***Development of novel technologies using magnetic nanoparticles for biomedical, environment and engineering applications"***

*and*

***Transforming academic ideas and research into successful commercial ventures***

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Magnetic fluids or ferrofluids are stable colloidal suspension of magnetic nanoparticles in a carrier liquid that can be aqueous or oil-based. Magnetic nanoparticles have generated considerable research and commercial interest due to their unique properties and wide applicability. The unique properties include susceptibility to external magnetic field and biocompatibility. We have developed a number of technologies specifically with bare magnetic nanoparticles which are technically proficient and industrially viable. Most of the applications till date use surface modified/coated magnetic nanoparticles. On the contrary, our applications use bare/uncoated magnetic nanoparticles that are cost effective, simpler to make and use.

Magnetic nanoparticles can be conjugated with drugs and injected intravenously. Further by the use of an external magnetic field they can be transported and retained at the site of action like cancerous tumor or arterial blockage. Some recent developments have also shown a potent approach for delivery of a gene or small interfering RNA (siRNA) using magnetic nanoparticles. Delivering a gene/si-RNA without any carrier makes it prone to rapid degradation by exonucleases or endonucleases and poor diffusion across the cell membrane. We are developing an oligonucleotide-Magnetic Nanoparticle (Oligo-MNP) complex in order to overcome these problems. Magnetic hyperthermia is another promising application wherein providing an external alternating magnetic field to nanosized magnetic particles causes heating via hysteresis energy losses. This approach can be used to kill cancerous cells in the body. Studies have also demonstrated the use of magnetic nanoparticles to improve MRI (magnetic resonance imaging) contrast. This MRI contrast enhancement relies on the differential engulfment of magnetic nanoparticles by different cells.

Our current research is based on the development of methods wherein magnetic nanoparticles are used for a rapid, efficient and contamination-free extraction of biomolecules like DNA, RNA and proteins. These technologies will be helpful to various research labs and industries in minimizing their efforts to isolate specific biomolecules. In this regard XpressDNA kits are already in the market for rapid DNA isolation from various biological samples. Another exciting prospect is the immobilization of proteins on magnetic nanoparticles for specific applications. Enzymes immobilized on magnetic nanoparticles were found to be active for “several days” in harsh conditions. This application can potentially change the way enzymes are used in industries. Immobilization of antibodies on magnetic nanoparticles on the other hand can be efficiently used for isolation of rare cells, immune cells or cancer cells from blood or a variety of tissues. These strategies have been proven to be highly usable at laboratory scale. We are looking forward to develop these technologies and bring them to the market to benefit the existing research and the industrial setups. Most importantly we are developing an instrument for purification of therapeutic proteins using our patented technology wherein affinity ligands immobilized on the surface of magnetic nanoparticles will enable rapid purification of therapeutic proteins like antibodies.

Scientific and technical discoveries can reap rich dividends if they are executed wisely in the commercial space. Current market promotes young entrepreneurs and scientists to start ventures. However it is advisable to follow certain paths to success to attain higher efficiency. Various aspects like team building, seeking right advisers and looking for sources of funding are some crucial aspects herein. Having been associated with several startups; I can explain several critical aspects of “How to build a startup” with special reference to Magnetic nanoparticles. I was able to introduce several academic projects into successful commercial projects under MagGenome. I will be covering the nuances of this journey during my talk.

CN Ramchand, a hardcore scientist at heart, is the driving force behind many Startup companies and numerous novel technologies. Dr CN Ramchand, a British Citizen, is currently the President and CEO of Saksin life Sciences Pvt Ltd, a start-up biotech company as well as MagGenome labs Pvt. Ltd, Cochin. He is also a key Adviser to several companies including Scigenome labs, Medgenome Inc, Theragen lifesciences/Biologics and Director in Thejo Engineering and Accel Limited, Chennai. He earlier was the Director, at KEMIN Pharma, India (A subsidiary of Kemin Pharma Belgium BVBA) and was holding a simultaneous position as Director of Research and Development, Kemin Industries South Asia Pvt. Ltd., a part of Kemin Industries Inc, Desmoines, USA. Dr. Ramchand also was a WW executive team member at Kemin Industries. Prior to the assignment at Kemin Industries, Dr Ramchand was with Sun Pharmaceuticals, currently the largest Pharma Company in India (as per ORG marg) as its Vice President and Head of Drug Discovery Research (Biological Research Programme) (1999-2004). He was closely involved in the setting up of a multimillion Drug Discovery centre including design and development of laboratories. Currently, Dr Ramchand is an Honorary Visiting Professor to European Nanotechnology consortium at University of Newcastle, UK. He is also an adjunct faculty, Visiting Professor and PhD guide at Swinburne University of technology, Australia along with Prof. Ajay Kapoor. Dr. Ramchand is currently also involved in development of a extensive PhD programmes for students in collaboration with Swineburne University and IIT Chennai through Scigenom labs, Cochin. Dr. Ramchand is a PhD in Biochemistry from MS University Baroda. He also served as assistant professor (1982-84) at MS University. He has also obtained his M Phil from the same university.

Dr. Ramchand`s forte includes Novel Drug Discovery and development mainly for Novel Biologics. He also has successfully developed various drugs, nutraceuticals and nanotechnology based products over the years. He has more than 100 publications in some of the top scientific journals and holds several granted patents worldwide. He holds a PhD degree in Biochemistry from MS University of Baroda and has served at Top positions in Academics in India and UK. In India, he has also headed drug discovery programs at some of the most renowned Pharmaceutical companies like Sun Pharma and Kemin industries.