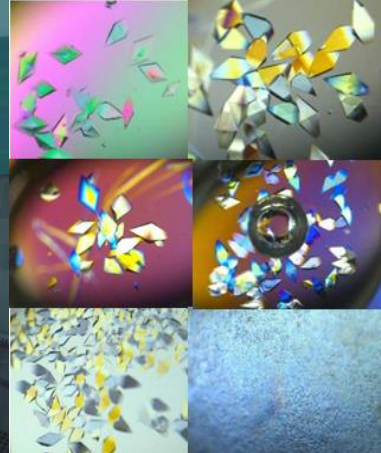


NOMAD Bioscience GmbH

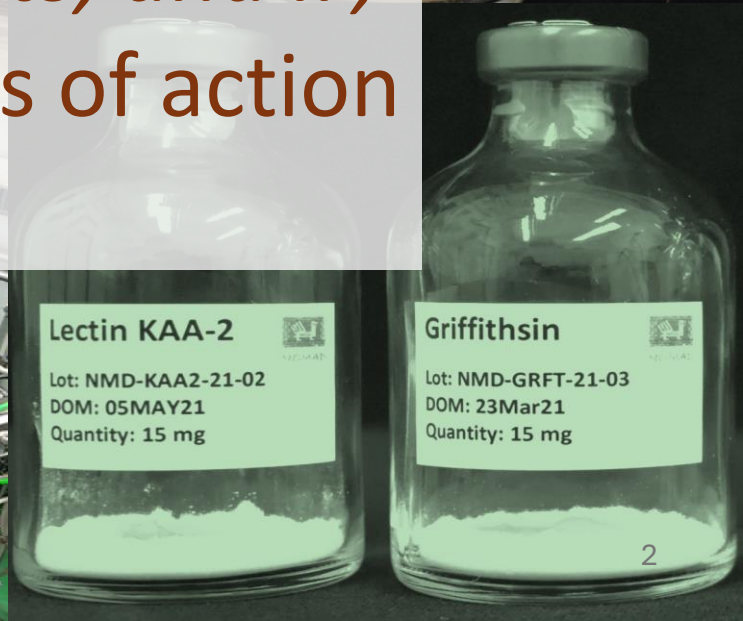
Your Discovery, Research,
Development & Industrialization
Partner



November, 2024



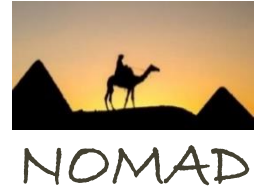
NOMAD offers R&D services, products, and IP, related to biologics with novel modes of action derived from plants



Lectin KAA-2
Lot: NMD-KAA2-21-02
DOM: 05MAY21
Quantity: 15 mg

Griffithsin
Lot: NMD-GRFT-21-03
DOM: 23Mar21
Quantity: 15 mg

NOMAD Bioscience - Portfolio



■ R&D Services

- magnICON™ and NOMADIC™ expression platforms for fast and high-level expression of recombinant proteins in plants
- Plant production hosts with humanized or designer glycosylation
- World-renown 'Golden Gate' DNA Assembly platform
- Genome editing
- Fast RNA-based plant reprogramming - 'traits on demand'

■ Products:

- Bacteriocins for control of multidrug-resistant bacteria (medicine)
- Antiviral proteins Lectins (medicine)
- Non-antibiotic antibacterials for food safety (FDA approved GRAS)
- Natural non-caloric Sweetener Proteins Thaumatin and Brazzeins (FDA & FEMA approved GRAS)

■ Intellectual Property:

- Vast patent estate with over 500 issued patents and >60 patent families available for (exclusive) licensing, including dominant IP in antibacterial proteins Bacteriocins & Sweet and Taste Modifying Proteins





Nomad

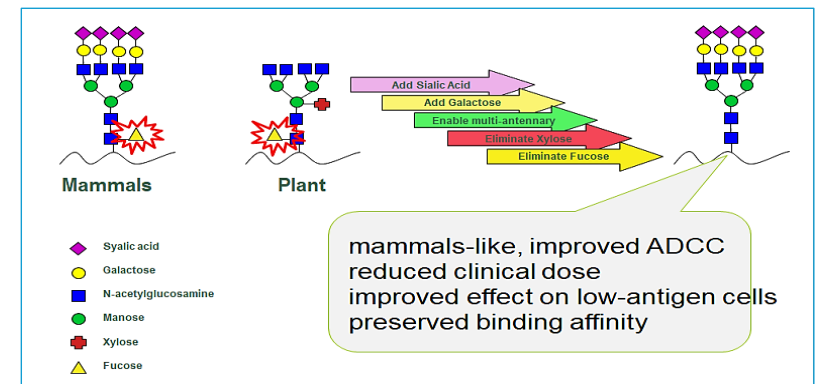
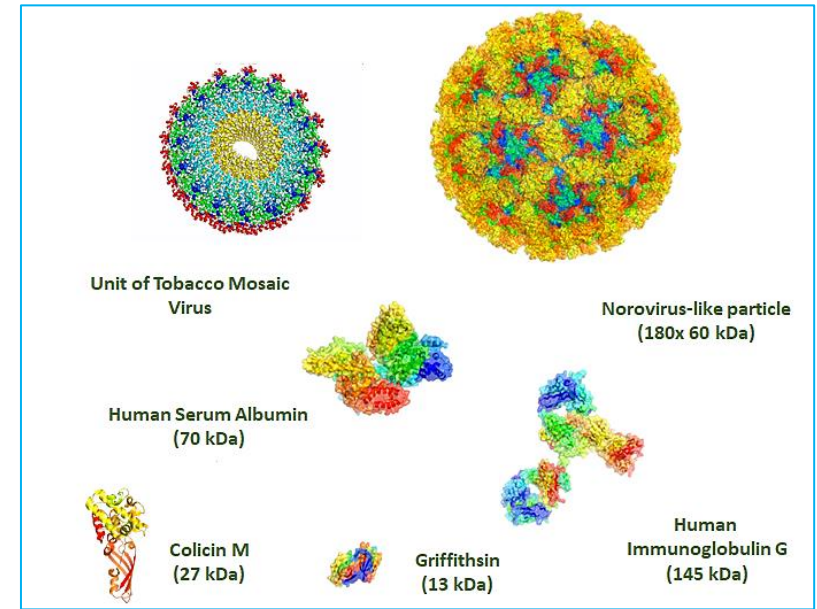
Bioscience

inspired by nature and evolution

R&D Services

NOMAD Bioscience – Research, Development and Manufacturing Platforms

- magnICON™ and NOMADIC™ expression platforms for fast and high-level expression of recombinant proteins in plants
 - Work with over 600 proteins of different classes, sizes and complexity
 - Expression levels of up to 80% of total soluble protein, 12 g/kg of biomass
 - Used to produce multiple product candidates in successful clinical trials (FDA, EMA)
 - Basis for 10 successful GRAS certifications with FDA, FEMA, USDA
- Adaptable expression systems for transient or transgenic expression optimized for fast R&D discovery/optimization or large-scale industrial production of recombinant proteins, GMP compliant
- Plant production hosts with humanized or designer glycosylation
- World-renown ‘Golden Gate’ DNA Assembly platform
- Genome editing
- Fast RNA-based plant reprogramming - ‘traits on demand’





Nomad

Bioscience

inspired by nature and evolution

Available Products

NOMAD Bioscience – Product Pipelines

- NOMAD's most advanced products are:

Medicine

- **Bacteriocin ColU** for control of bacteremia due to multidrug resistant *E. coli*; completing pre-clinical studies
- **Q-Griffithsin**, Antiviral protein for preventative therapy of respiratory enveloped viruses (Influenza, Corona and Rhino (common cold) viruses); Phase I clinical studies

Food

- **Thaumatococcus II**, natural high intensity non-caloric sweetener, pilot scale, industrial production to start in 2025
- **Salmocin E1a**, Non-antibiotic antibacterial for food substances/processing aids, pilot scale, industrial production to start in 2026

Agriculture

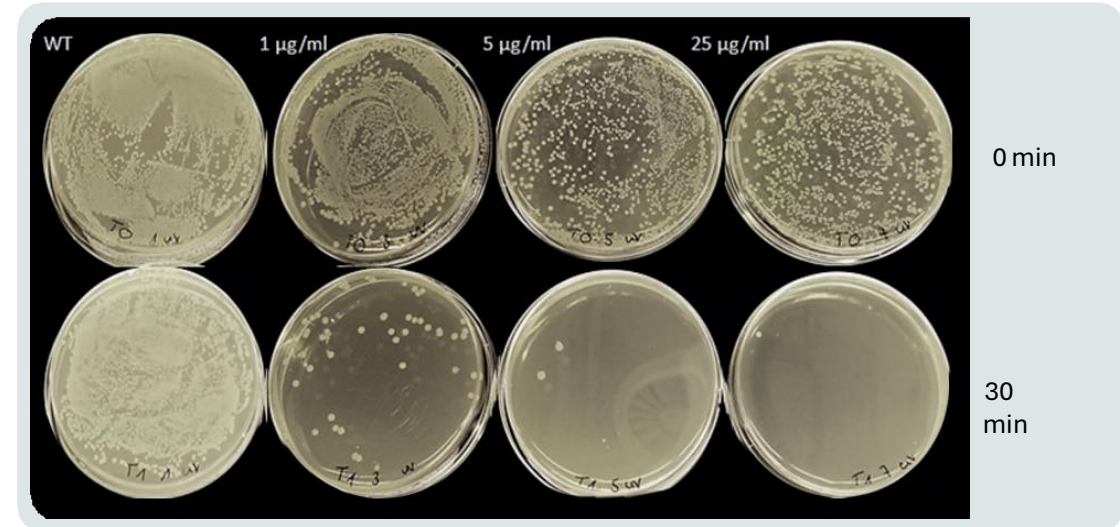
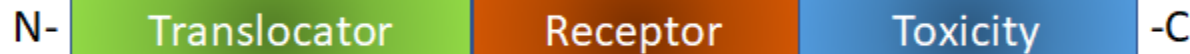
- **RNA-based platform**, spray for fast reprogramming crops for agronomic performance



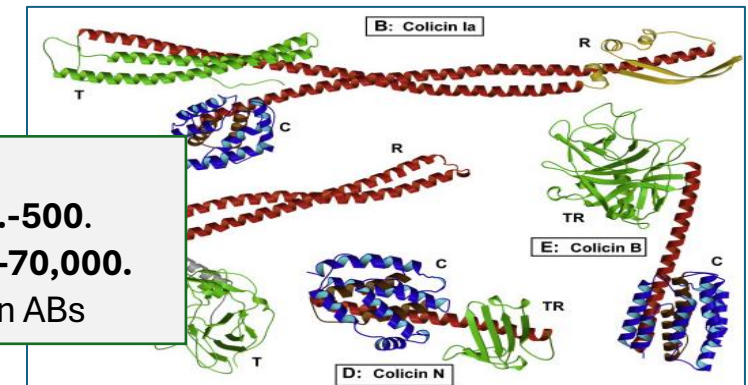
Bacteriocins: Bacteria's Own Antibacterials

Bacteriocins are proteins that kill other bacterial strains of the same/related species in order to reduce competition

- Representing natural, very smart and effective mechanisms optimized by evolution to overcome defence systems of Gram-negative bacteria
- Colicins are a class of precision bacteriocins produced by and toxic to some strains of *Escherichia coli*
- Similar proteins are made by other Gram-negatives such as *Klebsiella*, *Pseudomonas*, *Salmonella*, etc.
- Bacteriocins: (1) inhibit cell wall synthesis or (2) depolarize the inner cell membrane or (3) act as nuclease to hydrolyze DNA or RNA.
- Colicins have a 3-domain structural design:



Mol. Mass, g/mol:
 Antibiotics (ABs) **300.-500.**
 Bacteriocins **30,000.-70,000.**
 or 100-250X larger than ABs

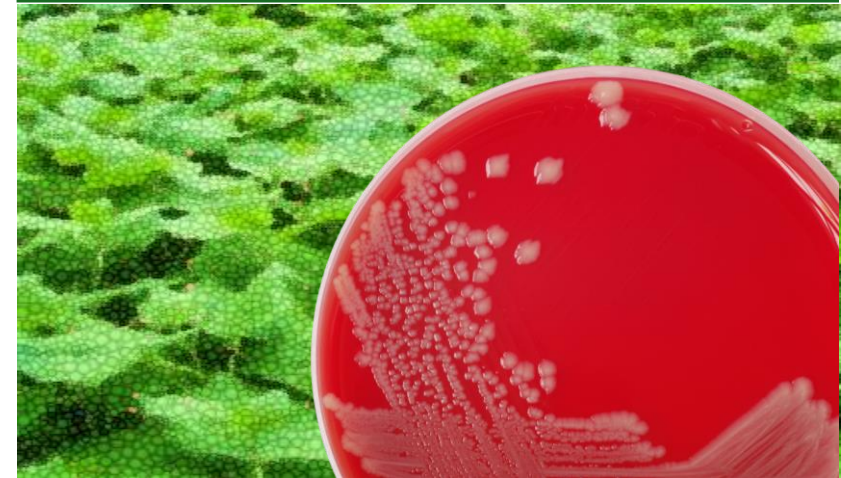


an intrinsically disordered proteins - lack fixed/ordered three-dimensional structure

Salmocins for Control of Salmonella in Food

		SalE1a nM	SalE1b nM	SalE1d nM
★ Enteritidis	ATCC® 13076™*	0.135	0.371	0.104
★ Enteritidis	ATCC® 49223™*	8.617	11.169	212.911
★ Typhimurium	ATCC® 14028™*	0.002	0.015	0.090
★ Typhimurium	ATCC® 13311™*	0.003	0.015	0.151
★ Newport	ATCC® 6962™*	4.065	1.068	11.393
★ Javiana	ATCC® 10721™*	0.010	0.778	85.324
★ Javiana	ATCC® BAA-1593™	0.098	2.789	31.165
★ Montevideo	ATCC® 8387™*	3.350	4.270	245.999
★ Infantis	ATCC® BAA-1675™	15.413	28.898	198.350
Muenchen	ATCC® 8388™*	3.345	3.686	
Heidelberg	ATCC® 8326™*	3.345	3.686	61.500
Bareilly	ATCC® 9115™*	4.519	19.303	179.248
Thompson	ATCC® 8391™*	4.795	90.577	941.261
Saintpaul	ATCC® 9712™*	3.345	5.438	174.526
Oranienburg	ATCC® 9239™*	1.673	3.394	245.999
Mississippi	ATCC® BAA-2739™	1.675	3.029	49.588
Anatum	ATCC® 9270™*	0.005	54.979	81.802
Agona	ATCC® 51957™*	1.201	1.688	46.244
Berta	ATCC® 8392™*	6.691	7.372	85.324
Dublin	ATCC® 15480™*	0.003	0.008	0.240
Derby	ATCC® 6960™*	0.008	0.008	0.017
Cerro	ATCC® 10723™*	0.363	0.405	15.689
Senftenberg	DSM 10062	0.005	0.015	0.227
Kentucky	ATCC® 9263™*	0.475	0.449	1.007
Mbandaka	ATCC® 51958™*	0.006	0.016	23.999
Cholerasius	ATCC® 10708™*	0.271	0.265	2.187
Tallahassee	ATCC® 12002™*	1.916	1.514	388.540
Paratyphi A	ATCC® 9150™*	0.018	0.015	0.274
Abony	NCTC 6017	1.673	2.135	71.285
Pullorum	ATCC® 13036™*	4.323	3.029	197.943
Vellore	ATCC® 15611™*	6.219	7.226	68.544
Bispebjerg	ATCC® 9842™*	3.374	2.135	132.973
Poona	NCTC 4840	1.916	5.000	113.263
Gallinarum	DSM 4883	20.966	64.802	661.048
Gallinarum	DSM 13674	245.226	273.295	536.628
Braenderup	ATCC® 700136™*	4.130	5.330	491.998

- MICs for Salmocin SalE1a are:
2 pM – 15 nM or
0.1 µg/L – 0.8 mg/L
- All 109 important pathogenic strains are controlled by SalE1a and SalE1b



- ★ Most important pathovars in USA and EU

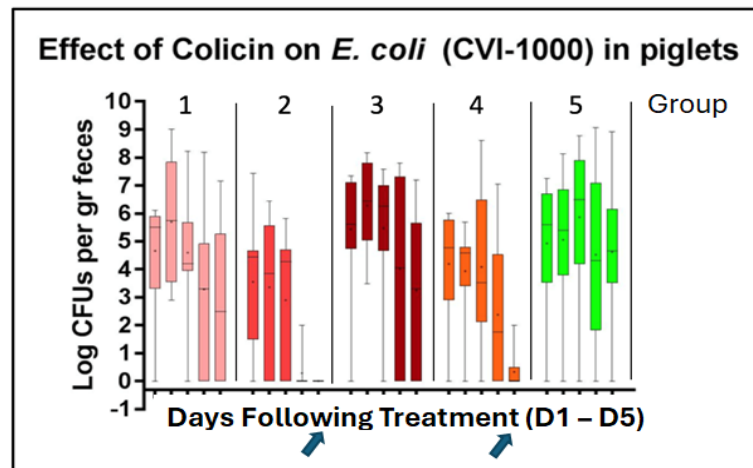
Bacteriocins: Regulatory Status



- Bacteriocins for control of food/feed safety
- Approved as ‘food processing aids’, no need to label the product, five GRAS approvals
- Listed in USDA/FSIS Directive 7120.1
- Five broad patent applications claiming control of *E. coli*, *Salmonella*, *Klebsiella*, *Pseudomonas*, chimaeric bacteriocins

Nomad Bioscience GRAS Submissions/Acceptances

Product/Origin	GRAS GRN	Submission Date	Response Date
Colicins/ <i>Escherichia coli</i>	593	07/2015	12/2015 - FDA
Colicins/ <i>E. coli</i>	676	04/2018	01/2017 – USDA 05/2017 - FDA
<i>Nicotiana</i> as GRAS host	775	04/2018	10/2018 - FDA
Endolysins/ <i>Clostridium perfringens</i>	802	07/2018	04/2019 - FDA
Salmocins/ <i>Salmonella enterica</i>	824	11/2018	10/2019 – FDA 10/2020 - USDA



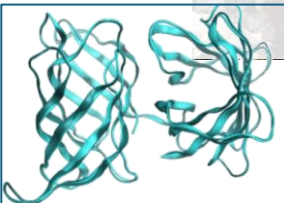
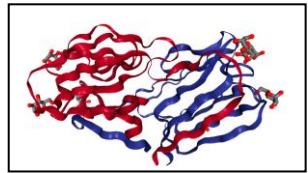
Colicins control *E. coli*-induced diarrhea in piglets including prevention of fecal shedding

Antviral Lectins

preventative antiviral biologics

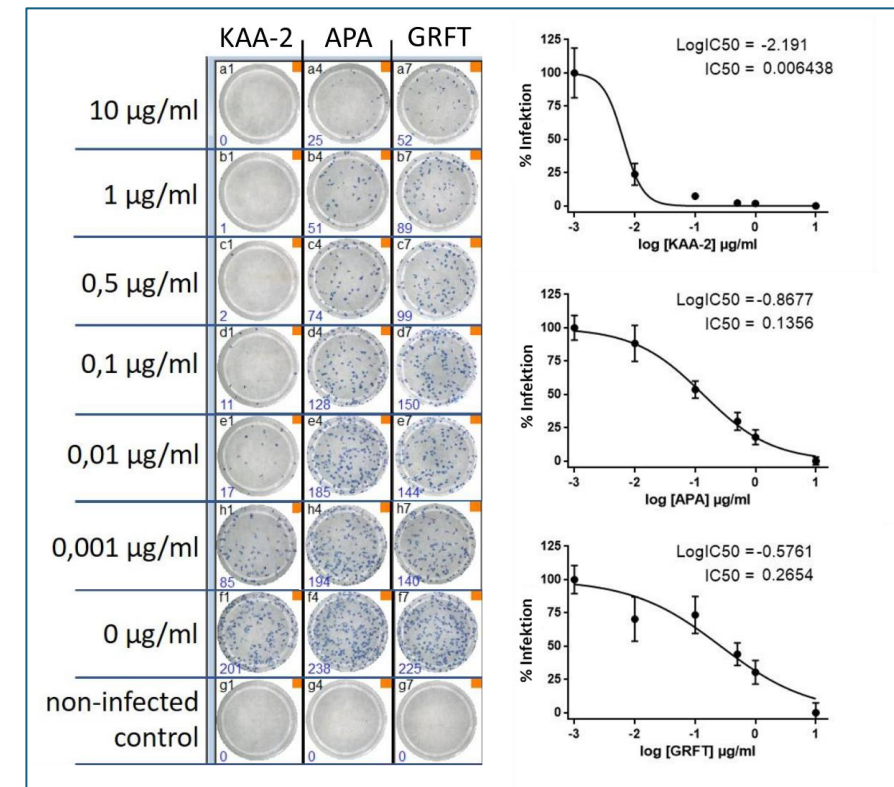
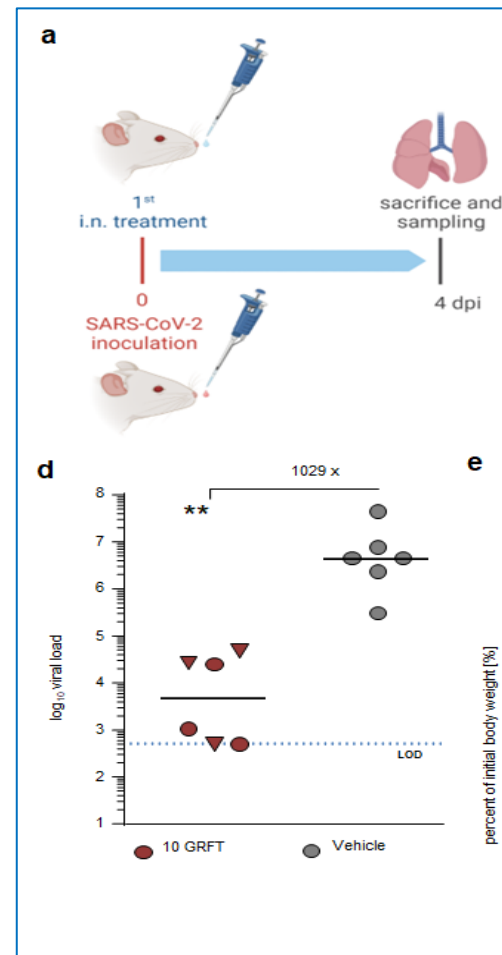
evolved naturally by plants to fight infections

- Highly potent *in vitro* and animal tests, rapid acting, multiple modes of action, huge natural diversity, easy to engineer, easy to produce and purify
- Block viruses from entering human cells
- Our lead lectin from alga *Griffithsia*, is already in several Phase I clinical trials



Lectins Confer SARS-CoV-2 Protection in Cell & Animal Models

- Multiple natural and engineered lectins expressed and tested *in vitro*
- Compounds 1 – 3 show excellent preventative activity in infection cell culture models
- Micromolar to picomolar minimum inhibitory concentrations (MICs)
- Viral load reduction over 1000 times (>3 logs) in murine animal models
- Low cytotoxicity



Protein Sweetener Thaumatin II

The chance to replace half of the sugar with natural non-caloric super sweet protein

- One out of four Thaumatin in the mixture sold today (Talin™), it has the best sweetness and taste profile of all natural Thaumatin
- Sweetest known natural substance: 10,900 - 13,100 times sweeter than sugar (w/w) at 50% - 35% sugar substitution level
- Can replace: ≥35% of sugar without taste changes; 50% - with light lingering aftertaste
- Initial markets as taste modifier and natural sweetener; can address up to a half of \$150 billion/year sugar market as high intensity sweetener
- Major patents filed; FTO, exclusivity; favorable techno-economics
- Unlimited supply; requires less than 10% of land used for sugar cane and sugar beets plantings to generate the same sweetness



Thaumatins, Regulatory Status

- Thaumatin II: 4 GRAS regulatory approvals by FDA, 1 by FEMA, 1 by GRAS Expert Panel
- Plans in place to approve Thaumatin II in Canada, Australia, China, EU, Japan
- Brazzein III: Clear regulatory path for GRAS registration with FDA, FEMA
- Five broad patent applications claiming Thaumatin II in combination with: sugar, high fructose corn syrup, Stevia Reb A & Reb M, monk fruit Mog V, Brazzein

Product	GRAS GRN	Submission Date	Response Date
Thaumatin Sweeteners	000738	10.2017	04.2018 FDA
Thaumatin II Sweetener	000910	02.2020	09.2020 FDA
Thaumatin II Flavour modifier	000920	04.2020	12.2020 FDA
Thaumatin II Sweetener Supplement	000910S	12.2020	02.2022 FDA
Thaumatin II Flavour modifier	FEMA 510	11.2021	03.2022 FEMA

- Trademark protection for Thaûma™ (lexical) granted in EU, UK and filed in the U.S. and other countries
- In ancient Greek, Thaûma means wonder, miracle





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Bioscience

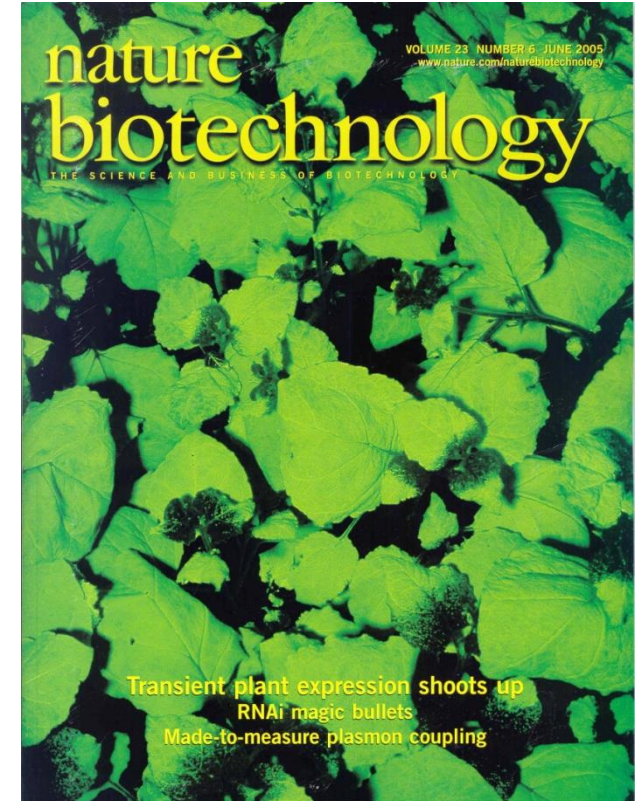
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Intellectual Property

NOMAD Bioscience – IP and Publications

- NOMAD, together with its former subsidiary Icon Genetics, has over 500 issued patents representing >60 patent families filed in 25 countries
- Freedom to operate and exclusivity in high-yield protein production in plants
- Broad ‘composition of matter’ patents covering antibacterial proteins bacteriocins, expected exclusivity in the area of Gram-negative pathogens
- Broad ‘composition of matter’ patents covering high intensity sweetener Thaumatin in combination with sugar and other natural sweeteners

- Nature Plants 10.1038/s41477-021-00851 (2021)
- Proc. Natl. Acad. Sci. USA, 112, 1513311 (2015)
- Proc. Natl. Acad. Sci. USA, 111, 1402836 (2014)
- Proc. Natl. Acad. Sci. USA, 108, 14061 (2011)
- PLoS One, 6, 19722 (2011)
- PLOS One, 4, 5553 (2009)
- PLOS One, 3, 3647 (2008)
- Proc. Natl. Acad. Sci. USA, 104, 6864 (2007)
- Proc. Natl. Acad. Sci. USA, 103, 17678 (2006)
- Proc. Natl. Acad. Sci. USA, 103, 14701 (2006)
- Proc. Natl. Acad. Sci. USA, 103, 861 (2006)
- Nature Biotechnology, 23, 718 (2005)
- Proc. Natl. Acad. Sci. USA, 101, 6852 (2004)
- Nature Biotechnology, 22, 461 (2004)
- Nature Biotechnology, 21, 224 (2003)
- Proc. Natl. Acad. Sci. USA, 99,5301 (2002)
- Nature Biotechnology, 18, 1303 (2000)
- Nature Biotechnology, 17, 466 (1999)
- Proc. Natl. Acad. Sci. USA, 96,5973 (1999)

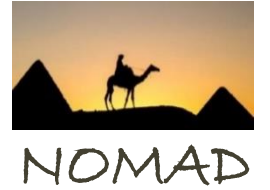


NOMAD Bioscience: Your Research Partner

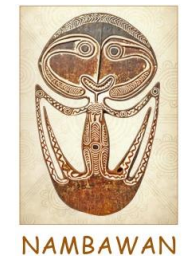
- NOMAD is a widely recognized leader known for its technologies, products, patent estate, approval successes for its products and its ability to discover the product candidates for unmet needs and take those through research and development all the way down to industrial scale-up and production
- Together with its partners, NOMAD offers a wide range of research, development and industrialization capabilities and expertise in multiple areas of medicine, food and agriculture
- NOMAD and its partners offer freedom to operate and exclusivity in broad range of biotechnology areas through collaborative product development or out-licensing its product candidates or technology platforms

Biologics instead of small molecules
Precision antibacterials
Truly novel modes of action
First-In-Class therapeutics
First-In-Humans clinical trials
Control of Gram-negatives
Highly active against multidrug resistant pathogens
Broadly active antivirals
Efficient control of bloodstream infections
Strong, eventually dominant IP position, available for out-licensing
Clear path to major value inflection points
Multiple R&D and industrial platforms

NOMAD Bioscience and Its Partners



- Icon Genetics GmbH, Germany
 - Nomad's predecessor, and later subsidiary, exclusive licensee of Icon/Nomad patents in vaccines and diagnostics, collaboration partner
- Nomads UAB, Lithuania
 - Nomad's wholly owned subsidiary, R&D in areas of bacteriocins and lysins
- Nambawan Biotech GmbH, Germany
 - Nomad's commercial spin-out, exclusive license in food antibacterials and agriculture. Continuing support of R&D by Nomad
- Nambawan Spain SLU, Spain
 - Wholly owned subsidiary of Nambawan Biotech, exclusive license in sweet and taste modifying proteins. Also continuing support of R&D by Nomad
- Fraunhofer Institute for Cell Therapy & Immunology, Germany
 - Major collaboration partner, pre-clinical research, assay development





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