UNITED STATES
SECURITIES AND EXCHANGE COMMISSION
Washington, D.C. 20549

FORM 8-K

CURRENT REPORT

Pursuant to Section 13 or 15(d) of the Securities Exchange Act of 1934

Date of report (date of earliest event reported): January 26, 2023

TONIX PHARMACEUTICALS HOLDING CORP.

(Exact name of registrant as specified in its charter)

Nevada	**001-36019**	**26-1434750**
(State or Other Jurisdiction of Incorporation)	**(Commission File Number)**	**(IRS Employer Identification No.)**

26 Main Street, Chatham, New Jersey 07928
(Address of principal executive offices) (Zip Code)

Registrant's telephone number, including area code: (862) 904-8182

Check the appropriate box below if the Form 8-K filing is intended to simultaneously satisfy the filing obligation of the registrant under any of the following provisions (see General Instruction A.2. below):

☐ Written communications pursuant to Rule 425 under the Securities Act (17 CFR 230.425)
☐ Soliciting material pursuant to Rule 14a-12 under the Exchange Act (17 CFR 240.14a-12)
☐ Pre-commencement communications pursuant to Rule 14d-2(b) under the Exchange Act (17 CFR 240.14d-2(b))
☐ Pre-commencement communications pursuant to Rule 13e-4(c) under the Exchange Act (17 CFR 240.13e-4(c))

Securities registered pursuant to Section 12(b) of the Act:

Title of each class	Trading Symbol(s)	Name of each exchange on which registered
Common Stock	TNXP	The NASDAQ Capital Market

Indicate by check mark whether the registrant is an emerging growth company as defined in Rule 405 of the Securities Act of 1933 (§ 230.405 of this chapter) or Rule 12b-2 of the Securities Exchange Act of 1934 (§ 240.12b-2 of this chapter).

Emerging growth company ☐

If an emerging growth company, indicate by check mark if the registrant has elected not to use the extended transition period for complying with any new or revised financial accounting standards provided pursuant to Section 13(a) of the Exchange Act. ☐

Item 7.01 Regulation FD Disclosure.

On January 26, 2023, Tonix Pharmaceuticals Holding Corp. (the "Company") announced that Tom Hobman, Ph.D., Professor of Cell Biology, University of Alberta, presented data from his laboratory at The University of Alberta during an oral presentation at the 2nd Wnt & β-Catenin Targeted Drug Development Conference on January 26, 2023 (the "Presentation"). A copy of the press release which discusses this matter is furnished hereto as Exhibit 99.01, and incorporated herein by reference. The Presentation, which may contain nonpublic information, is filed as Exhibit 99.02 hereto and incorporated herein by reference.

The information in this Item 7.01 of this Current Report on Form 8-K, including Exhibits 99.01 and 99.02 attached hereto, shall not be deemed "filed" for purposes of Section 18 of the United States Securities Exchange Act of 1934 (the "Exchange Act") or otherwise subject to the liabilities of that section, nor shall they be deemed incorporated by reference in any filing under the United States Securities Act of 1933 or the Exchange Act, except as shall be expressly set forth by specific reference in such a filing.

Item 8.01. Other Events.

On January 26, 2023, the Company announced that Dr. Hobman presented data from the Presentation, entitled "*Targeting the Wnt/β-catenin pathway as a broad-spectrum antiviral strategy*," which includes research sponsored by the Company focused on the development and testing of Wnt/β-catenin signaling pathway inhibitors as broad-spectrum antivirals against SARS-CoV-2 and other emerging viruses. The research demonstrated that inhibition of Wnt/β-catenin pathway induces peroxisomes and enhances interferon response during viral infection, significantly reducing SARS-CoV-2 replication *in vitro* and *in vivo* The Company previously announced that it exercised an option to license the antiviral technology platform.

Forward- Looking Statements

This Current Report on Form 8-K contains certain forward-looking statements within the meaning of Section 27A of the Securities Act of 1933 and Section 21E of the Securities Exchange Act of 1934 and Private Securities Litigation Reform Act, as amended, including those relating to the Company's product development, clinical trials, clinical and regulatory timelines, market opportunity, competitive position, possible or assumed future results of operations, business strategies, potential growth opportunities and other statement that are predictive in nature. These forward-looking statements are based on current expectations, estimates, forecasts and projections about the industry and

markets in which we operate and management's current beliefs and assumptions.

These statements may be identified by the use of forward-looking expressions, including, but not limited to, "expect," "anticipate," "intend," "plan," "believe," "estimate," "potential," "predict," "project," "should," "would" and similar expressions and the negatives of those terms. These statements relate to future events or our financial performance and involve known and unknown risks, uncertainties, and other factors which may cause actual results, performance or achievements to be materially different from any future results, performance or achievements expressed or implied by the forward-looking statements. Such factors include those set forth in the Company's filings with the SEC. Prospective investors are cautioned not to place undue reliance on such forward-looking statements, which speak only as of the date of this press release. The Company undertakes no obligation to publicly update any forward-looking statement, whether as a result of new information, future events or otherwise.

Item 9.01 Financial Statements and Exhibits.

(d)

Exhibit No.	Description
99.01	Press release of the Company, dated January 26, 2023
99.02	Targeting the Wnt/β-catenin pathway as a broad-spectrum antiviral strategy
104	Cover Page Interactive Data File (embedded within the Inline XBRL document)

SIGNATURE

Pursuant to the requirement of the Securities Exchange Act of 1934, the registrant has duly caused this report to be signed on its behalf by the undersigned thereunto duly authorized.

TONIX PHARMACEUTICALS HOLDING CORP.

Date: January 26, 2023

By: /s/ Bradley Saenger
Bradley Saenger
Chief Financial Officer

Exhibit 99.01

Tonix Pharmaceuticals Announces Presentation of Licensed Antiviral Drug Technology at the 2nd Wnt & β-catenin Targeted Drug Development Conference

Oral Presentation Describes Activity of Wnt/β-catenin Signaling Pathway Inhibitors Against SARS-CoV-2 in Cell Culture and in an Animal Model

CHATHAM, N.J., January 26, 2023 – Tonix Pharmaceuticals Holding Corp. (Nasdaq: TNXP) (Tonix or the Company), a clinical-stage biopharmaceutical company, today announced that Tom Hobman, Ph.D., Professor of Cell Biology, University of Alberta, presented data from his laboratory at The University of Alberta during a presentation at the 2nd Wnt & β-catenin Targeted Drug Development Conference held in Boston, Mass., on January 26, 2023. The oral presentation titled, "***Targeting the Wnt/β -catenin pathway as a broad-spectrum antiviral strategy***," includes research sponsored by Tonix Pharmaceuticals focused on the development and testing of Wnt/β-catenin signaling pathway inhibitors as broad-spectrum antivirals against SARS-CoV-2 and other emerging viruses. Tonix has previously announced that it exercised an option to license the antiviral technology platform. A copy of the presentation is available on the Tonix Pharmaceuticals corporate website at www.tonixpharma.com.

"Antiviral therapeutics are needed to mitigate the effects of SARS-CoV-2 and future coronavirus outbreaks, and Professor Hobman's work is designed to facilitate the identification and testing of novel broad-spectrum antiviral drugs," said Seth Lederman, M.D., Chief Executive Officer of Tonix Pharmaceuticals. "Professor Hobman presented data showing that inhibition of Wnt/β-catenin pathway induces peroxisomes and enhances interferon response during viral infection, significantly reducing SARS-CoV-2 replication *in vitro* and *in vivo*."

"For future pandemics, the scientific community must be ready with an arsenal of easily self-administered drugs that can be tested in rapid, efficient clinical trials immediately after the causative viral agent is identified," said Professor Tom Hobman. "The research collaboration between Tonix and The University of Alberta is focused on the development and testing of Wnt/β-catenin signaling pathway inhibitors as broad-spectrum antivirals against SARS-CoV-2 and other emerging viruses."

Tonix Pharmaceuticals Holding Corp.*

Tonix is a clinical-stage biopharmaceutical company focused on discovering, licensing, acquiring and developing therapeutics to treat and prevent human disease and alleviate suffering. Tonix's portfolio is composed of central nervous system (CNS), rare disease, immunology and infectious disease product candidates. Tonix's CNS portfolio includes both small molecules and biologics to treat pain, neurologic, psychiatric and addiction conditions. Tonix's lead CNS candidate, TNX-102 SL (cyclobenzaprine HCl sublingual tablet), is in mid-Phase 3 development for the management of fibromyalgia with a new Phase 3 study launched in the second quarter of 2022 and interim data expected in the second quarter of 2023. TNX-102 SL is also being developed to treat Long COVID, a chronic post-acute COVID-19 condition. Tonix initiated a Phase 2 study in Long COVID in the third quarter of 2022 and expects interim data in the third quarter of 2023. TNX-1300 (cocaine esterase) is a biologic designed to treat cocaine intoxication and has been granted Breakthrough Therapy designation by the FDA. A Phase 2 study of TNX-1300 is expected to be initiated in the first quarter of 2023. TNX-1900 (intranasal potentiated oxytocin), a small molecule in development for chronic migraine, is expected to enter the clinic with a Phase 2 study in the first quarter of 2023. TNX-601 ER (tianeptine hemioxalate extended-release tablets) is a once-daily formulation of tianeptine being developed as a potential treatment for major depressive disorder (MDD) with a Phase 2 study expected to be initiated in the first quarter of 2023. Tonix's rare disease portfolio includes TNX-2900 (intranasal potentiated oxytocin) for the treatment of Prader-Willi syndrome. TNX-2900 has been granted Orphan Drug designation by the FDA. Tonix's immunology portfolio includes biologics to address organ transplant rejection, autoimmunity and cancer, including TNX-1500, which is a humanized monoclonal antibody targeting CD40-ligand (CD40L or CD154) being developed for the prevention of allograft and xenograft rejection and for the treatment of autoimmune diseases. A Phase 1 study of TNX-1500 is expected to be initiated in the first half of 2023. Tonix's infectious disease pipeline includes a vaccine in development to prevent smallpox and monkeypox, TNX-801, a next-generation vaccine to prevent COVID-19, TNX-1850, a platform to make fully human monoclonal antibodies to treat COVID-19, TNX-3600, and humanized anti-SARS-CoV-2 monoclonal antibodies, TNX-3800, recently licensed from Curia. TNX-801, Tonix's vaccine in development to prevent smallpox and monkeypox, also serves as the live virus vaccine platform or recombinant pox vaccine (RPV) platform for other infectious diseases. A Phase 1 study of TNX-801 is expected to be initiated in Kenya in the second half of 2023.

**All of Tonix's product candidates are investigational new drugs or biologics and have not been approved for any indication.*

This press release and further information about Tonix can be found atwww.tonixpharma.com.

Forward Looking Statements

Certain statements in this press release are forward-looking within the meaning of the Private Securities Litigation Reform Act of 1995. These statements may be identified by the use of forward-looking words such as "anticipate," "believe," "forecast," "estimate," "expect," and "intend," among others. These forward-looking statements are based on Tonix's current expectations and actual results could differ materially. There are a number of factors that could cause actual events to differ materially from those indicated by such forward-looking statements. These factors include, but are not limited to, risks related to the failure to obtain FDA clearances or approvals and noncompliance with FDA regulations; delays and uncertainties caused by the global COVID-19 pandemic; risks related to the timing and progress of clinical development of our product candidates; our need for additional financing; uncertainties of patent protection and litigation; uncertainties of government or third party payor reimbursement; limited research and development efforts and dependence upon third parties; and substantial competition. As with any pharmaceutical under development, there are significant risks in the development, regulatory approval and commercialization of new products. Tonix does not undertake an obligation to update or revise any forward-looking statement. Investors should read the risk factors set forth in the Annual Report on Form 10-K for the year ended December 31, 2021, as filed with the Securities and Exchange Commission (the "SEC") on March 14, 2022, and periodic reports filed with the SEC on or after the date thereof. All of Tonix's forward-looking statements are expressly qualified by all such risk factors and other cautionary statements. The information set forth herein speaks only as of the date thereof.

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Exhibit 99.02

Targeting the Wnt/β-catenin pathway as a broad-spectrum antiviral strategy

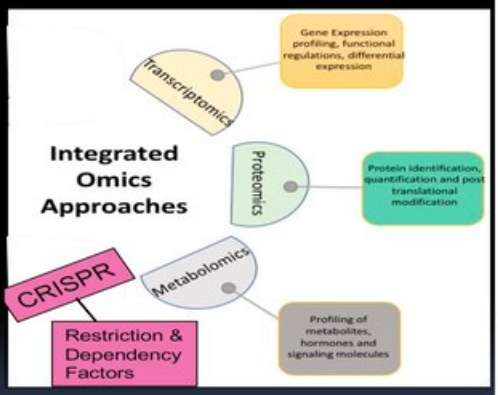
Tom C. Hobman
Department of Cell Biology
Li Ka Shing Institute of Virology
University of Alberta

Disclosures

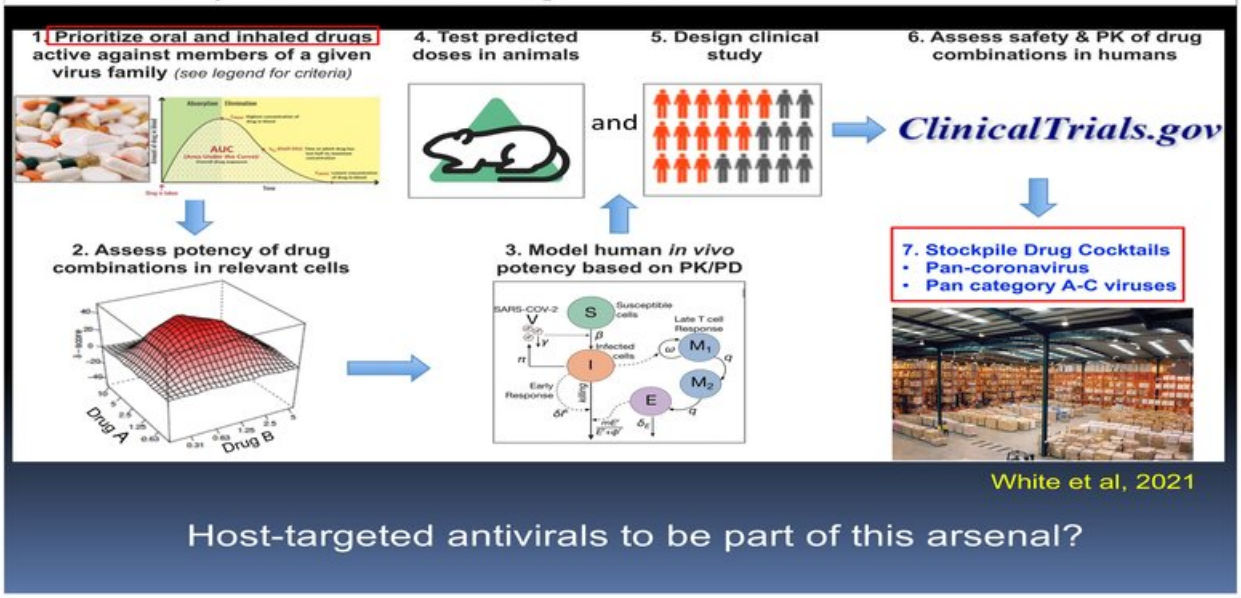
- Received research funding from Tonix Pharmaceuticals
- Licensing agreement with Tonix Pharmaceuticals

Research Focus

- Identification of key host factors/pathways that are utilized or affected by multiple RNA viruses
- Pharmacological targeting of these host factors/pathways should result in broad-spectrum antiviral activity



"For the present pandemic response, and for future pandemics …. the scientific community must be ready with an arsenal of easily self-administered drugs that can be tested in rapid, efficient clinical trials immediately after the causative viral agent is identified."

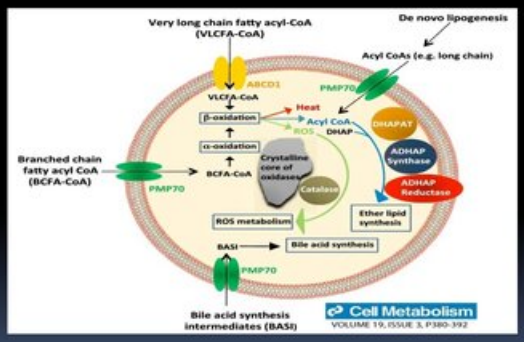


White et al, 2021

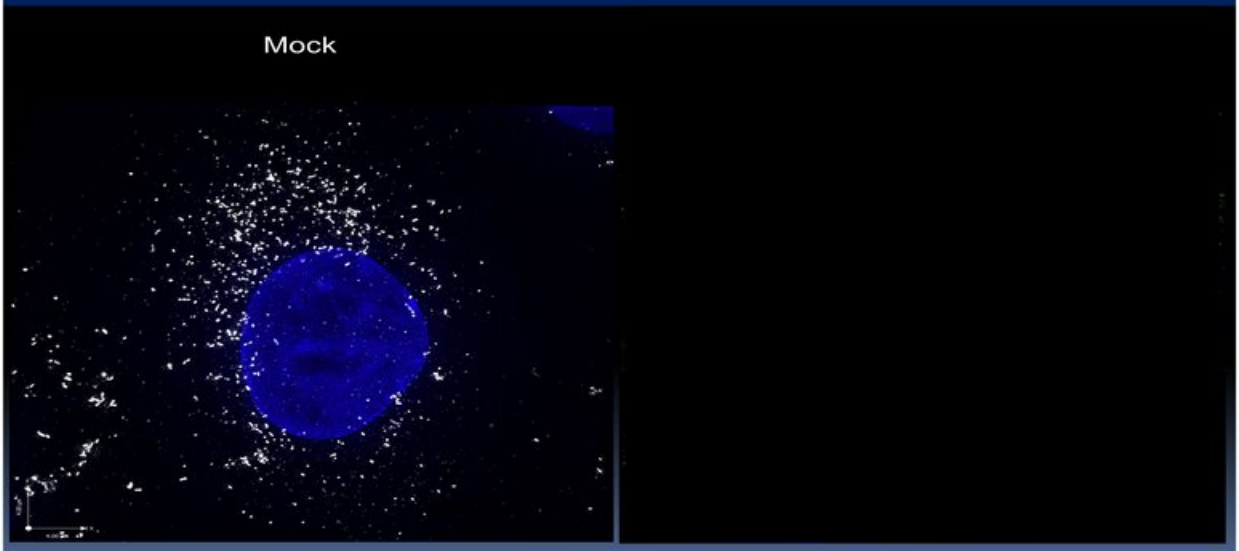
Host-targeted antivirals to be part of this arsenal?

Peroxisomes are targeted during RNA virus infection

- Abundant metabolic organelles in the cytoplasm
  - Catabolize very long chain fatty acids
  - Regulate reactive oxygen species
  - Produce specialized phospholipids (e.g. plasmalogens)

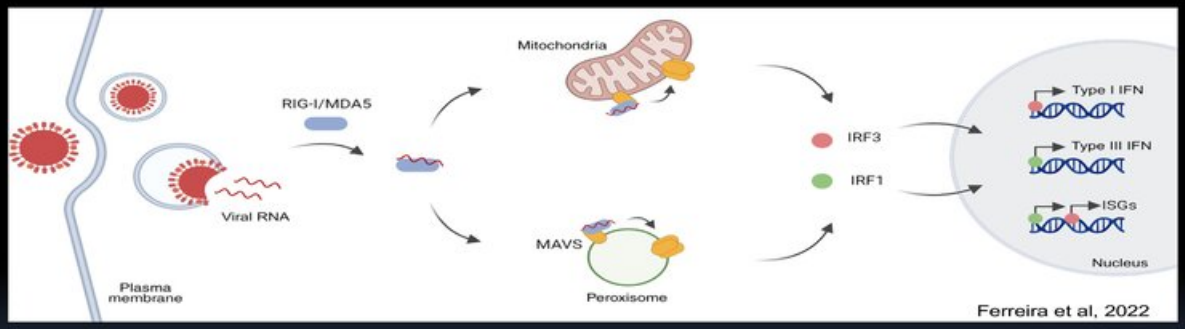


Flavivirus infection results in loss of peroxisomes



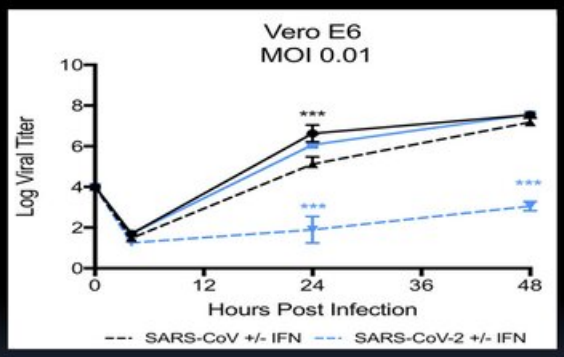
You, Hou *et al*. 2015

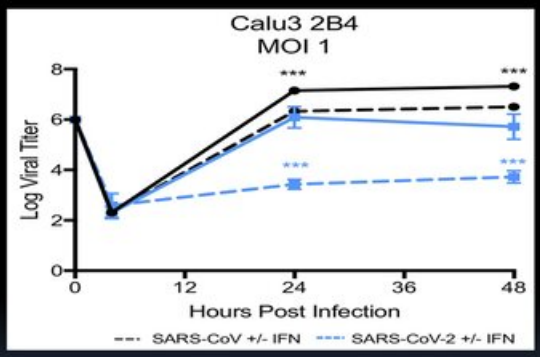
Why would a virus want to deplete the peroxisome pool?



>>Peroxisomes are antiviral signaling platforms that facilitate induction of type I and III interferons (IFN)

SARS-CoV-2 is highly sensitive to Interferon (IFN)





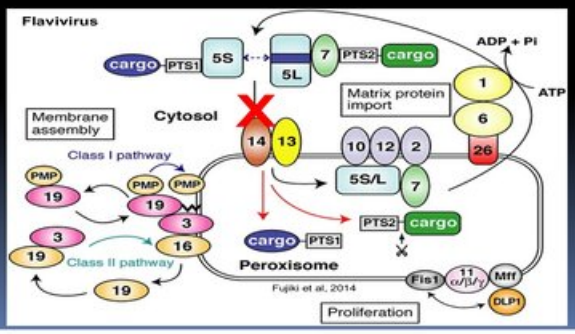
Lokugamage *et al*, 2020

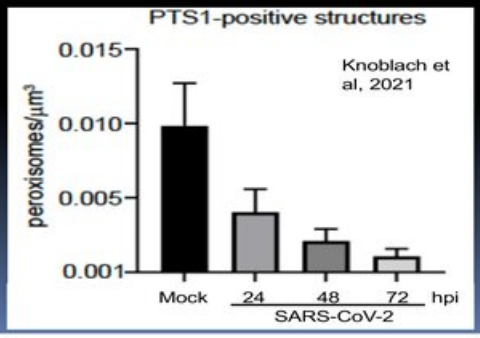
SARS-CoV-2 depletes functional peroxisomes

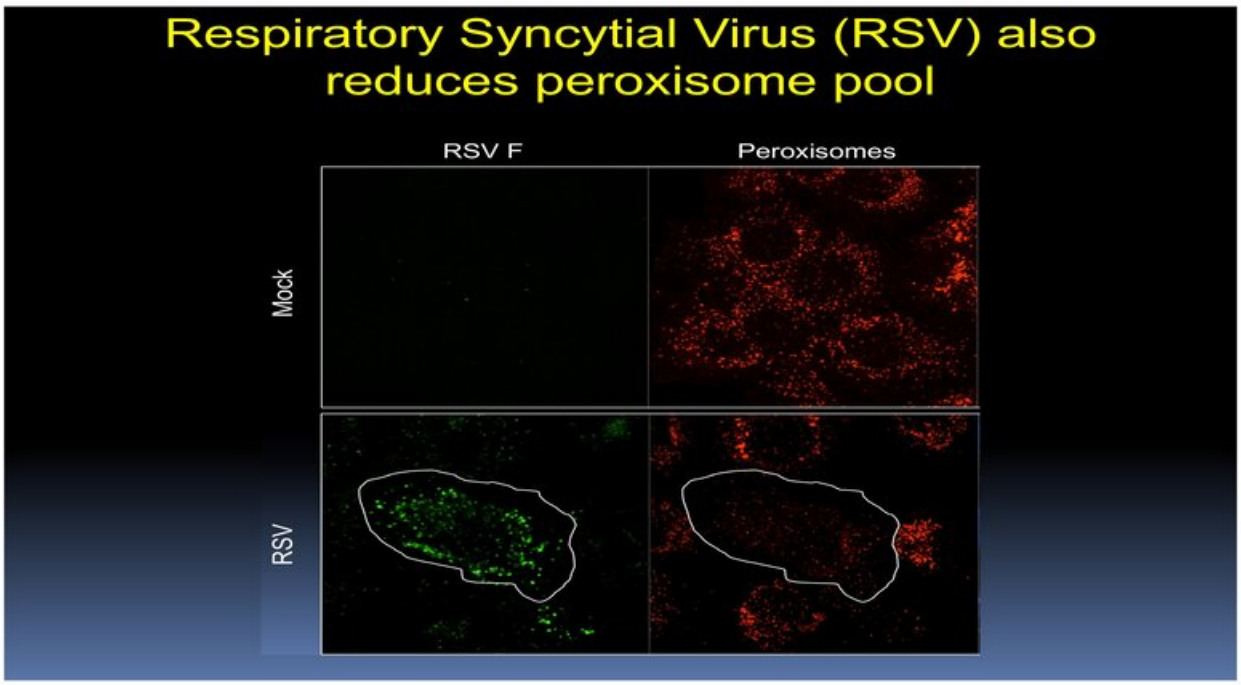
SARS-CoV-2

Mock | 24-hr | 48-hr | 72-hr

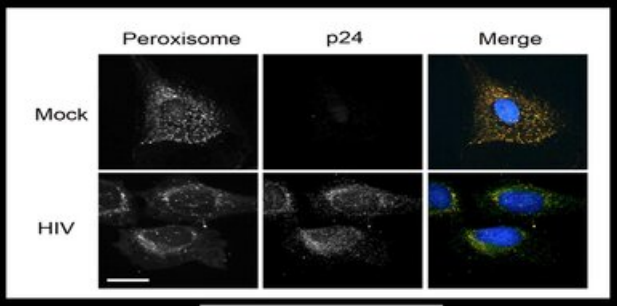
α-PTS1

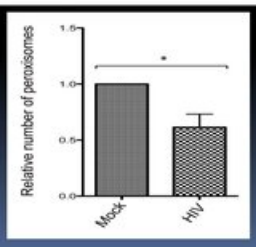


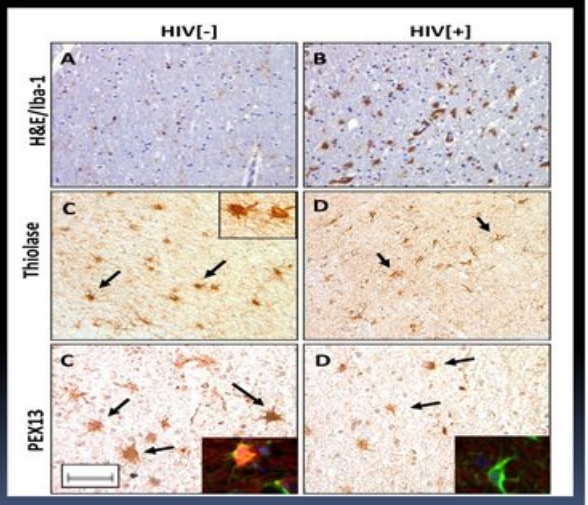



Respiratory Syncytial Virus (RSV) also reduces peroxisome pool
RSV F
Peroxisomes
Mock
RSV

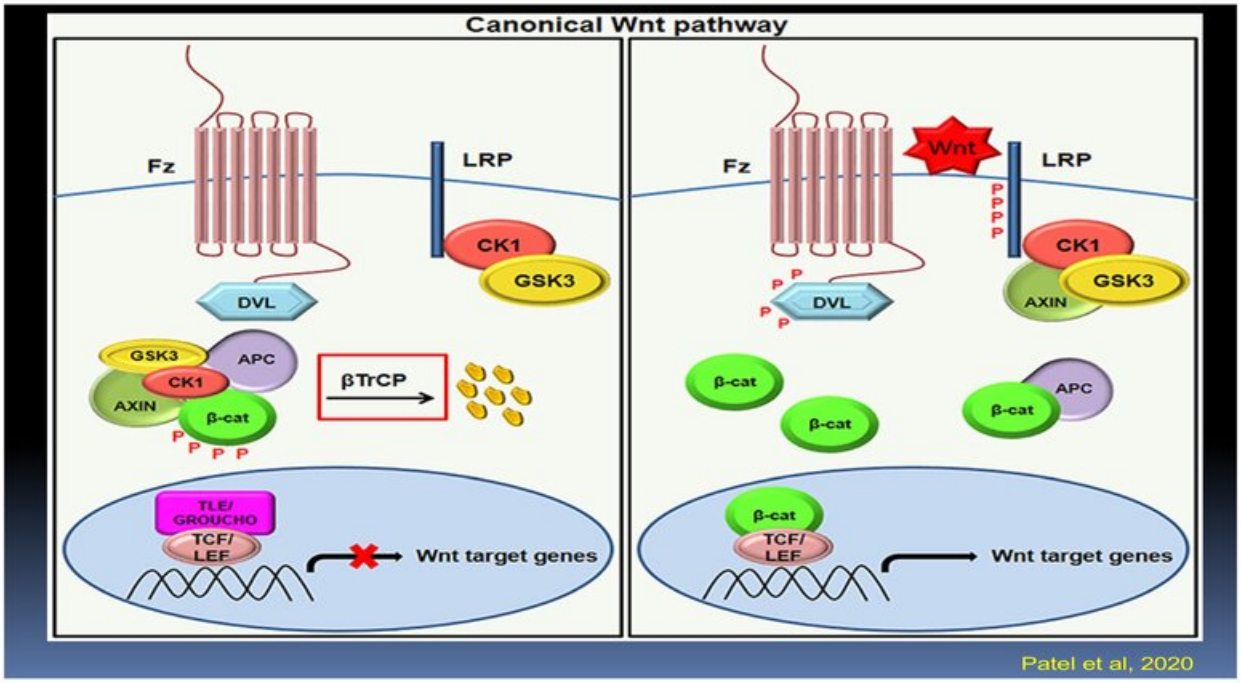
As does HIV….

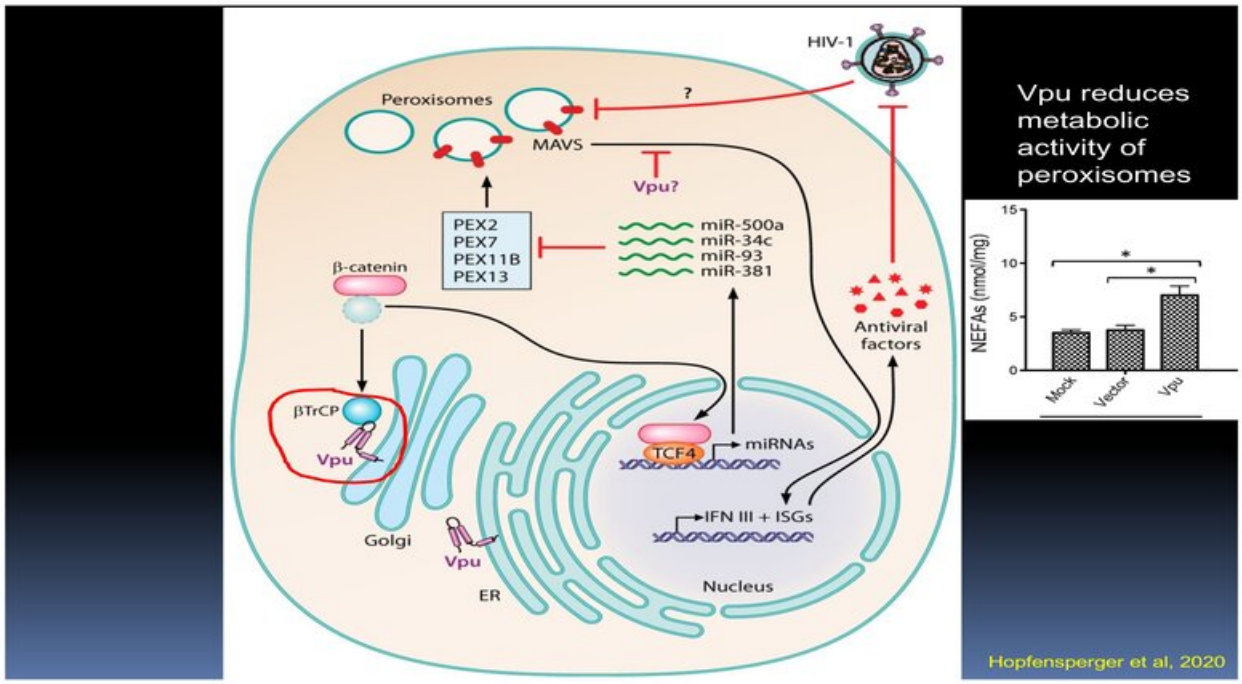






Xu et al, 2017


Canonical Wnt pathway
Fz
LRP
CK1
GSK3
DVL
GSK3
APC
CK1
AXIN
β-cat
P P P P
βTrCP
TLE/
GROUCHO
TCF/
LEF
Wnt target genes
Fz
Wnt
LRP
P P P P
CK1
GSK3
AXIN
P P
P
DVL
β-cat
β-cat
APC
β-cat
β-cat
TCF/
LEF
Wnt target genes
Patel et al, 2020

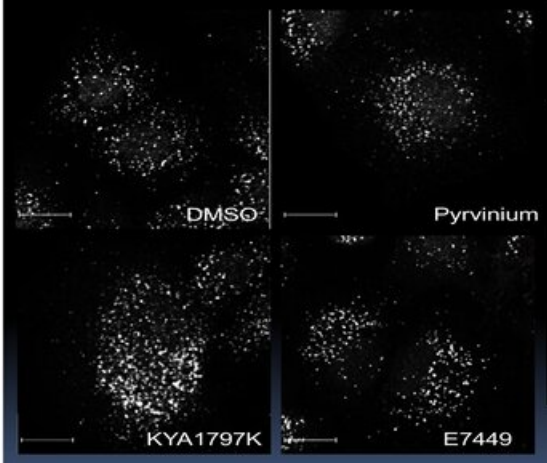

HIV-1
Peroxisomes
?
MAVS
Vpu?
PEX2
PEX7
PEX11B
PEX13
miR-500a
miR-34c
miR-93
miR-381
β-catenin
Antiviral factors
βTrCP
Vpu
TCF4
miRNAs
IFN III + ISGs
Golgi
Vpu
ER
Nucleus
Vpu reduces metabolic activity of peroxisomes
NEFAs (nmol/mg)
15
10
5
0
*
*
Mock
Vector
Vpu
Hopfensperger et al, 2020

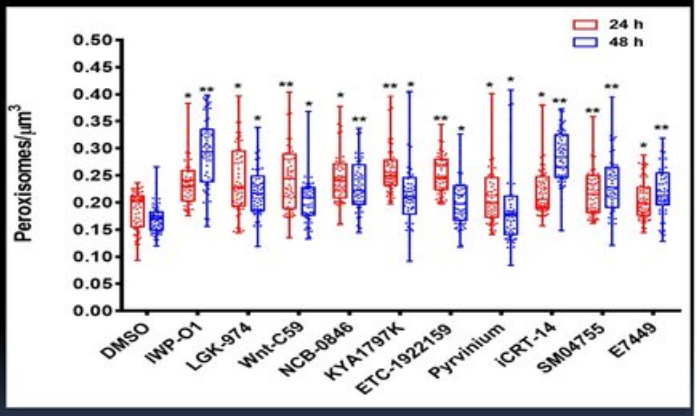
- Wnt/β pathway inhibits peroxisome biogenesis

Hypothesis: Inhibiting Wnt/β pathway will induce peroxisomes and reduce virus replication via enhanced IFN response

Test effects of Wnt/β pathway inhibitors on peroxisome density

Wnt/β-catenin inhibitors increase peroxisome density

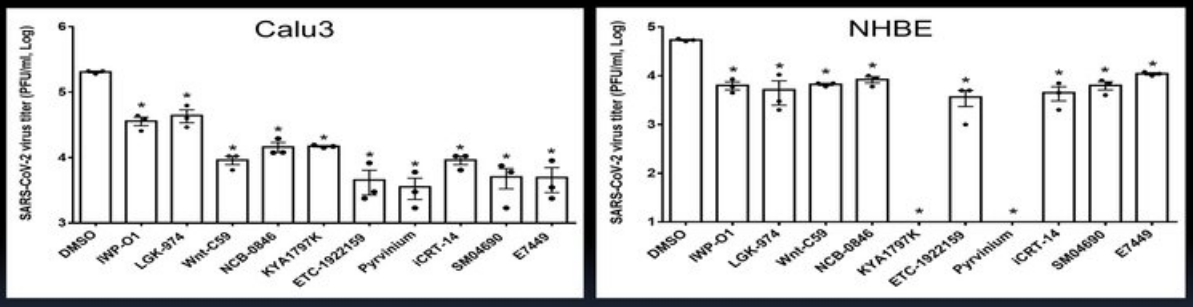




Xu, Elaish, Wong et al, in preparation

But do they inhibit virus replication?

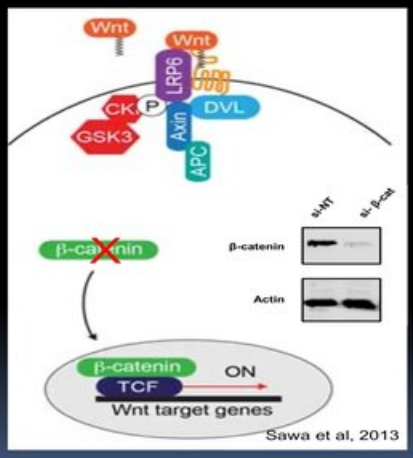
Wnt/β-catenin inhibitors reduce SARS-CoV-2 replication in multiple cell types

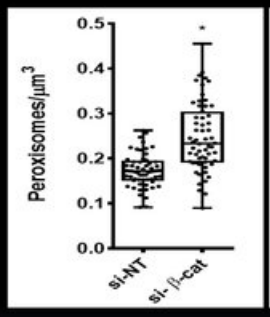


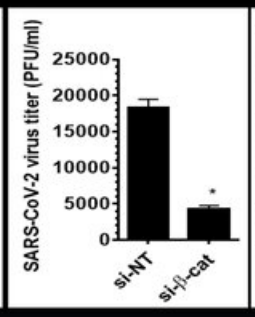
Calu3-human lung adenocarcinoma
NHBE-normal human bronchial epithelial cells

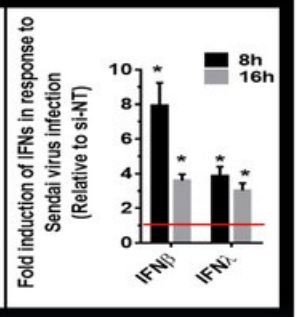
Xu, Elaish, Wong et al, in preparation

Reducing β-catenin levels induces peroxisome proliferation and enhances IFN response





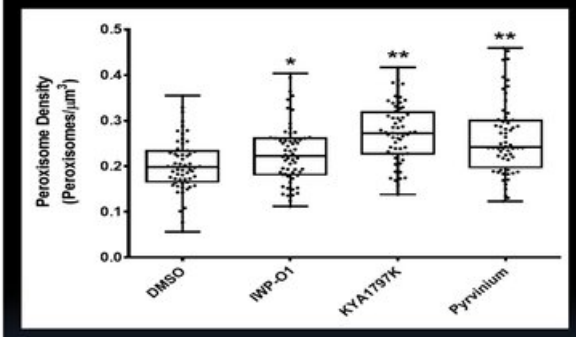


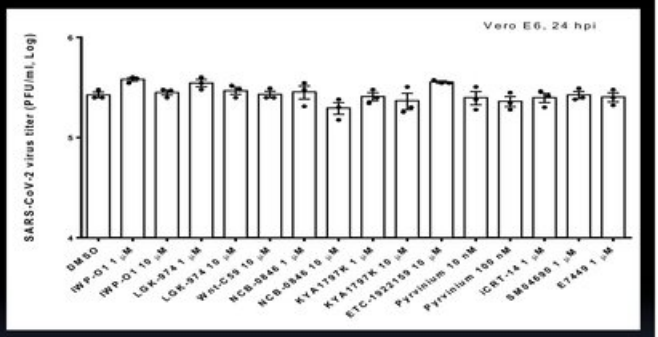


Suggests that antiviral effects of Wnt/β catenin inhibitors is not due to off target effects

Xu, Elaish, Wong et al, in preparation

Wnt/β-catenin inhibitors increase peroxisome density in Vero cells but do not reduce virus replication

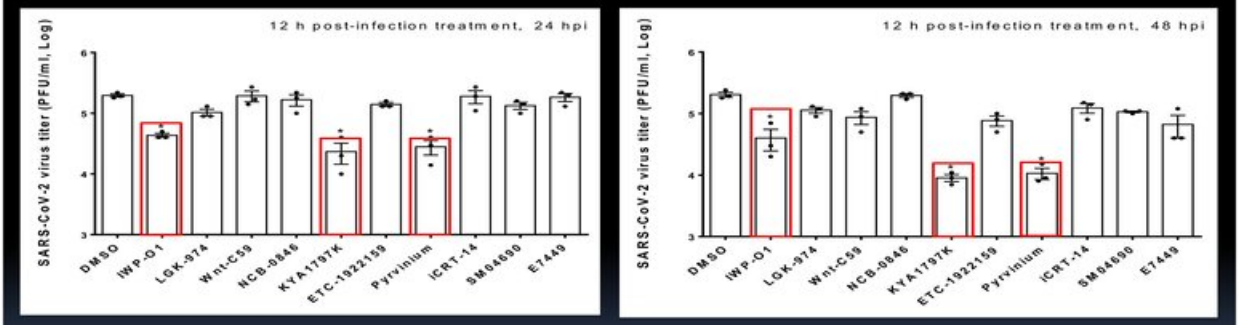




Consistent with model that antiviral effects of these drugs are IFN-dependent

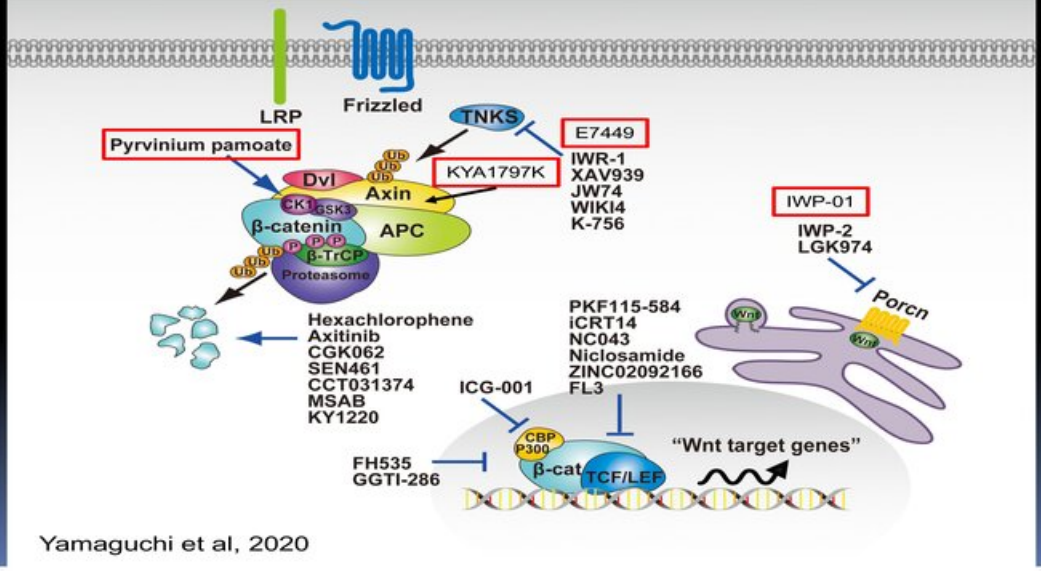
Xu, Elaish, Wong et al, in preparation

Some Wnt/β-catenin inhibitors decrease virus replication when added post-infection



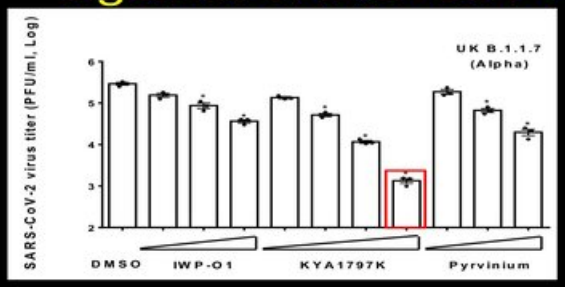
Xu, Elaish, Wong et al, in preparation

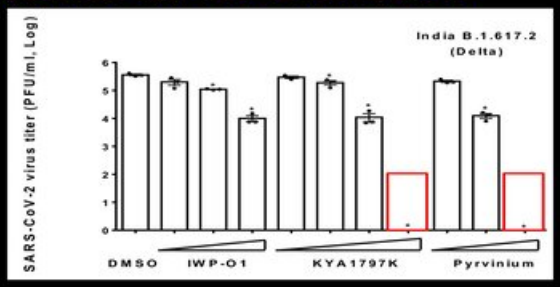
Drugs with high SIs chosen for testing against Variants of Concern and small animal studies

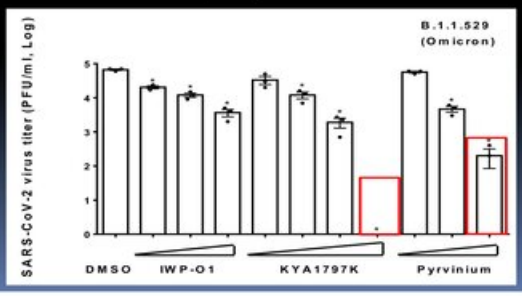


Yamaguchi et al, 2020

Peroxisome-modulating drugs are effective against SARS-CoV-2 Variants of Concern

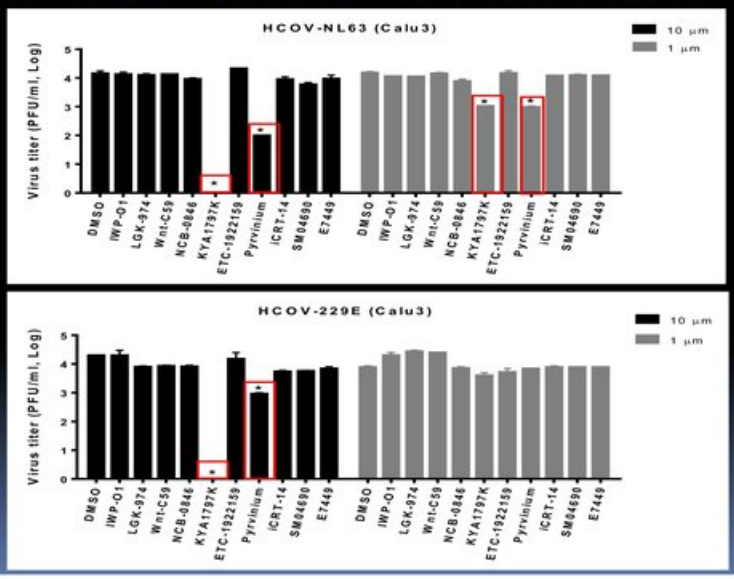




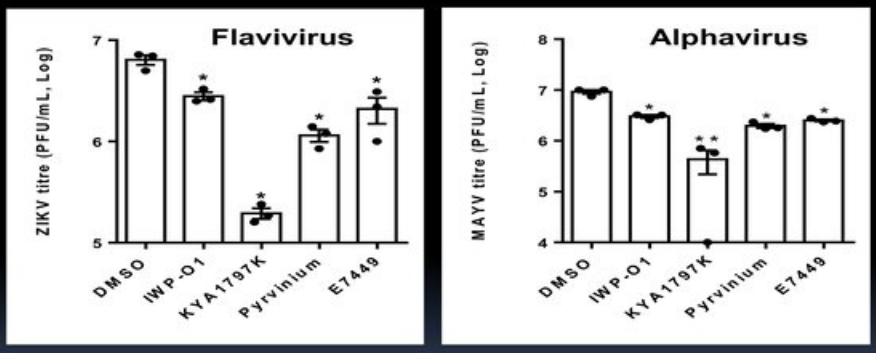


Xu, Elaish, Wong et al, in preparation

Some Wnt/β-catenin inhibitors reduce replication of other human coronaviruses



Wnt/β-catenin inhibitors reduce replication of other RNA viruses



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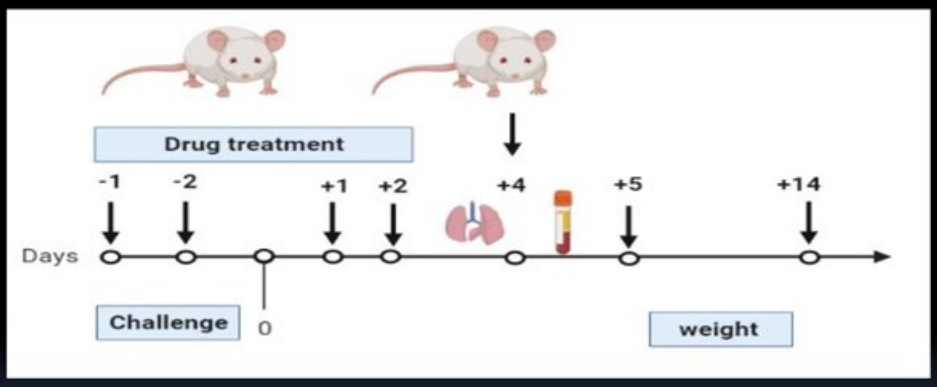
In vivo testing of Wnt inhibitors

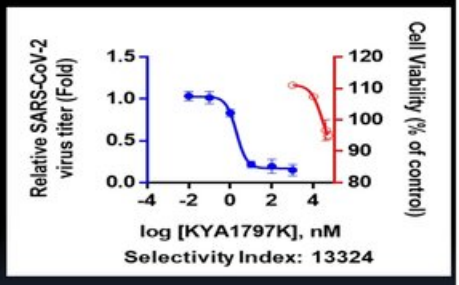


Drugs administered intranasally to female BALB/c mice (5 in each group)

Intranasal challenge with 5 x 10^3 pfu of mouse-adapted SARS-CoV-2

KYA1797K

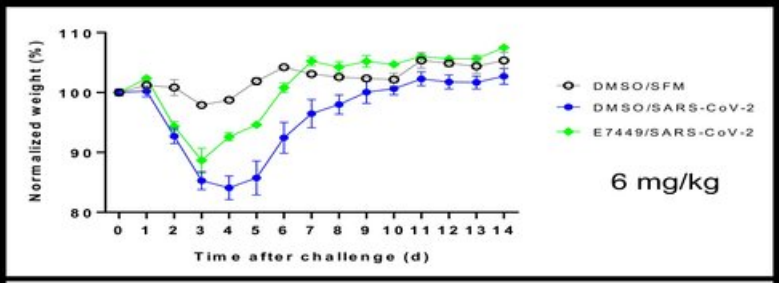
- Destabilizes β-catenin by activating Axin-GSK3β complex
- Tested via IP administration in mice (20 mg/kg/day)
  - Here limited to 3 mg/kg due to solubility

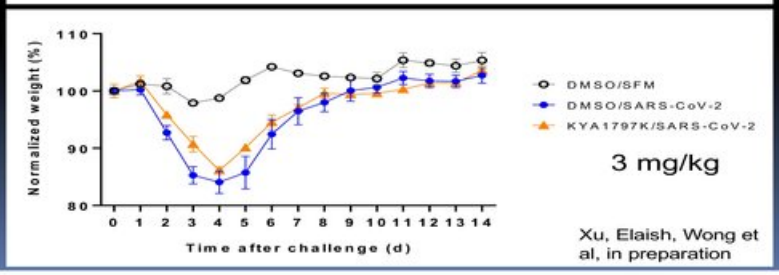


E7449

- Other names: Stenoparib
- Dual inhibitor of PARP1/2 & tankyrase1/2
- Orally bioavailable
- Phase1/2 study for cancer indications
  - Well tolerated (50-800 mg dosing) in humans
  - 0% cytotoxicity in human cells at 10 μM *in vitro*

Wnt inhibitors have modest effect on virus-induced weight loss





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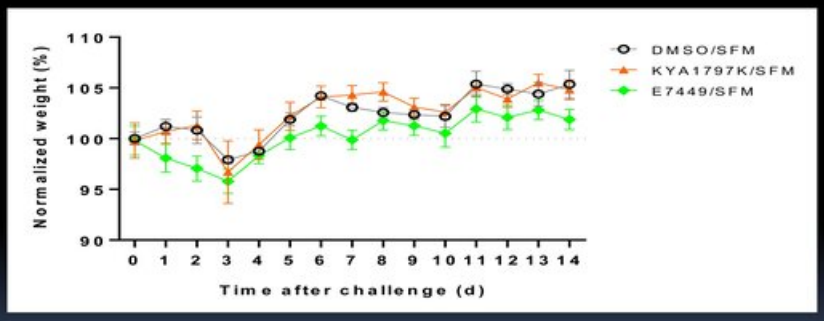
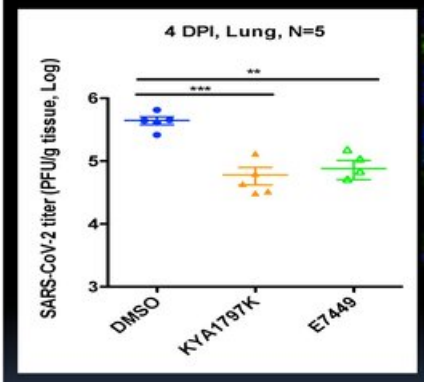
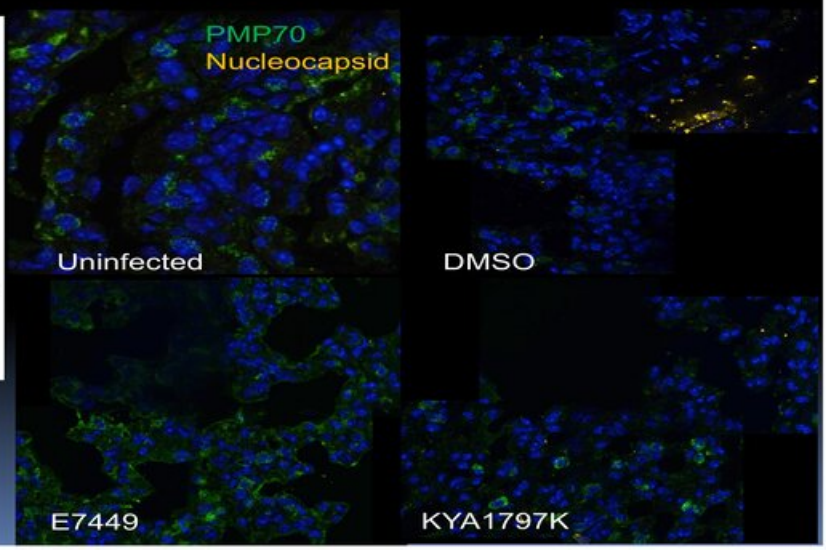
Anesthesia/IN drug administration causes mild transient weight loss



Wnt inhibitors reduce viral load in lungs





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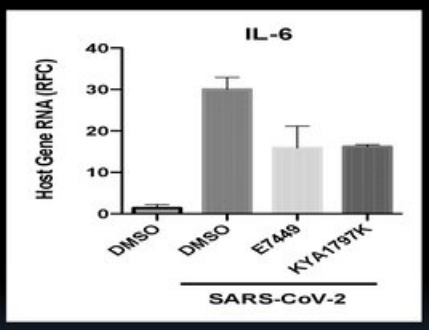
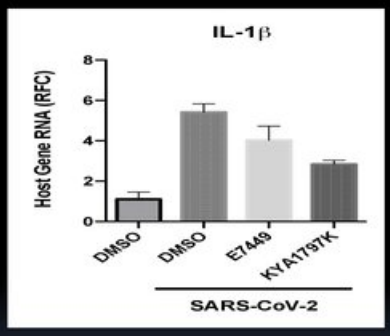
Wnt inhibitors reduce proinflammatory markers in lungs





4-days post-infection

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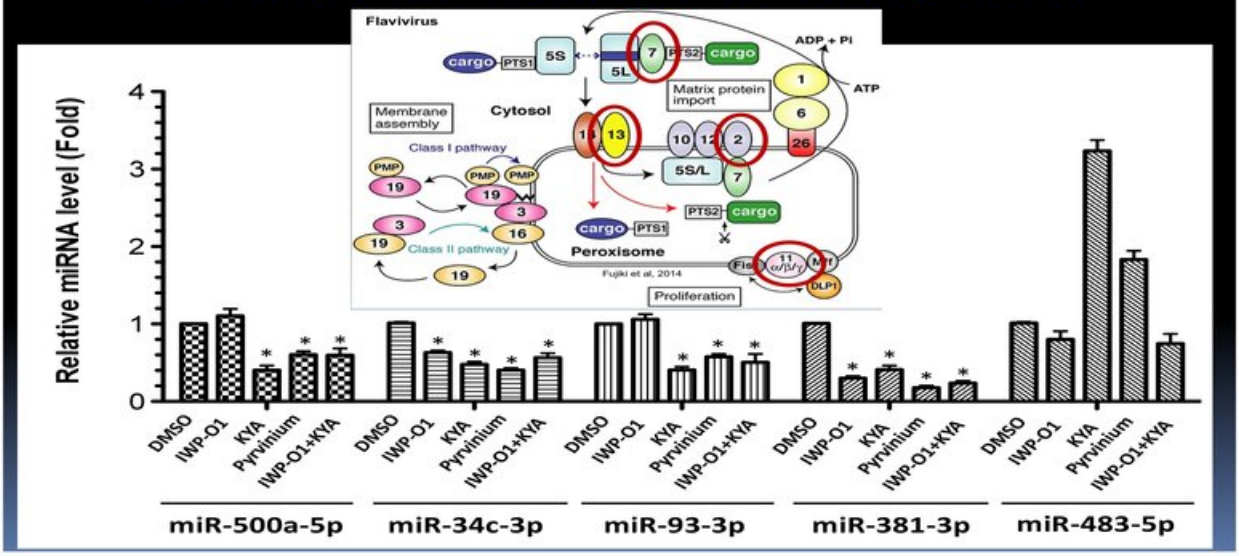
Wnt inhibitors reduce expression of miRNAs that suppress peroxisome biogenesis



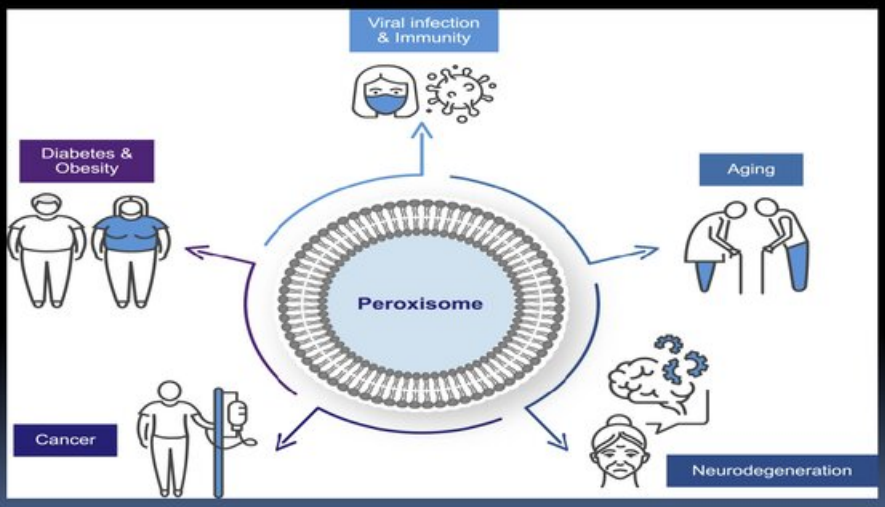
Summary

- Inhibition of Wnt/β catenin pathway induces peroxisomes and enhances IFN response during viral infection
- Significantly reduces SARS-CoV-2 replication *in vitro* and *in vivo*
- Broad-spectrum activity against other RNA viruses

Potential benefits of targeting peroxisomes for antiviral therapy

- Drug candidates with good safety profiles
  - Wnt inhibitors
  - Peroxisome proliferator-activated receptor agonists
- Reduce inflammation?
- Prophylactic and early therapeutic use?
- *Do not induce IFN in absence of viral infection*

Inducing peroxisome biogenesis may have multiple health benefits



Zalckvar and Schuldiner, 2022

Ongoing/Future studies

- *In vivo* efficacy of post-infection administration of Wnt/β catenin inhibitors
- Increase bioavailability of drugs?
  - Oral?
  - Nebulizer?
  - Derivatives?
- Testing other Wnt/β catenin inhibitors and peroxisome proliferators alone and in combination
- High throughput screening for novel peroxisome-inducing drugs

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