



Document prepared by Nerve Center of TFORD, Venture Center, Pune  
**Task Force on Repurposing of Drugs (TFORD) for COVID19**  
 S&T Core Group on COVID19 constituted by PSA to Gol

## Molecule Brief: Famotidine

**Ref:** TFORD/MB/028 **Date:** 18 June 2020

**About this document:** This document summarizes information available on drug candidates for COVID19. One Molecule Brief document covers one candidate at a time.

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### 1. Summary Information on Famotidine

Information About the Candidate for Approved Indication(s)	
Common Name of Drug	Famotidine
Brand Name	Pepcid Femtin, Febcid, Femidin, Fontain Forte, Fudone, and more <a href="http://www.drugupdate.com/brand/showavailablebrands/48/2">http://www.drugupdate.com/brand/showavailablebrands/48/2</a>
Category/ Type	Gastric acid controller; Anti-viral
Drug Bank ID/Link	DB00927 <a href="https://www.drugbank.ca/drugs/DB00927">https://www.drugbank.ca/drugs/DB00927</a>
Mode of Action	Famotidine is a competitive histamine-2 (H2) receptor antagonist that works to inhibit gastric acid secretion by blocking the action of histamine. Famotidine displays higher selectivity towards the H2 receptor and is more potent at inhibiting gastric acid secretion than <a href="#">cimetidine (20X)</a> and <a href="#">ranitidine (7.5X)</a>
Therapeutic Target	Histamine-2 (H2) receptor
Is action Host or Virus directed?	Host
Currently Approved for which Indication(s)	<ul style="list-style-type: none"> <li>Active duodenal ulcer (DU)</li> <li>Reduction of risk of DU recurrence</li> <li>Active gastric ulcer</li> <li>Symptomatic non-erosive gastroesophageal reflux disease (GERD) and erosive esophagitis due to GERD, diagnosed by biopsy</li> <li>Treatment of pathological hypersecretory conditions (Zollinger Ellison Syndrome, Multiple Endocrine Neoplasias)</li> </ul>
Approved Dose	20mg once daily to 40 mg twice daily
Route of Administration	Oral, IV injection
Safety Profile of drug (dose range in which it has been tested to be safe in humans)	The lowest published toxic dose (TDLo) in humans following oral administration is 4 mg/kg/7D
Adverse	Headache, dizziness, constipation, and diarrhea

events/Side effects reported at the current approved dose	
Reported Drug-Drug Interactions	Drugs Dependent on Gastric pH for Absorption (dasatinib, delavirdine mesylate, cefditoren, and fosamprenavir), Tizanidine (CYP1A2) Substrate <i>(Clinicians need to note relevant drug-drug interactions depending on nature of use)</i>
Link to Datasheet	<a href="https://www.accessdata.fda.gov/drugsatfda_docs/label/2018/019462s039lbl.pdf">https://www.accessdata.fda.gov/drugsatfda_docs/label/2018/019462s039lbl.pdf</a>
Current TRL level of the Drug	TRL 9; approved drug
Has the drug been repurposed for any other indication before?	No
Is the Drug being sold in India?	Yes
Indian Manufacturer(s)	SMS Pharma, Rakshit Pharma, Dr. Reddy's, Ipca Lab, Alembic Pharma, Gonane Pharma, Hoventa Pharma, Nakoda Chemicals, Parth Antibiotics, Phalanx Labs, Remedy labs, Rumit Lifecare, Wanbury, Kramer, SPPL, Aurobindo, Bewell, IPCA, Sun, Biomedica, Fincure pharma, Intas, Aristo, Alchem, Cadila, USV, Wallace, AHPL, Micro B&B, Taj Pharms, Sresan, Wockhardt, Stredman, PCI, Overseas, Max, Themis Pharms, Torrent, Cipla, Inga, Wyth, Chemo <a href="http://www.drugsupdate.com/brand/showavailablebrands/48/2">http://www.drugsupdate.com/brand/showavailablebrands/48/2</a>
International Manufacturer(s)	Lupin, Navinta, Salix, Akorn strides, Apotex, Apothecon, App, Baxter, Bedford, Hospira, Ben venue laboratories, Claris, Abbott, Merck, L perrigo, Schwarz, Actavis Elizabeth, Alembic, Apotex, Carlsbad, Dr reddys, Genpharm, Ivax, Mutual, Mylan, Perrigo, Ranbaxy, Sandoz, Teva, Watson Wockhardt
Cost of the Drug in India	Rs. 3-30/- per 14 tablets
<b>Information About the Candidate for COVID-19</b>	
Repurposing Claim	New Indication (COVID-19) + New Dose (not confirmed)
Rationale for Repurposing for COVID19/MoA?	There is no published data proving a specific mechanism of action for Famotidine in COVID-19. However, recent computational studies suggest Famotidine could work as an anti-viral (see Pre-Clinical Data Section)
Proposed use as Primary or Adjuvant?	Primary
Pre-Clinical Data available for COVID-19	Docking study identified Famotidine to bind to SARS-CoV-2 3CLpro <a href="https://www.sciencedirect.com/science/article/pii/S2211383520302999">https://www.sciencedirect.com/science/article/pii/S2211383520302999</a>
Status of Clinical Trials	1 ongoing
Trial Details	See table below

Trial ID/Link	Type of Trial	No. of patients	Drug Combination/Dose/ Stage of Disease	Primary and Secondary Measures	Has data from the trial been published?
<a href="#">NCT04370262</a>	Randomized, Double-Blind, Multi-Arm Historical Control, Comparative Trial	1170	HCQ + Intravenous Famotidine  Dose: Famotidine Injection, 10mg/mL mixed with Normal Saline is given intravenously at 120mg (30% of 400 mg oral	Primary Outcome: Mortality Secondary Outcome: Virologic response to study treatment detected in blood, Virologic clearance in nasal swab and/or lower respiratory secretions, Clinical	No

			dose). The total daily dose proposed is 360mg/day famotidine IV for a maximum of 14 days, or hospital discharge, whichever comes first  Stage: patients hospitalized with moderate to severe disease	Severity	
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Key Data from Clinical Trials	<ul style="list-style-type: none"> <li>A ScienceMag article states – “Director of the Cold Spring Harbor Laboratory Cancer Center, recommended famotidine to his 44-year-old sister. She had tested positive for COVID-19 and developed a fever. Her lips became dark blue from hypoxia. She took her first megadose of oral famotidine on 28 March. The next morning, her fever broke and her oxygen saturation returned to a normal range. Five sick co-workers, including three with confirmed COVID-19, also showed dramatic improvements after taking over-the-counter versions of the drug, according a spreadsheet of case histories Tuveson shared with <i>Science</i>.” <a href="https://www.sciencemag.org/news/2020/04/new-york-clinical-trial-quietly-tests-heartburn-remedy-against-coronavirus">https://www.sciencemag.org/news/2020/04/new-york-clinical-trial-quietly-tests-heartburn-remedy-against-coronavirus</a></li> <li>A retrospective study conducted by the same group (as mentioned in the above article) shows that in patients hospitalized with COVID-19, famotidine use was associated with a significant reduced risk of clinical deterioration leading to intubation or death. <a href="https://www.medrxiv.org/content/10.1101/2020.05.01.20086694v2.full.pdf">https://www.medrxiv.org/content/10.1101/2020.05.01.20086694v2.full.pdf</a></li> </ul>
TRL Level for COVID19	TRL> 7 (Ph III trial)
Other Key References	<ul style="list-style-type: none"> <li><a href="https://link.springer.com/content/pdf/10.1007/s00296-020-04584-7.pdf">The effect of histamine type 2 receptor antagonists on human immunodeficiency virus (HIV) replication: identification of a new class of antiviral agents</a></li> <li><a href="https://link.springer.com/content/pdf/10.1007/s00296-020-04584-7.pdf">https://link.springer.com/content/pdf/10.1007/s00296-020-04584-7.pdf</a></li> <li><a href="https://www.researchgate.net/profile/Moshe_Rogosnitzky/publication/340732235_Delivering_Benefits_at_Speed_through_Real-World_Repurposing_of_Off-Patent_Drugs_The_COVID-19_Pandemic_as_a_Case_in_Point/links/5e9ad2dc299bf13079a280bd/Delivering-Benefits-at-Speed-through-Real-World-Repurposing-of-Off-Patent-Drugs-The-COVID-19-Pandemic-as-a-Case-in-Point.pdf">https://www.researchgate.net/profile/Moshe_Rogosnitzky/publication/340732235_Delivering_Benefits_at_Speed_through_Real-World_Repurposing_of_Off-Patent_Drugs_The_COVID-19_Pandemic_as_a_Case_in_Point/links/5e9ad2dc299bf13079a280bd/Delivering-Benefits-at-Speed-through-Real-World-Repurposing-of-Off-Patent-Drugs-The-COVID-19-Pandemic-as-a-Case-in-Point.pdf</a></li> <li><a href="https://www.biochem2.com/newsentry/2020-05-05">https://www.biochem2.com/newsentry/2020-05-05</a></li> </ul>

## IP Status

Status/ Molecule	Famotidine
Pending applications	<p><a href="#">2549/MUM/2012</a> Title: Design development and evaluation of floating drug delivery system of Famotidine Inventor: Bharati Vasantrao Bakde Filing date: 01/09/2012 Publication date: 14/03/2014 Status: Under prosecution</p> <p><a href="#">3782/MUM/2014</a> Title: Fast release taste masked dry powder for oral suspension Assignee: North Maharashtra University Filing date: 27/11/2014 Publication date: 16/10/2015 Status: Under prosecution</p> <p><a href="#">201621007619</a></p>

	<p>Title: Travelers' friendly oral soluble film of Ondansetron hydrochloride and Famotidine  Inventor: Shende Pravin Keshavrao  Filing date: 04/03/2016  Publication date: 24/11/2017  Status: Under prosecution  <a href="#">201841017647</a></p> <p>Title: Pharmaceutical composition comprising ibuprofen and Famotidine  Assignee: Aurobindo Pharma Ltd  Filing Date: 10/05/2018  Publication Date: 15/11/2019  Status: Under prosecution  <a href="#">201811021553</a></p> <p>Title: Novel amine salts and amide derivatives of various active pharmaceutical ingredients  Assignee: Morepen Laboratories Limited  Filing date: 08/06/2018  Publication date: 13/12/2019  Status: Under prosecution  <a href="#">201841035899</a></p> <p>Title: Stable pharmaceutical compositions of Ibuprofen and Famotidine  Assignee: Granules India Limited  Filing Date: 24/09/2018  Publication Date: 27/03/2020  Status: Under prosecution</p>
Approved and Active applications	Not applicable
Expired or Lapsed application or examination request not filed	<p><a href="#">196052</a> (No link on WIPO site)  Title: A process for the preparation of a combination of Famotidine polymorphs A and B  Assignee: Tonira Pharma Limited  Filing date: 02/05/2002  Grant date: 24/10/2005  Status: Patent ceased on 02/05/2007</p> <p><a href="#">196254</a> (No link on WIPO site)  Title: A process for the preparation of a combination of famotidine polymorphs A and B  Assignee: Torira Pharma Limited  Filing date: 02/05/2002  Grant date: 07/12/2005  Status: Patent ceased on 02/05/2007  <a href="#">258037</a></p> <p>Title: An oral unit dose form suitable for three-times-per-day administration  Assignee: Horizon Therapeutics Inc.  Filing date: 04/02/2009  Grant date: 28/11/2013  Status: Patent ceased on 17/07/2018  <a href="#">316442</a></p> <p>Title: Design and development and evaluation of orodispersible drug delivery system of taste masked Famotidine by newer range of ion-exchange resin  Assignee: Bharati Vasantrao Bakde  Filing date: 11/12/2012  Grant date: 19/07/2019  Status: Patent ceased on 19/10/2019  <a href="#">2329/MUM/2011</a></p> <p>Title: Pharmaceutical compositions of Ibuprofen and Famotidine  Assignee: Cadila Healthcare Limited  Filing Date: 17/08/2011  Publication Date: 22/02/2013  Status: Patent application abandoned  <a href="#">2529/MUMNP/2012</a></p> <p>Title: Nitric oxide releasing pro-drugs of therapeutic agents  Assignee: Piramal Healthcare Limited, Satyam Apparao  Filing date: 06/11/2012  Publication date: 10/01/2014  Status: Patent application abandoned</p>

## 2. Background information

### **About TFORD-COVID19**

*The Principal Scientific Advisor to the GoI, Dr K VijayRaghavan, has constituted a S&T Core Group on COVID19. Under the aegis of the S&T Core Group on COVID19, a Task Force has been constituted focused on Repurposing of Drugs for COVID19 (in short "TFORD-COVID19"). The Task Force is being coordinated by Dr V Premnath, Head, NCL Innovations at CSIR-NCL and Director, Venture Center and Dr Anurag Agarwal, Director, CSIR-IGIB. The Nerve Center for the Coordination is located be at Venture Center, Pune (located in the campus of CSIR-NCL).*

### **Credits**

*Editor: Dr Priya Nagaraj; Contributors: Dr Priya Nagaraj, Dr Vidula Walimbe, Dr Smita Kale, Dr Kirtee Wani, Dr Tejas Shah, Dr Mugdha Lele, Mr Navnath Kadam, Dr Manisha Premnath, Dr Premnath V; Information also contributed by Dr Gopakumar Nair, GNAS and GnanLex.*

### **About Advisory Group**

*The Nerve Center at TFORD-COVID19 has constituted an inter-disciplinary Advisory Group. This Advisory Group reviews the information compiled by the Nerve Center, provides suggestions on data, information sources, organization of data etc. while also providing inputs to refine the analysis and create a structured information base to support decision-making. The Advisory Group also provides expert input and opinions on certain selected points where experience-based inputs are needed. The members of the Advisory Group for each Discussion Paper are listed at <https://nclinnovations.org/covid19/teams/>.*

### **Disclaimer**

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