新潟薬科大学
Niigata University of Pharmacy and Medical and Life Sciences

Innovative technologies in healthcare

ヘルスケアにおける革新的な技術

Dr Seiya Sato – Visiting Professor

No slide

I am deeply grateful to Prof. Kalaji and Warsaw University of Life Sciences (SGGW) for the opportunity to present my research at such an international event as the Osaka Expo. I am also deeply grateful to the Polish government for their consideration. This event was an opportunity to conclude an agreement on international exchange between SGGW and Niigata University of Pharmacy and Life Sciences (NUPALS). We are very happy to conclude an agreement on international exchange with the Warsaw University of Life Sciences SGGW and Niigata University of Pharmacy and Life Sciences NUPALS. Thanks to Prof. Kalaji, we feel it is of great significance that the exchange between the two universities will continue for a long time in the future and that we will be able to send promising students to the University.

大阪万博という国際的なイベントで研究発表の機会を与えてくださったカラジ教授とワルシャワ生命科学大学（SGGW）に深く感謝いたします。また、ポーランド政府のご配慮にも深く感謝いたします。このイベントを機にSGGWと新潟薬科大学（NUPALS）の間で国際交流協定が締結されました。ワルシャワ生命科学大学SGGWと新潟薬科大学NUPALSと国際交流協定を締結できたことを大変嬉しく思います。カラジ教授のおかげで、両大学の交流が今後も長く続き、将来有望な学生を大学に送り出すことができることは大変意義深いことだと感じています。

Career

1966：Graduated from Niigata University Faculty of Agriculture, Faculty of Agricultural Chemistry; Entered DENKA Seiken

1983：Doctoral course at Toyama Medical and Pharmaceutical University Graduate School Doctor of Medicine

1990：Visiting professor at Niigata University（5 years）

1991： Director, Denka Seiken（4 years）

1995： Managing Director, Denka Seiken（8 years）Director of the Vaccine Associationof Japan

2004：Representative Director, NBRP, Niigata Bioresearch Park Ltd. (for 5 years)

2005：Director, Health Business Association (for 10 years), Niitsu Country Director (for 3 years) and Board Member (currently ongoing)

2006：Vice-president of Kanazawa University/Niigata University, collaboration KTLO=NITTestablished(4years)

2011： Establishment of Unibio Ltd.（development of transient gene expression technology in plants）（5 years）

2017： Representative Director of Greens Green Co Ltd（4years）

2022：President of the University of Health and Disease (Lions Clubs: currently ongoing)
Advisor FINE Pharmaceuticals Ltd.

Visiting Professor, Niigata University of Pharmacy and Life Sciences（NUPALS ongoing）

Development in Japan

Development in Hepatitis A vaccine
New influenza vaccine
AIDS test reagents
SRCF test method
Clinical test reagent
Development of moss cultivation methods
Influenza test reagent
Coronavirus test reagentsLegionella reagents
O157 test reagent
iPS cell growth factorsetc

肝炎ワクチンの開発
新型インフルエンザワクチン開発
エイズ検査試薬の開発
SRCF検査法の開発
臨床検査試薬の開発
苔の栽培法の開発
インフルエンザ検査試薬の開発
コロナウイルス検査試薬の開発
レジオネラ試薬の開発
O157検査試薬の開発
iPS細胞増殖因子の開発など

International relations

Establishment of virus laboratory in Sri Lanka JICA

Establishment of AIDS virus culture at Cambridge University

Development of novel vaccines with Chiron

Development of transient gene expression technology with MEDECAGO, Canada

Guidance on Vietnamese virus testing methods

Guidance on Chinese virus testing methods

国際関係スリランカにおけるウイルス研究所設立
JACAケンブリッジ大学でエイズウイルス培養法の確立
カイロン社と新規ワクチンの開発
カナダ　MEDECAGO社と一過性遺伝子発現技術の開発
ベトナムウイルス検査法の指導
中国ウイルス検査法の指導

- 私および私の大学との長年の共同研究と協力について

For many years of collaboration and cooperation with me and my university

Prof. Hazem M. Kalaji

•Department of Plant Physiology

•Institute of Biology

Teaching

Plant Physiology

NUPALS

Visiting Professor

I was taught by Prof. Kalaji that plants are humanity's greatest benefactors.
Taking care of plants is man's greatest task.
To do this, we must study plant physiology.
The benefits of photosynthesis efficiency and prodcutivity of plants measurements
That‘s why He developed „Big Brother” system for the World

Two themes that I have worked on in collaboration with Prof. Kalaji and applied for 2 patents

1. The discovery that the components of sword bean prevent the transmission of coronaviruses and influenza viruses, and the prototype of the sword bean candy was made as an example for this purpose.

Dr Seiya Sato (MD, PhD), Prof. Hazem M. Kalaji

The 29th Annual Meeting of the Japanese Society for Preventive Medicine
Chairperson Dr. Nagaoka (Professor, Faculty of Medical Sciences, Juntendo University)

第29回日本未病学会学術総会日本未病学会雑誌 28 (3) 2-2, 2022

2. Virus Adsorption Capabilities of the moss *Thuidium delicatulum*.
Dr Seiya Sato (MD, PhD)1, Prof. Hazem M. Kalaji2 1Guest Professor

The Bryological Times
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My encounter with Sword Beans

I'm a flu vaccine researcher Influenza vaccines are manufactured by growing the virus in animal cells (11-day-old chicken eggs or MDCK cells). However, because it is derived from animals, it contains components that are harmful to the human, and advanced purification techniques are required to remove these components.
Still not perfect

I have been considering the use of immunostimulants to minimise adverse reactants and maximise vaccine effectiveness. Concanavalin A was encountered and has been investigated, but difficulties have been experienced in the method of evaluation and testing.

Concanavalin A is plant-derived, safe and secure. Moreover, it is only found in sword beans.

ConA is a lectin and I thought it might possibly adsorb to viruses.

Started experiments.

RESULT
1）For influenza viruses、ConA was **found not to adsorb** to the virus, but **to adsorb to the epithelial cells** of the human throat, preventing viral entry
2）~~the case of coronaviruses~~, ConA was **found to adsorb directly onto the virus** and prevent infection

Different forms of bonding

- 最初の特許についての説明：抗ウイルスフィルターとしてのコケ（フェイスマスクを含む）

So, what is Sword Bean； the natamame　?

Sword Bean in Japan

Proven effective herbal medicine

In Japan, it is grown in relatively warm regions, such as Kagoshima and western Japan, and has been used for natamame tea and toothpaste.

I have been interested in the greatness of the sword bean for 45 years

I have just continued my research. I have found it to be rich in nutrients (rich in essential amino acids) and effective in fighting corona and influenza,

The discovery that the components of sword bean prevent the transmission of coronaviruses and influenza viruses, and the prototype of the sword bean candy was made as an example for this purpose.

Dr Seiya Sato (MD, PhD)[1], Prof. Hazem M. Kalaji[2]

Japan Mibyou Association　11.12.2022 at Juntendo University

Mibyou ＝A state of continuous change between health and illness.

Subject

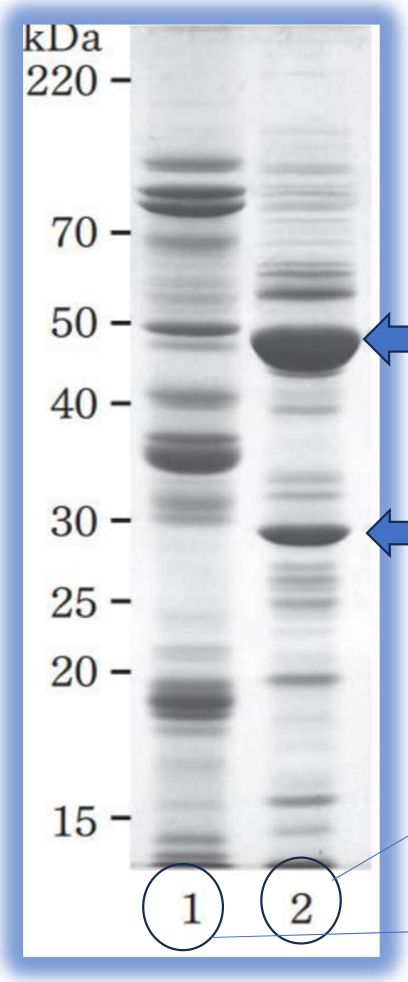
Mechanism of control of viral infection by the sword bean component lectin (ConA).

Seiya Sato（Niigata University of Pharmacy and Life Sciences) NUPALS

Coronaviruses are a global threat to humanity. In influenza viruses, too, a large number of victims are counted every year. Effective treatments have been developed for each of these viruses, but they are all chemicals, and there are high hopes for plant-based control. In this context, we have confirmed that an ingredient in sword beans can control these viruses and will present the result

コロナウイルスは人類にとって世界的な脅威である。インフルエンザウイルスにおいても、毎年多くの犠牲者を数えている。それぞれ有効な治療薬が開発されているが、しかしすべて化学薬品であり、植物由来の防除に期待がかかるこのような状況の中で、sword beansの成分にこれらのウイルスを防除することを確認し、その結果を発表する

Composition of Sword Bean



SDS-PAGE analysis

49kD Canavaline
Eessential amino acid assembly

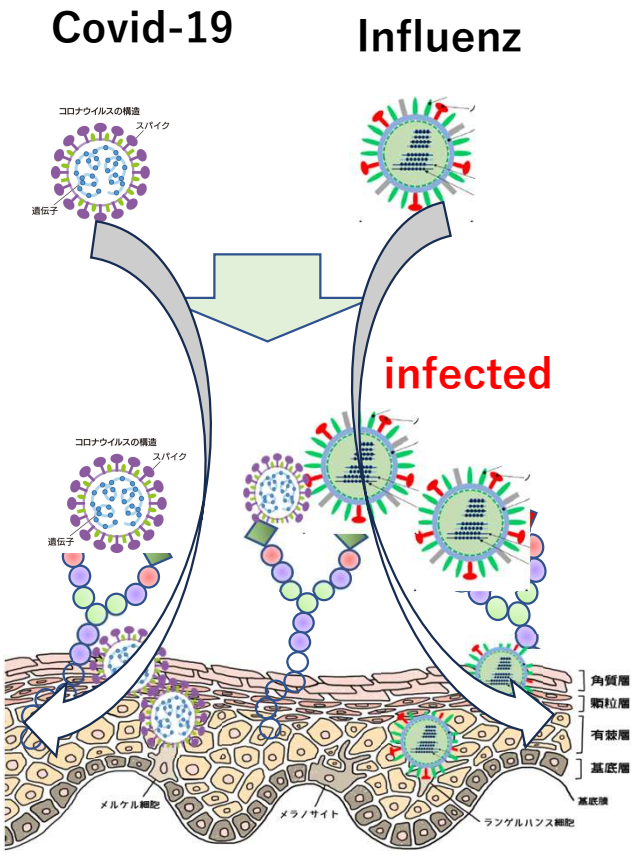
29kD ConcanavalineA
Immunostimulants, anti-cancer and anti-viral drugs

①sword bean

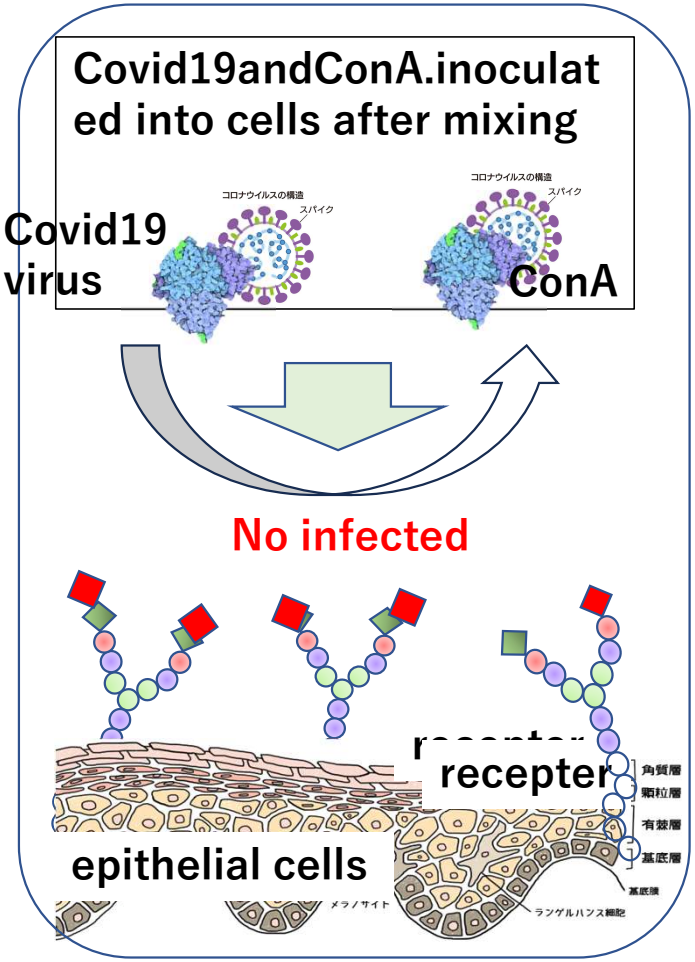
②soybean

Schematic of the viral infective inhibition in Con A.

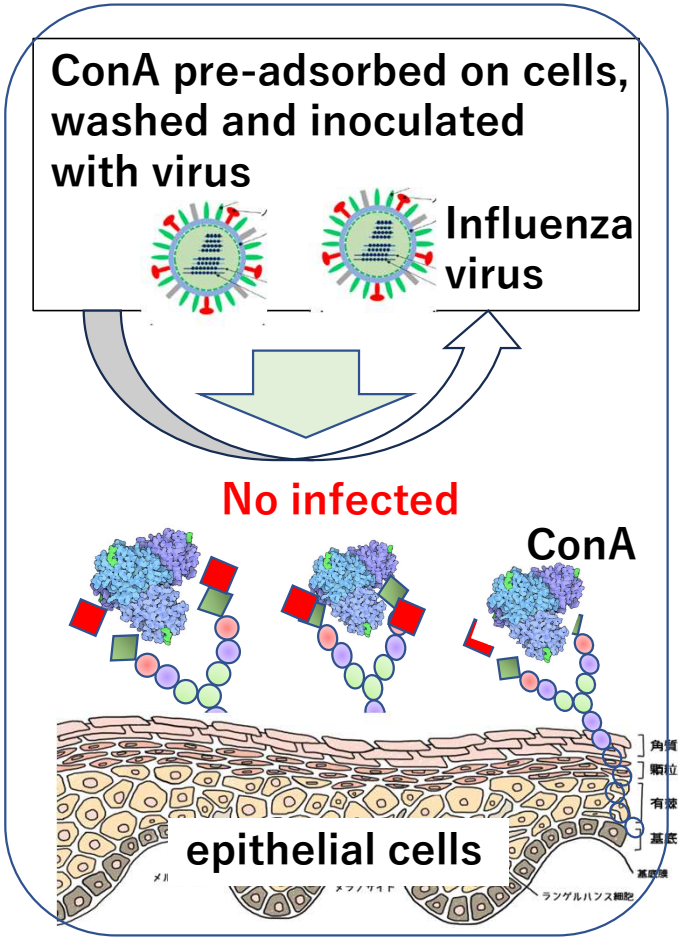
Normal infection



Case: Covid-19 coronavirus



Case: Influenza virus



Canavaline from sea bream is an essential amino acid derived from plants

Muscle recovery in young people, measures against sarcoplegia in the elderly, etc.
Expected as a material for health foods

Muscle recovery in the elderly: sarcopenia

A phenomenon in which muscle mass decreases as we age.
An aging phenomenon in which muscle mass decreases.
Progression begins around the age of 25 to 30 and progresses throughout life.
The number of muscle fibers and muscle cross-sectional area decrease

高齢になるに伴い、筋肉の量が減少していく現象。 筋肉の量が減少していく老化現象のこと。 25～30歳頃から進行が始まり生涯を通して進行する。 筋線維数と筋横断面積の減少が同時に進んでいく。

Sword candy 3% Sword Bean included

summary

１．植物成分（レクチン）によるウイルス感染症防御対策として、上気道感染症におけるウイルスレセプターの吸着侵入メカニズムに焦点を当てて研究してきた。

1. I have focused my research on the mechanisms of viral receptors in upper respiratory tract infections. as a protective measure against viral infections with plant components (lectins),

２． MaKeLaの植物レクチン分類による第3類マンノース結合型レクチンに属するレクチンがインフルエンザウイルスのレセプター吸着を阻止し、その中でも、コンカナバリンＡ（ConA）が最も強い活性を示した。

2. Lectins belonging to class 3 mannose-binding lectins according to MaKeLa's classification of plant lectins showed influenzavirus receptor adsorption, of which concanavalin A (ConA) showed the strongest activity.

３．私はそのメカニズムを解明した。すなわち、ConAが、上気道上皮細胞の糖鎖レセプターに結合し、インフルエンザ
ウイルスの侵入を阻止する。

3. I have deduced the mechanism. Namely, ConA binds to sugar chain receptors on upper airway epithelial cells and prevents influenza virus entry.

４．コロナウイルスCovid-19についてはConAがCovid-19に直接結合することによって感染阻害がおこることを実証した。

4. For coronavirus Covid-19, it was demonstrated that ConA inhibits infection by binding directly to Covid-19.

2. **Virus Adsorption Capabilities of the moss *Thuidium delicatulum*.**

Dr Seiya Sato (MD, PhD)1, Prof. Hazem M. Kalaji2 1Guest Professor

The Bryological Times

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- 現在取り組んでいる研究の紹介

Virus Adsorption Capabilities of the moss *Thuidium delicatulum*.

The moss *Thuidium delicatulum* was tested for effective virus adsorption capabilities against influenza and coronavirus (COVID-19). The potential mechanism through which moss can adsorb viruses, highlighting the
role of mannose-binding lectin structures in the cell walls of the moss is described. The work was published in detail as an applied patent in 2021 (https://www.j-platpat.inpit.go.jp/c1801/PU/JP-2021-179052/11/en).

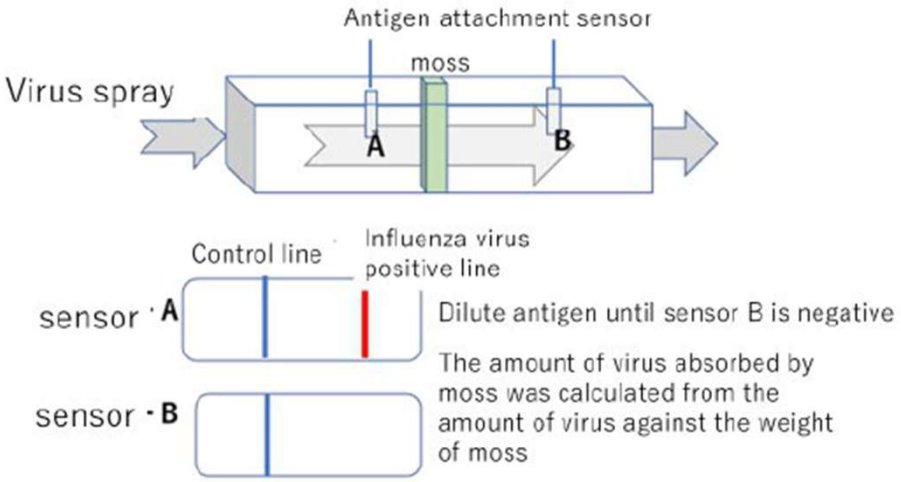


Fig. 1. Absorption of influenza virus by the moss filter.

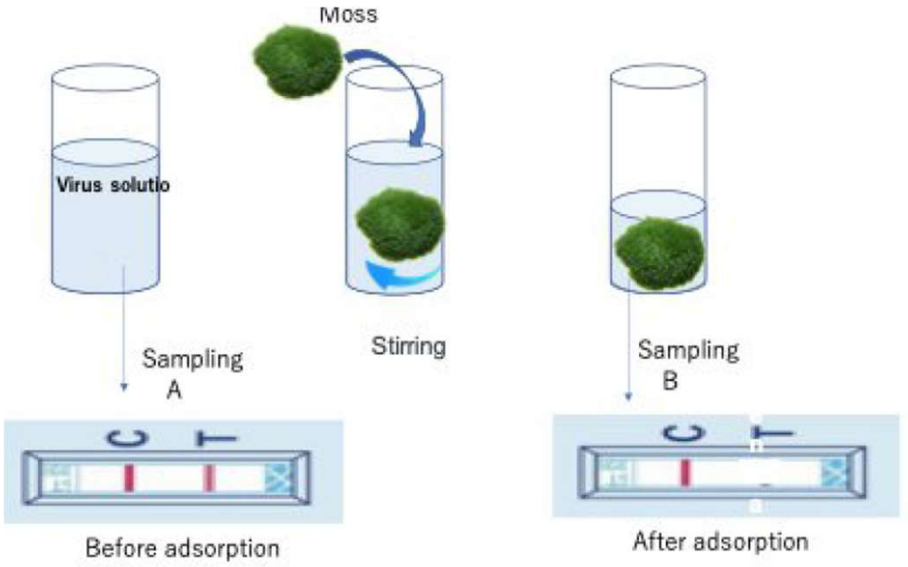
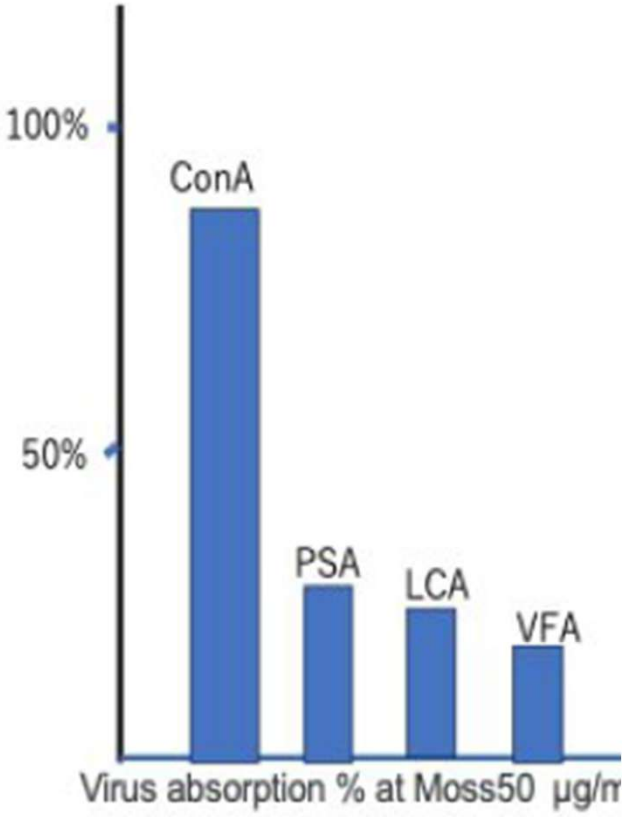


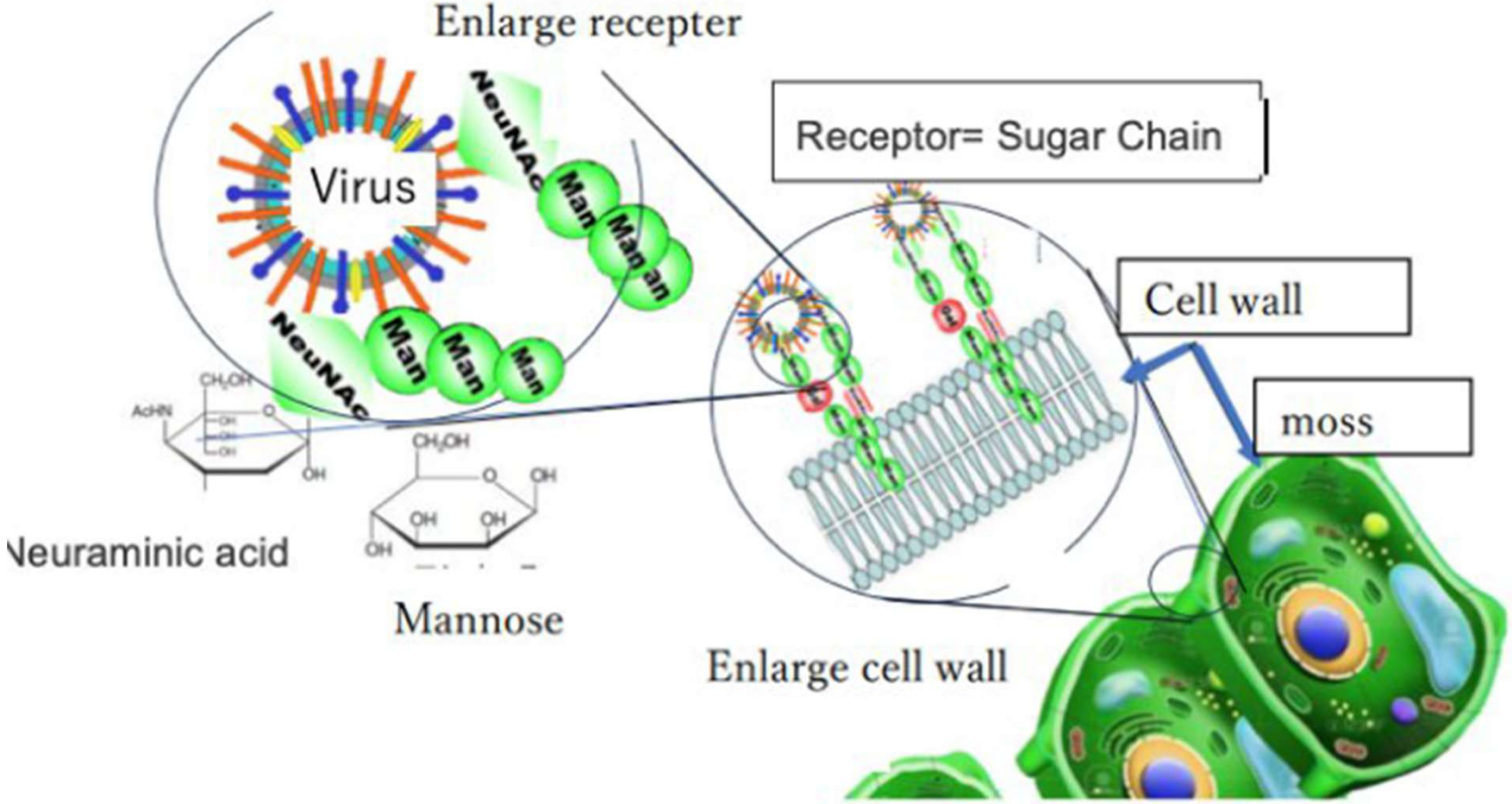
Fig. 2. Absorption on influenza virus in moss solution.

	Classification of lectins based on Mäkelä monosaccharide recognition			
Class		comm on name	Binding specificity	Virus absorpti on ability
Cass1	Fuc	UEA-I	α-L-Fuc	−
Class2	Gal GalNAc	SBA PNA RCA120 DBA ABA PHA-E PHA-L	α-GalNAc > β-GalNAc β-Gal β-Gal α-GalNAc Gal β1-3GalNAc GalNAc GalNAc	−
Class3	Man Glc GlcNAc	Con A PSA LCA VFA	α-Man > α-Glc α-Man > α-Glc α-Man > α-Glc α-Man > α-Glc	+
Class4	GlcNAc	PWM STA WGA UEA-II	GlcNAc β1-4GlcNAc GlcNAc β1-4GlcNAc GlcNAc β1-4GlcNAc GlcNAc β1-4GlcNAc	−



. Types of lectins and influenza virus absorption ability

- 今後の共同研究の計画について



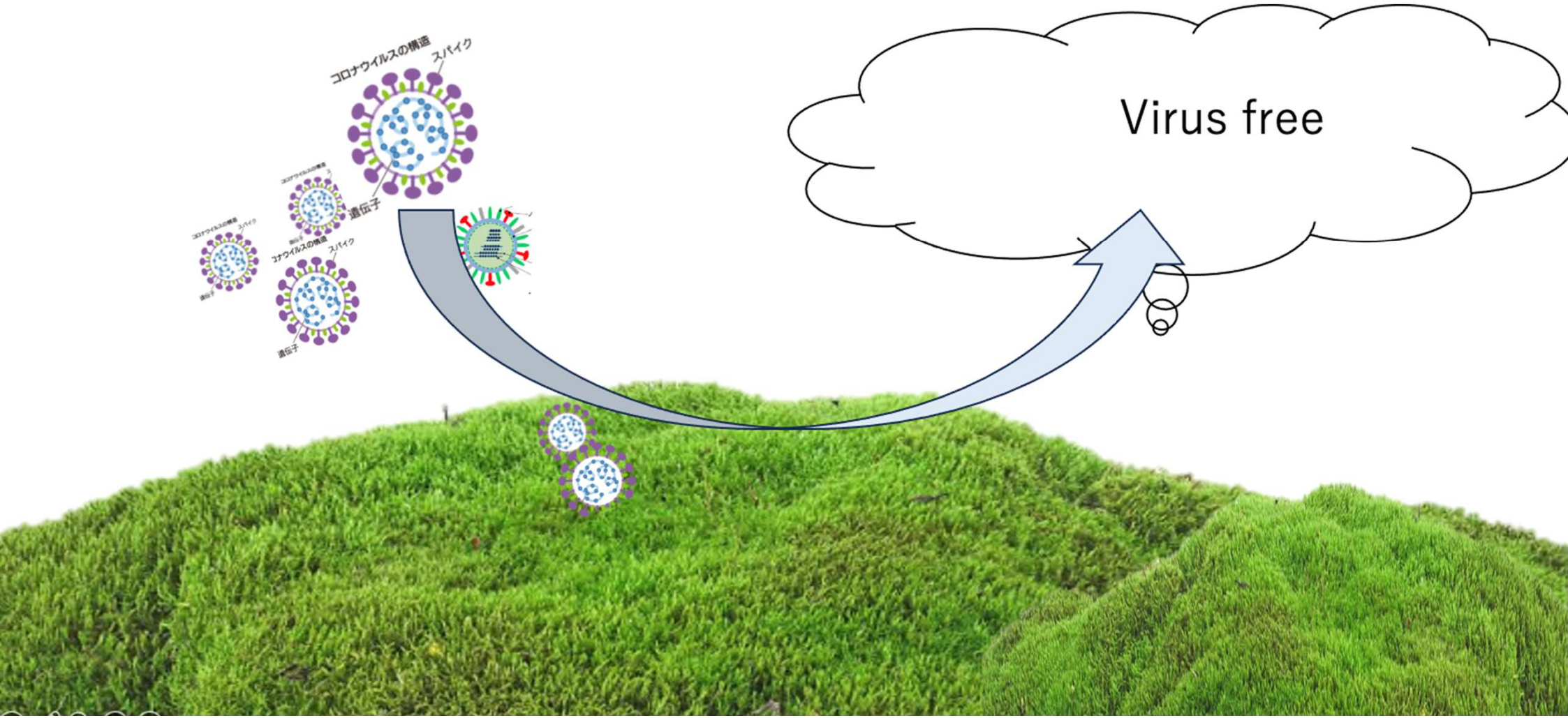
Schematic on a proposed mechanism for the attachment of viruses to moss cell walls. Mannose-type sugar chains with sialic acid and mannose at the ends are formed on the cell walls of moss, and influenza viruses are thought to be adsorbed there.

Conclusion:
In this study, the moss *Thuidium delicatulum* demonstrated significant virus adsorption capabilities, particularly against influenza and coronavirus (COVID-19), attributed to mannose-binding lectin structures within its cell walls.
The research underscores the moss's potential in reducing virus loads in environments and combating respiratory infections, showing that virus adsorption is proportional to the moss quantity and virus amount sprayed.

These findings not only highlight the moss's environmental benefits, such as air purification and CO_2 absorption, but also its promising application in public health for controlling viral pathogens.

本研究では、コケの一種であるThuidium delicatulumがウイルス吸着能力を示した、特に、インフルエンザやコロナウイルス（COVID-19）に対する効果は、コケの細胞壁内のマンノース結合レクチン構造に起因している。
この研究は、コケが環境中のウイルス量を減らし、呼吸器感染症に対抗できる可能性を強調するものである。ウイルスの吸着量はコケの量と散布されたウイルスの量に比例することを示した。散布されたウイルスの量に比例することを示した。この発見は、コケが空気浄化やCO2吸収といった環境面でも優れていることを強調している。この発見は、空気浄化やCO2吸収といったコケの環境面での利点だけでなく、ウイルス病原体を制御するための公衆衛生分野での応用も有望であることを強調している。

These findings not only highlight the moss's environmental benefits, such as air purification and CO_2 absorption, but also its promising application in public health for controlling viral pathogens.



„Big brother” equipped drone

Optimization of Artificial moss cultivation by monitoring photosynthesis

In order to contribute to human health, we must first contribute to the health of plants.

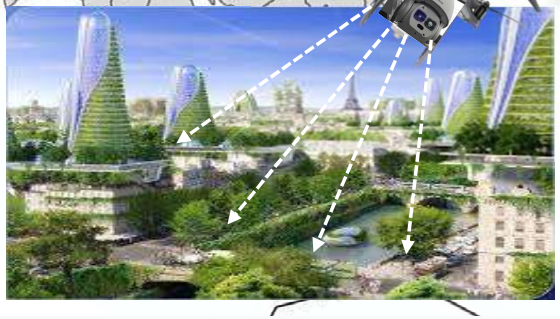
Dr. Karaj's research : Big Brother

In JAPAN

smart agriculture

smart city

biophilia



Healthy plants

Air purification

Indoor green effect

Human Health

Warsaw University of Life Sciences SGGW

Prof. Kalaj's research
"Big Brother"

Major agricultural companies

Niigata University of Pharmacy and Life Sciences NUPALS

Joint development