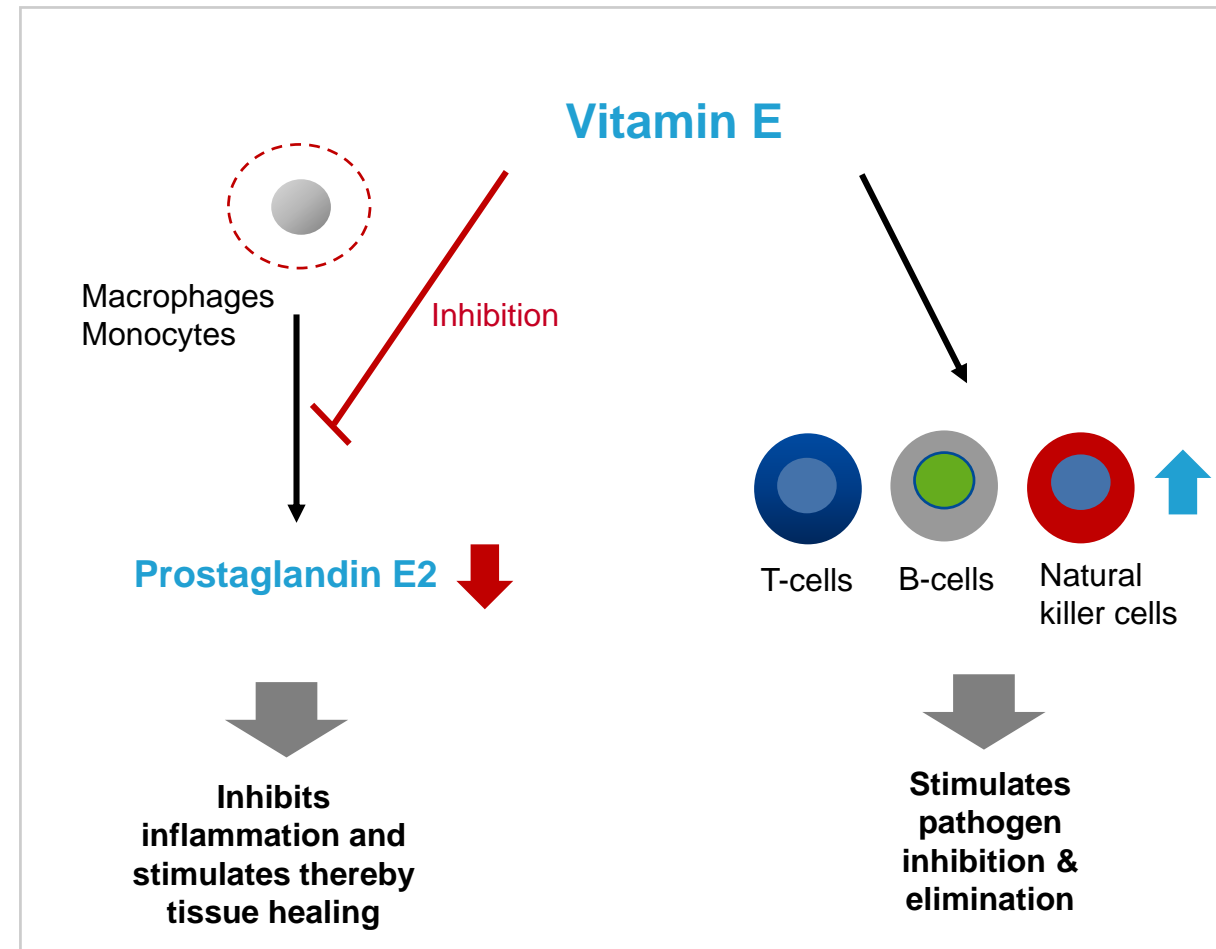
**Beta-carotene supports barrier function and is precursor of key regulator in the immune system**



# Vitamin E regulates immune functions via antioxidant and anti-inflammatory effects

- Vitamin E has an important impact on immune functions as it modulates both **cellular & humoral immune responses**.
- In immune cells, Vitamin E is strongly enriched. These cells have a high oxidative stress burden due to rapid metabolic turnover. Vitamin E as an antioxidant helps protect immune cells and impacts their production & function.
- Vitamin E **inhibits** production of pro-inflammatory **prostaglandin E2** in macrophages/monocytes and thereby inhibits inflammatory processes.

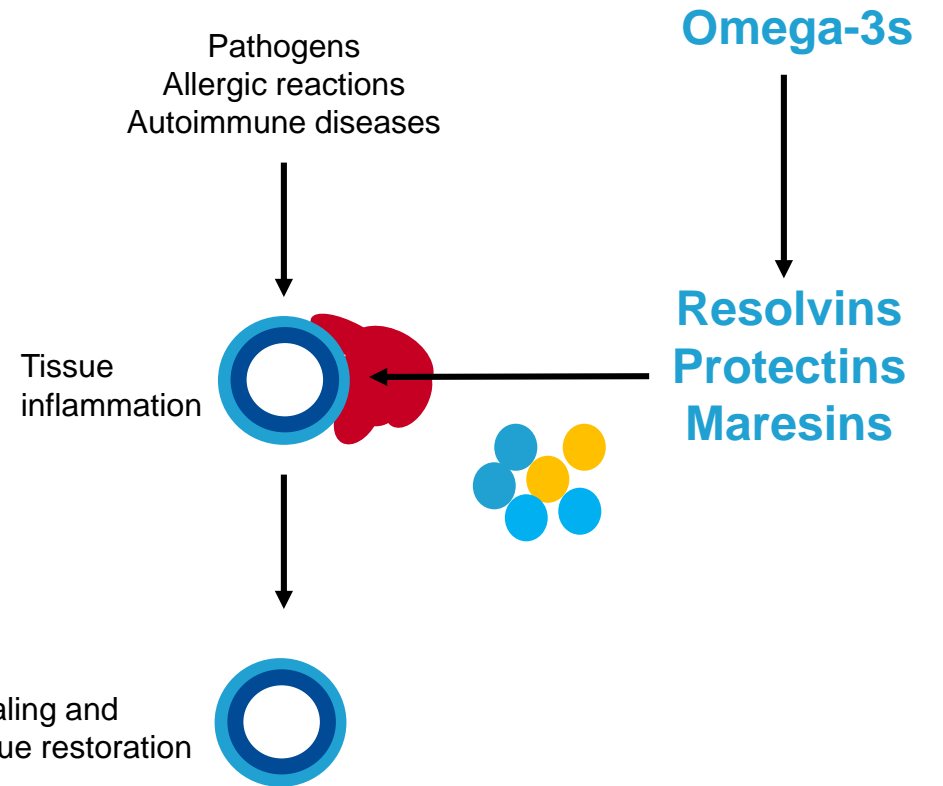
**Vitamin E helps maintain immune function by inhibiting inflammation & supporting immune cells**





# Omega-3 fatty acids have major anti-inflammatory function and thereby support healing

- The omega-3 fatty acids EPA and DHA have **anti-inflammatory** effects. At the site of inflammation, the two omega-3 fatty acids are metabolized into specialized pro-resolving mediators (SPMs) known as resolvins, protectins, and maresins.
- Thereby, resolution of inflammation occurs and **healing** of tissues is supported.
- Moreover, DHA is a structural fatty acids helping to stabilize **membranes of immune cells**.



**Omega-3 fatty acids support immune cells and resolution of inflammation**

# HMO: Prebiotic 2'-FL benefits immune system in the gut & beyond

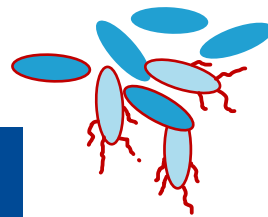
INNOVATION  
OPPORTUNITY

## Enteric immune system

- 2'-fucosyllactose (2'-FL) is the **most abundant oligosaccharide in women's breastmilk**
- Important for child development, e.g. building a strong immune system
  - **Stimulates growth of beneficial bacteria** like bifidobacteria and fosters a healthy gut microbiome (prebiotic effect)
  - **Anti-microbial effects** inhibiting pathogen adhesion & colonization (bacteria, viruses)
  - **Strengthens gut barrier** as it supports maturation and helps maintain barrier function, helps restore damages



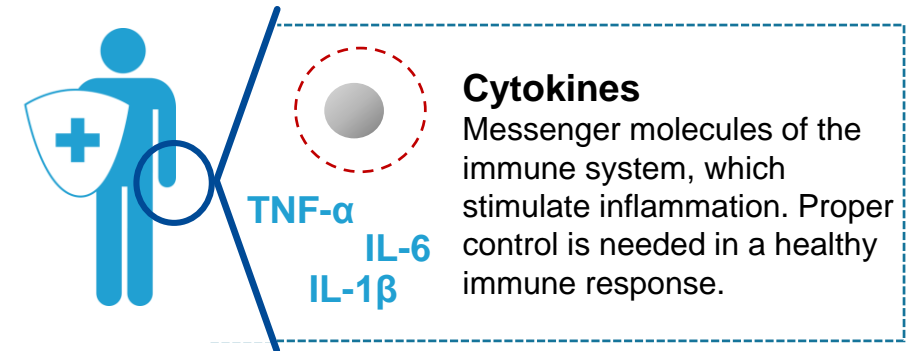
Beneficial effects observed also in adults



**2'-FL is an important human milk oligosaccharide which supports the enteric immune system**

## Systemic immune system

- 2'-FL likely has positive effects beyond gut health (as shown mostly in experimental studies so far)
  - Decrease in pro-inflammatory cytokines in blood
  - Lower risk of allergies
  - Improved vaccination response



**2'-FL is an important human milk oligosaccharide which supports the enteric immune system**

# Learn more about the important role the gut and 2'-FL can play in supporting immune health



## Join us at our virtual exhibition “BASF GROWTH DAY 2.0”

**Date:** Monday July 13, 2020 **Time:** 11:00 – 15:00 GST



Human Nutrition will showcase relevant products and solutions to meet our customer and your consumer needs. In addition, you will have the opportunity to virtually connect with one of many other BASF segments. There will be excellent networking and information sharing opportunities via live chats and keynote presentations. Visit our booth and don't miss our webinars where you can directly interact with our experts!

**11:15 – 12:00 or 13:15 – 14:00 GST**

### **Food Performance Ingredients: Clean label trend in bakery**

**Speakers:** Kathrin Saur, Global Product Manager Food Performance Ingredients, Jochen Kutscher, Manager Application Labs Food Performance Ingredients and Anna Denhoyer, Head of Product Management & Application Food Performance Ingredients, BASF

**12:15 – 13:00 or 14:15 – 15:00 GST**

### **Health Ingredients: Exploring the interface between gut health and immunity**

**Speakers:** Marianne Heer, Scientific Marketing Manager, and Mareike Kampmann, Global Marketing Dietary Supplements, BASF

For more information on the exhibition and registration please

[CLICK HERE](#)



# Consumer Solutions

Providing the right nutrients to the right people at the right time





# Immunity Power Juice

*“I live in a big city and my life is rather stressful.  
I want to have a strong immune system”*

## What is the market need?

- Beverages for immune support
- Good taste with herbals, fruits & vegetables (“superfoods”)

## What is the consumer benefit?

- Provides (pro)vitamin A, E & C in a modern type of “ACE” beverage
- Beta-carotene is a precursor of retinoic acid, a key regulator in the immune system. Vitamin E and Vitamin C have antioxidant, tissue protective function and stimulate immune cells
- Fruits & vegetables are popular “superfoods”
- Herbals are traditionally used for immune support

... Better immune function when life is busy



## Health ingredients

Serving size: 1 glass/day

	Dosage per glass
Vitamin A	400 µg
Vitamin E	6 mg
Vitamin C	40 mg



# Immunity Booster Effervescent Tablets

*"I want to be as healthy as I was when I was younger.  
My immune system needs an extra boost."*

## What is the market need?

- Easy to consume supplements for elderly people, no big capsules
- Support of immune system as it naturally declines during aging

## What is the consumer benefit?

- Provides high-dose beta-carotene, vitamin E and vitamin D<sub>3</sub>
- Beta-carotene is a precursor of retinoic acid, a key regulator in the immune system; important for barrier functions as first line of defense against pathogens, and for effectiveness of vaccinations
- Vitamin E has anti-inflammatory properties and stimulates immune cells
- Vitamin D<sub>3</sub> strengthens antimicrobial defence, stimulates immune cells and has anti-inflammatory properties

## ... Better immune function while aging



## Health ingredients

**Serving size:**  
**1 effervescent tablet/day**

	Dosage per tablet
Beta-carotene	20 mg
Vitamin E	200 mg
Vitamin D <sub>3</sub>	15 µg



# Daily Defense Antioxidant Capsules

*“I live in a crowded, polluted city and wonder how I can protect myself better.”*

## What is the market need?

- Easy to swallow capsules for daily immune support

## What is the consumer benefit?

- Provides 24 mg of antioxidants per capsule including beta-carotene, lutein, lycopene and vitamin E
- Helps to evenly distribute fat-soluble antioxidants in body tissues
- Antioxidant combination helps replenish the body's antioxidant defence network and supports barrier immune function
- In addition, beta-carotene is a precursor of retinoids, which are key regulators in the immune system.

## ... Better protection against environmental stressors



## Health ingredients

**Serving size: 1 capsule/day**

	Dosage per capsule
Betatene® Beta-carotene	4 mg
Xangold® Lutein esters	4 mg
LycoVit® Lycopene	4 mg
Vitamin E	12 mg

# Prebilac® 2'-FL plus Vitamin Immune Sachet

*"I want to take a supplement that helps boost my gut immune system."*

## What is the market need?

- Supplements that can be mixed easily into beverages & foods
- Neutral taste or, alternatively, fruity taste (lemon, orange)

## What is the consumer benefit?

- 2'-FL fosters a healthy gut by facilitating the growth of beneficial bacteria and supporting intestinal immune functions
- Vitamin D<sub>3</sub> strengthens antimicrobial defence, stimulates immune cells and has anti-inflammatory properties
- Vitamin B<sub>12</sub> supports production of antibodies and immune cells
- Vitamin B<sub>2</sub> contributes to the protection of cells from oxidative stress



## Health ingredients

**Serving size: 1 sachet/day**

Dosage per sachet

<b>PREBILAC® 2'-FL</b>	<b>3 g</b>
<b>Vitamin D<sub>3</sub></b>	<b>5 µg</b>
<b>Vitamin B<sub>12</sub></b>	<b>2.5 µg</b>
<b>Vitamin B<sub>2</sub></b>	<b>1.4 mg</b>

## ... Better immune function in the gut

# “New Normal” Immunity Smoothie

*“My life has changed. I work from home and have virtual meetings all day long. Going out and meeting people is very limited.”*

## What is the market need?

- Modern nutritional solutions for teenagers & young adults that address changes in lifestyle and the “New Normal”
- Healthy, fortified ready-to-drink beverages

## What is the consumer benefit?

- 2'-FL fosters a healthy gut by facilitating the growth of beneficial bacteria and supporting intestinal immune functions
- Vitamin D strengthens the immune system in its antimicrobial defence, stimulates immune cells and has anti-inflammatory properties
- Lutein has anti-oxidant function and helps support eye health, e.g. during prolonged exposure to digital devices

... **Better support of immunity and “new normal” lifestyle!**



## Health ingredients

**Serving size: 1 smoothie/day**

**PREBILAC® 2'-FL**

**Vitamin D<sub>3</sub>**

**Xangold® Lutein**

Dosage per 240 mL

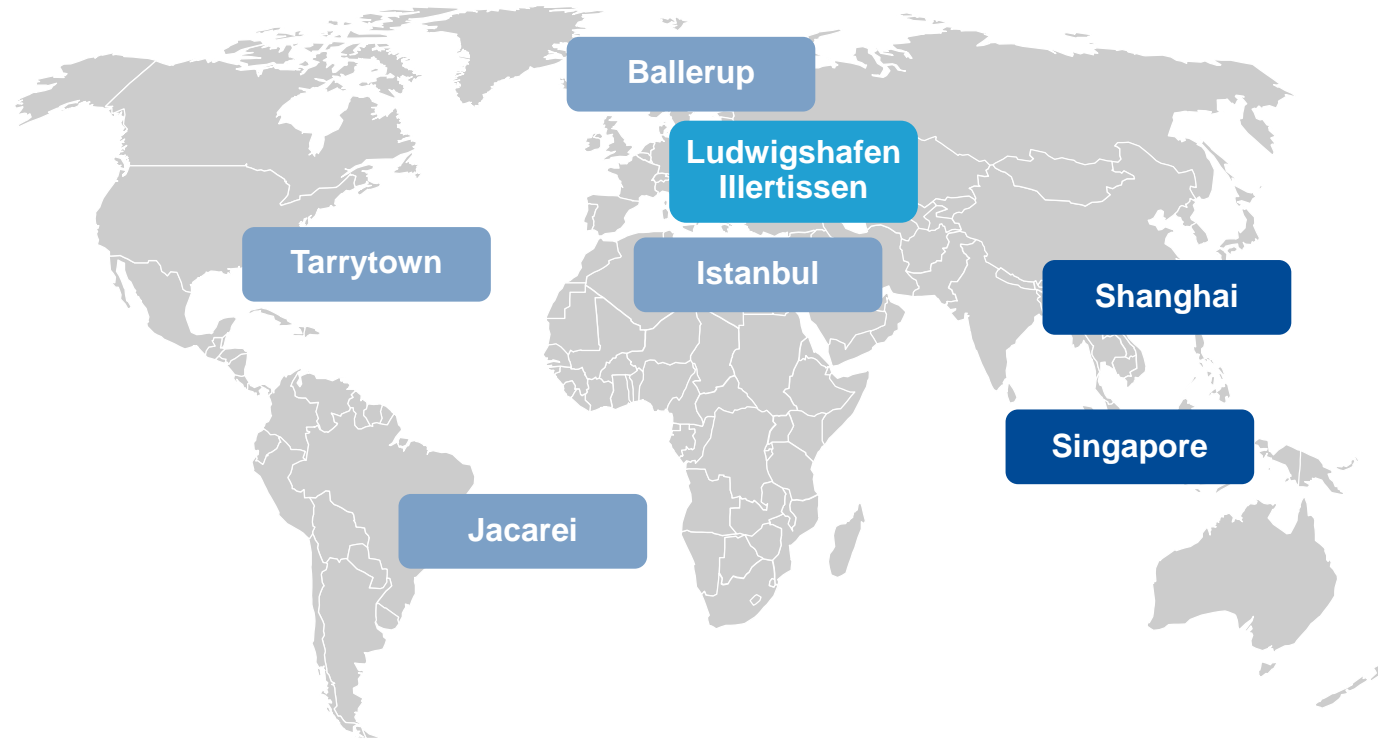
**200 mg**

**200 IU**

**2 mg**



# We are close to our customers & close to their markets



- Combining expert know-how of health and performance ingredients with state of the art equipment
- Deep understanding of local needs, preferences and habits
- Access to local ingredients from diverse cultures and tastes

## Solid applications



## Liquid applications



## Food Performance Systems



**Let's stay connected!**  
**Stay healthy!**

**Follow us:**



**BASF Human Nutrition**



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**Local account manager or**

**Natalie-devi.glube-hooff@basf.com**

**Ute.obermueller-jevic@basf.com**

**Thorsten.schmeller@basf.com**



We create chemistry