

茶カテキンによる上気道感染予防効果

The 7th Annual Colloquium of the Global Tea Initiative (GTI) for the Study of Tea Culture and Science, UC, Davis, California, USA. 2022/01/13

Tea Catechins for the Prevention of Upper Respiratory Tract Infections

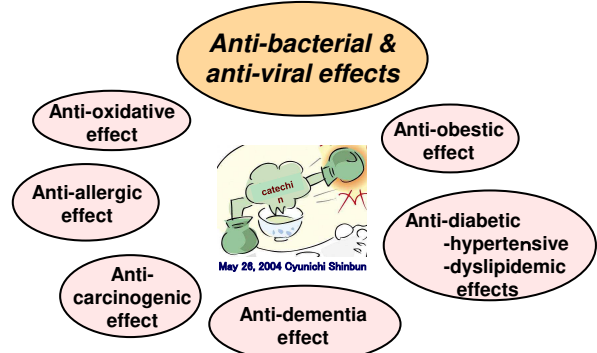
Hiroshi Yamada, MD, PhD, FACP

Professor & Chairman
Department of Drug Evaluation & Informatics
School of Pharmaceutical Sciences
University of Shizuoka, Japan
E-mail: hyamada@u-shizuoka-ken.ac.jp



茶カテキンの機能 ~抗バクテリア、ウイルス作用~

Experimentally reported functional benefits of tea catechins



上気道感染症 (URTI) に対するカテキンの抗ウイルス効果

Anti-viral effects of catechins against the upper respiratory tract infections (URTI)

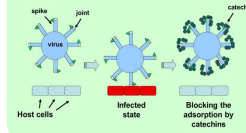
- Influenza virus
- Parainfluenza virus
- Adenovirus
- Respiratory syncytial virus (RSV)
- Coronavirus (SARS-CoV-2)

- ★ Inhibition of attachment to the host cell against hemagglutinin (HA).
- ★ Replication inhibition against viral RNA polymerase /nucleoprotein.
- ★ Neuraminidase (NA) inhibition to suppress the release of virion progeny from infected cells

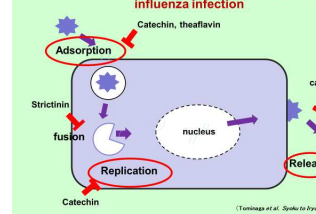
- ★ 血球凝集素 (HA) に対する宿主細胞に対する阻害効果
- ★ ウイルスRNAにポリメラーゼ / 核タンパク質に対する複製阻害効果
- ★ 感染細胞からのビリオン子孫放出を抑制する / イラミナーゼ (NA) 阻害

茶カテキンによるインフルエンザウイルス感染阻害

Anti-viral effect of tea catechins (schema)

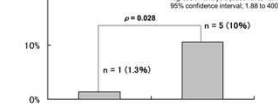


Anti-viral mechanism of catechins against influenza infection

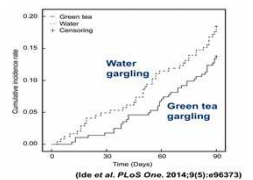


Comparison of the incidence of influenza infection

(Concentration of total catechins: 200 µg/ml, gargling 3 times daily, for 3 months)



(Yamada et al. J Altern Complement Med, 12:669-672, 2006)



茶カテキンによるインフルエンザウイルス感染阻害のメタ解析

Preventive effects of tea and tea catechins against influenza and acute upper respiratory tract infections: a systematic review and meta-analysis

Umeta et al. Eur J Nutr. 2021; 60(8): 4188-4202

Results from the meta-analysis

4 randomized controlled trials (RCTs) and 4 prospective cohort studies (n = 3748).

Total (gargling and consumption with tea or tea catechins) (risk ratio [RR] = 0.74, 95% confidence interval [CI] 0.64-0.87)

	risk ratio [RR]	confidence interval [CI]
Study type:		
prospective cohort study	0.67	0.50-0.91
RCT	0.79	0.66-0.94
Disease type:		
influenza	0.69	0.58-0.84
URTI	0.78	0.62-0.98
Consumption or gargling:		
consumption	0.68	0.52-0.87
gargling	0.83	0.72-0.96

(Umeta et al. Eur J Nutr. 2021; 60(8): 4188-4202)

Gargling with green tea: a Japanese custom

Gargling with green tea has been recommended for the prophylaxis of flu in elementary schools in Japan.



Yomiuri Shinbun Jan. 24, 2007

Yomiuri Shinbun Dec. 24, 1998

Prospective cohort study: 前向きコホート研究

RCT: 無作為化比較試験

URTI: 上気道感染症

Consumption: 飲用

Meta-analysis: 複数の臨床研究のデータを収集・統合し、統計的方法を用いて解析した系統的総説

ケニアからのCovid19 に関する話題提供

RBAL TEA DRINKS FOR DIETARY MANAGEMENT OF COVID- 19: A MYTH OR FACT?

UNIVERSITY OF CALIFORNIA- DAVIS
Global Tea Initiative 7th Annual Colloquium
Bridging Science and Culture, Time and Space
13th January 2022

Dr. Mary N Muchiri PhD (Co-authors: Dr. D Maina and L. Asiko)
Food & Nutrition Sciences

Covid19に対するハーブティーの効果 神話か事実か?

ケニアからのCovid19 に関する話題提供の結論

CONCLUSIONS & RECOMMENDED FUTURE STUDIES

No scientific evidence that recommends either for or against the use of herbal teas for dietary management/mitigation of COVID-19

RESEARCHABLE AREAS

- Proven clinical studies using randomized/control human trials
- Efficacy, Biosafety and hygiene standards of the tea beverages
- Socioeconomic impact
- Psychological effects
- Environmental and risk assessments

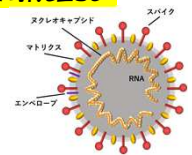


Covid19に対するハーブティーの効果に繋がるもしくは繋がらないという科学的証拠がない場合、飲料の心理的/認知的効果や神話は、人間のウェルビーイングに良い影響を与えるのか？

今後は臨床試験や、茶飲料の衛生基準・有効性、経済的・心理的な影響等々の研究の余地がある。

茶学術研究会セミナー

お茶の抗ウイルス性とストレス緩和 ～with/afterコロナ時代を生きる～



新興ウイルスの脅威と
茶の効果について

茶学術研究会と静岡県茶業会議所の共催 WEBセミナー

講師：静岡県立大学 鈴木 隆 先生
新興ウイルスの脅威と茶の効果について 前半

<https://youtu.be/frOd-V0Vjro>

新興ウイルスの脅威と茶の効果について 後半

<https://youtu.be/EEbtT58z71Q>

配信期間：2021年11月15日～

静岡県立大学名誉教授
薬学部客員教授
鈴木 隆

お茶によるウイルスの感染阻害作用

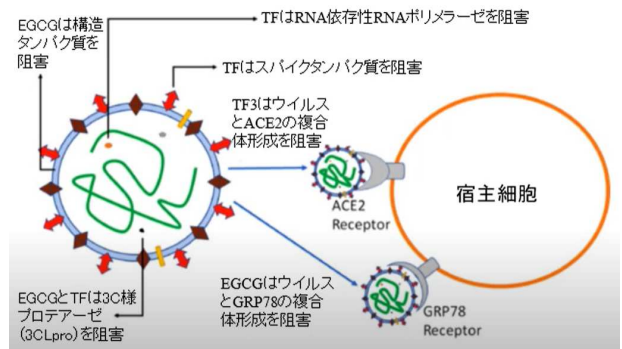
表1. 茶ポリフェノールの抗インフルエンザウイルス作用

ポリフェノールの種類	主な抗ウイルス作用
エピガロカテキンガレート (EGCG)	1. 感染阻害作用 2. 受容体結合阻害作用 3. シアリダーゼ活性阻害作用 4. 細胞内小胞の酸性化抑制による脱殻阻害作用 5. ウイルスRNA合成阻害作用 6. ウイルス凝集作用
エピカテキンガレート (ECG)	1. 感染阻害作用 2. 受容体結合阻害作用 3. シアリダーゼ活性阻害作用 4. ウイルスRNA合成阻害作用
テアフラビンガレート (Theaflavin digallate)	1. 感染阻害作用 2. 受容体結合阻害作用 3. ウイルス凝集作用



お茶によるコロナウイルスに対しては？

SARS-Coronavirus-2における茶成分の作用



ChaOIフォーラム公開セミナーより

緑茶と新型コロナウイルス研究のシンポジウム

ChaOIフォーラム 公開セミナー

緑茶と新型コロナウイルス研究のシンポジウム

セミナー開始までこのままお待ちください

国内外における緑茶の研究成果

—新型コロナウイルス感染症に対するEGCGの可能性—

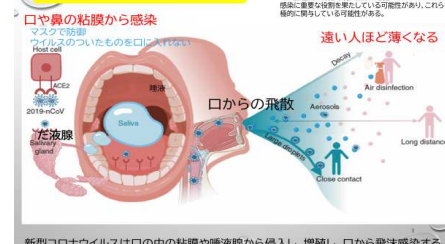
静岡県農林技術研究所
茶業研究センター 松浦英之



松浦氏の講演内容

- 口腔環境の重要性
- 茶カテキンの不活性化効果
- EGCGの効果可能性に関するレビュー
- EGCGの体内動態
- SARS-CoV-2のライフサイクル
- サイトカインストームに対する保護効果
- 茶カテキンを用いた臨床研究
- 消費者者からの注意喚起
- まとめ
- 引用文献

お茶と新型コロナウイルス



新型コロナウイルスは口の中の粘膜や唾液腺から侵入し、増殖し、口から飛沫感染する。
Ruoshti Xu et al. Int. J. Oral Sci. 2020 12:144-149

口腔および唾液のSARS-CoV-2感染

ARTICLES
SARS-CoV-2 infection of the oral cavity and saliva
Ni Huang^{1,2}, Pei Pei^{1,2}, Takashi Kato^{1,2}, Yu Miao^{1,2}, Kazuo Shino^{1,2},
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2}, Margaret Beaudry,
Elmer Priyadarshi, Joon D. Mahalingam^{1,2}, Ronald A. Lefkowitz^{1,2}, Shihong Jiang^{1,2}, Hailan Wang,
Ruiyuan C. Gao^{1,2}, Genta Doriguchi^{1,2}, Eiji Goto^{1,2}, Satoru Imai^{1,2},

