

COMMERCIAL OPPORTUNITY IN THROMBOSIS AND CANCER METASTASIS THERAPEUTICS



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VARIEGIN – Small peptides from blood sucking parasites Technology Source: Natural Environment Research Council (NERC), UK.

Novel serine protease inhibitor – with indications in Blood clotting disorders, acute coronary syndrome, cancer metastasis and tumour invasion.

THE INVENTION

A novel serine protease inhibitor, Variegin, derived from the salivary glands of the *Amblyomma variegatum* tick has been discovered. The research has been developed through a collaborative agreement between Prof Nuttall at the UK's Centre for Ecology and Hydrology, Dr Kazimirova at the Slovak Academy of Sciences, and Prof Kini of the National University of Singapore.

Preclinical studies show that Variegin is a first-in-class multi-valent, fast, tight-binding, competitive inhibitor of thrombin. The molecule has tuneable structure and function providing potential to develop a suite of related molecules with specifically enhanced properties. Detailed knowledge of the structure and functional relationships of Variegin have profound implications concerning the design of drugs to target clotting disorders and other disease areas such as metastatic cancer.



MARKETING OPPORTUNITY

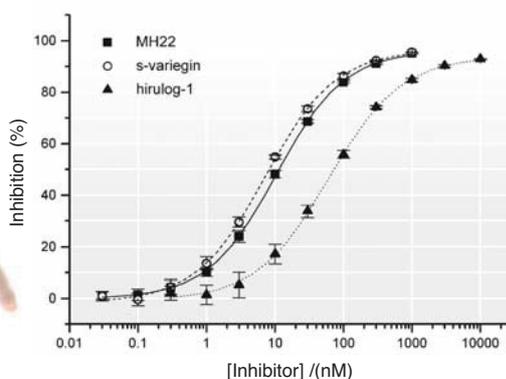
Variegin offers advantages over the current market leaders in blood clotting therapy with potential target markets across a wide range of disorders.

Advantages

- Tuneable properties
- Small size
- Neutralisation features
- Duration of activity
- Improved potency

Potential target markets

- Heparin replacement in HIT
- Venous thrombosis prophylaxis after major orthopaedic surgery
- Prevention of arterial thrombosis and re-occlusions during/after invasive cardiology
- Management of acute coronary syndrome and acute myocardial infarction
- Cancer adjuvant therapy



Inhibition of amidolytic activity of human plasma thrombin by different peptides.

For further information contact Mr Bill Barnett, Business Development Manager

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Key Researchers Biographies

Prof Patricia Nuttall, Director CEH



Pat Nuttall was appointed Director of CEH at the beginning of June 2001, having previously been Director of CEH Oxford. She is Professor of Virology of the University of Oxford and a Supernumerary Fellow of Wolfson College, Oxford. She was awarded the Ivanovsky Medal for Virology in 1996 by the Russian Academy of Sciences and the OBE in 2000 for services to environmental sciences. In 2006 she

was made a LeConte Scholar by the Georgia Southern University, USA, and an Honorary Professor of Nankia University, P.R. China in 2008. Since March 2008, Professor Nuttall has also been chair of PEER (Partnership for European Environmental Research organisations), and earlier this year she received the Chevalier in the Order of the Mérite Agricole from the French Ministry of Agriculture and Fishing. Through her research, she is currently a Director of Pharmatic, a NERC spin out company that aims to develop new drugs from blood-feeding parasites.



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Dr. Mária Kazimírová



Mária Kazimírová joined the Institute of Zoology in 1997, where she started to work in the Department of Virus Ecology (later Department of Medical Zoology), headed by the late Dr. Milan Labuda. She obtained her MSc. degree in biology at the Faculty of Natural Sciences of the Comenius University in Bratislava. From 1981 to 1996, she worked at the Institute of Experimental Phytopathology and

Entomology, where she obtained her CSc. (PhD.) degree in entomology in 1987. After joining Dr. Labuda's department, she changed her field of study and started to investigate blood-feeding arthropods, mainly ticks, and the processes at the host-vector-pathogen interface. At present, she works as a senior scientist in the Section of Medical Zoology. Besides scientific activities, M. Kazimírová is also managing editor of Section Zoology of the international journal *Biologia*.



Publications

Variegin, a novel fast and tight binding thrombin inhibitor from the tropical bont tick.
Koh CY, Kazimirova M, Trimmell A, Takac P, Labuda M, Nuttall PA, Kini RM.
J Biol Chem. 2007 Oct 5;282(40):29101-13.

Noncompetitive inhibitor of thrombin.
Koh CY, Kazimirova M, Nuttall PA, Kini RM.
Chembiochem. 2009 Sep 4;10(13):2155-8.

CY Koh et al. (2009). Structure-function relationships of variegin: a novel class of thrombin inhibitors. (submitted).

Cho Yeow Koh



Dr. Koh graduated from University of Singapore (NUS), Singapore in 2009. He was awarded the NUS Graduate Research Scholarship and joined the laboratory of Professor R. Manjunatha Kini in 2004 to pursue his Ph.D. degree. He is interested in the structure-function relationships and mechanism of actions of anticoagulants from snake venom and saliva of haematophagous animals. He has published

two original research articles, four patent applications, one review and one editorial. He has also won awards to deliver speeches in international conferences including the 30th Congress of Japanese Society on Thrombosis and Hemostasis and the XXII Congress of The International Society on Thrombosis and Hemostasis.



Prof R. Manjunatha Kini



Dr. Kini graduated from University of Mysore, India in 1983 and did his postdoc in Kyushu University, Japan and Virginia Commonwealth University, Richmond, U.S.A. Then he joined National University of Singapore, Singapore in 1994. Currently, he is a Professor in the Department of Biological Sciences, National University of Singapore. He also holds an Affiliate Professor in the Department of Biochemistry at Medical

College of Virginia, Virginia Commonwealth University, Richmond. He is the founder and Chief Scientific Officer of a small start-up company ProTherapeutics Private Limited, Singapore, which engineers orally and sublingually active therapeutic peptides. He has been the Chairman or Co-Chairman of the Registry of Exogenous Hemostatic Factors, a sub-committee of International Society on Thrombosis and Haemostasis since 1998. He is also a member of the Council of the International Society on Toxinology. Dr. Kini is on the editorial board of a few international scientific journals. He has published 141 original articles, 31 patent applications and 25 reviews. He edited a monograph on Snake venom phospholipases and was guest editor for three special issues. His research interests include structure-function relationships and mechanism of action of proteins, particularly snake venom toxins. The functional sites are used in designing proteins with novel biological activities and prototypes of therapeutic agents.



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