





Editor's Note

Dear Reader,

This letter comes to you from an exile, an exile enjoying every bit of his compulsory quarantine as an editor. Statistics being our field; We are forced to abide by a set of rules. This exile has been a welcome vacation. Reading vivid, cheerful articles where there are no limits to one's imagination, this has been a liberating experience. As with all good things, this one has reached its end and we cannot wait to present to you the first issue of the annual department magazine, "Endeavour".

Time is a healer, and a great guide. When you have time on your hands, you tend to venture beyond familiar territory. In our capacity as editor, one of our more pleasant discoveries has been the various articles, imaginatively thought out and beautifully written. It is no exaggeration when we say that each contribution in this magazine successfully archives present-day circumstances, cultures, traditions and their consequences.

During the 2012 US presidential election, statistician Nate Silver correctly predicted the outcome in all 50 states — an impressive feat for any politico. How? Big Data analytics. In this era, data is everywhere — with every click on a web browser, text message, mobile bank transaction or purchase, data is being collected, stored and analyzed.

Data analytics are already transforming the way businesses are making strategic decisions by using data to give them a competitive advantage and insights about their customers. While the concept of Big Data is not new, proper information management is helping organizations transform their business.

We will refrain from saying more and taking away from the surprises and excitement that we hope this magazine brings to you, our reader.

Sincerely,
Your Editors



From the Desk of Head of the Department

What excites me about the Department today is the energy it exudes in everything it does. It is indeed heartening to see so much happening all around the department, with societies, clubs and individual initiatives collating their enterprise and expertise to enliven the collective space we all share.

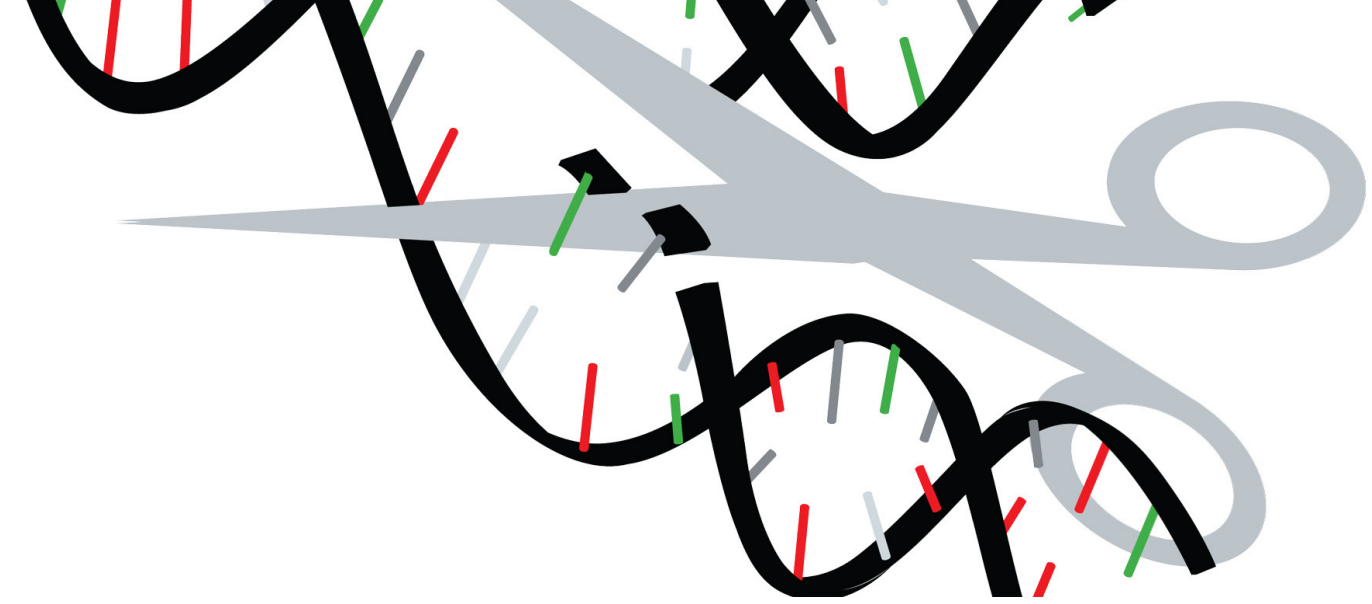
As we move to Department's 45th year, we are planning for some new initiatives. The energy we see around us will, I hope, build up a crescendo as we proceed to future. It gives me great pleasure in putting forward this first edition of department magazine "Endeavour". The present edition encapsulates the energy that is straining to burst forward across the department. While academics have been the traditional domain of excellence, the department ranks highly among various institutes across the country. It is our other skills, especially our creative abilities, that mark us out as special. This magazine is a platform for exchange of ideas and

knowledge sharing for the students of the department and readers of this magazine. I am excited to witness the first firm step in the direction of achieving this dream of knowledge sharing - the first edition of "Endeavour". I hope that this edition will keep up to expectations of its readers.

Finally, I congratulate the entire team of Udaan, the authors and the editorial team for their contribution and hope that the forthcoming batches will take this step forward. I am sure that all of us will read it with care and realize in the process how proud we ought to be as members of the department.

May this sapling keep growing.

Prof. Poonam Singh
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AN AWESOME YET DISQUIETING PROSPECT OF EDITING HUMANITY

Shubham Mehta considers recent advances in human genome editing and what these could mean for insurers and wider society

THE genome is written in an alphabet of just four letters. Being able to read, study and compare DNA sequences for humans, and thousands of other species, has become routine. A new technology promises to make it possible to edit genetic information quickly and cheaply. This could correct terrible genetic defects that blight lives. It also heralds the distant prospect of parents building their children to order.

It has long been predicted that human genome editing carries immense potential – for better or for worse. In 1980, astronomer Carl Sagan commented: “Fortunately we do not know, or at least, do not yet know, how to assemble alternative sequences of nucleotides to make alternative kinds of human beings. But in the future we might well be able to put nucleotides together in any desired sequence to produce whatever human characteristics we think desirable – an awesome yet disquieting prospect.” As of 2017, we may no longer be so fortunate in our ignorance of how to do this.

The technology is known as CRISPR-Cas9, or just CRISPR. It involves a piece of RNA, a chemical messenger, designed to target a section of DNA; and an enzyme, called nuclease, that can snip unwanted genes out and paste new ones in. Other ways of editing DNA exist, but CRISPR holds the promise of doing so with unrivalled simplicity, speed and precision.

It does not require much imagination to grasp the sprawling implications of such technology. It has a potential to disrupt the existing health industry. Also, it is likely to have a great impact on health, critical illness and life insurance products.

CRISPR can be used for gene editing in both somatic cells (cells that do not pass information to future generations) and human germline (cells that pass information to future generations). Its main advantages over the other gene editing tools are that it is relatively cheap, quick, precise and allows the modification of more than one gene at a time. This means that gene editing experiments and research can be conducted



on an unprecedented scale, resulting in many new treatments within 10 years.

With the advent of precision genome editing, the ability to modify living organisms has proceeded with remarkable speed and breadth. Any application of this technology to the human germ line must be tightly coupled to deliberate consideration of the consequences, both scientific and social, of introducing heritable alterations to the human population.

How it works

CRISPR is a natural part of the immune system. It is a DNA sequence containing DNA snippets of viruses that previously attacked the organism or its ancestors. These snippets are located between identical subsequences of the organism's DNA called 'spacer DNA'. This is the origin of the CRISPR acronym (Clustered Regularly Interspaced Short Palindromic Repeats).

If a virus attacks the cell again, the cell will use the corresponding DNA snippet together with a protein, called Cas, to destroy this virus. If, however, a new virus attacks the cell, the cell will use Cas to form a defense mechanism and then add the new foreign DNA snippet into the CRISPR.

Benefits of CRISPR/Cas9

Some of the potential benefits of gene editing are revolutionary, for example: Prevention or treatment of genetic diseases, such as hemophilia, cystic fibrosis, MYBPC3 (condition causing heart muscles to

thicken, a cause of death in young athletes) and others Enhancing resistance to infectious diseases and cancers Enhancing immune system to defend against industrially important bacteria, including some used in food production and large-scale fermentation Removing dietary intolerances (lactose, gluten) and obtaining nutritional benefit from plants humans cannot currently digest.

Successful gene editing has been demonstrated in multiple organisms, including bacteria, plants, insects, fish, reptiles, birds and mammals.

Research using the CRISPR/Cas9 technology has helped to achieve some remarkable results so far, for example:

Removing HIV from a living organism in three different animal models Removing cystic fibrosis, cataracts, hereditary tyrosinemia and other genetic diseases from cells Slowing growth of cancer cells Removing Huntington's disease genes in mice Enhancing our understanding of the functions of various genes.

Impact on the insurance industry

As the technology becomes widely used for medical treatments, it can have a radical impact – not only on the insurance market but also on society more broadly. It can improve life expectancy and, thus, pose a clear risk to annuity providers. Nonetheless, it may still be quite a while until we see an impact on the insurance industry. Although the CRISPR/Cas9 technology is relatively cheap compared with other

gene editing methods, it is very expensive when considering an individual patient's treatment. If the treatment costs per patient remain high, patients are unlikely to benefit from the new technology unless insurance companies cover it.

So far, no major insurance firm has confirmed whether it is considering covering personalised CRISPR treatments. If such treatments were to be covered, this could, of course, affect insurance premiums.

The only way is ethics

These fall into two categories: practical and philosophical. The immediate barrier is practical. As well as cutting the intended DNA, CRISPR often finds targets elsewhere, too. In the laboratory that may not matter; in people it could cause grave harm. In someone with a terrible disease, the risk of collateral damage might be worth running. But for germ-line applications, where the side-effects would be felt in every cell, the bar should be high. It may take a generation to ensure that the technology is safe. Until then, couples with some genetic diseases can conceive using in-vitro fertilisation and select healthy embryos.

Moreover, awash though it is with gene-sequence data, biology still has a tenuous grip on the origins of almost all the interesting and complex traits in humanity. Very few are likely to be easily enhanced with a quick cut-and-paste. There will often be trade-offs between some capabilities and others. An à la carte menu of attributes seems a long way off. Yet science makes progress—indeed, as gene sequencing shows, it sometimes does so remarkably quickly. So scientists are right to be thinking now about how best to regulate CRISPR.

That means answering the philosophical questions. There are those who will oppose CRISPR because it lets humans play God. But medicine routinely intervenes in the natural order of things—saving people from infections and parasites, say. The opportunities to treat cancer, save children from

genetic disease and understand diabetes offer justification to push ahead.

A harder question is whether it is ever right to edit human germ-line cells, to make changes that are inherited. This is banned in 40 countries and restricted in many others. There is no reason for a ban on research or therapeutic use: some countries, rightly, allow research on human embryos, as long as they are left over from in-vitro fertilisation and are not grown beyond 14 days. And CRISPR deals with the objection that germ-line changes are irrevocable: if genes can be edited out, they can also be edited back in.

A deeper quandary concerns the use of CRISPR to make discretionary tweaks to a person's genome. There comes a point where therapy (removing genes that make breast cancer or early-onset Alzheimer's more likely, say) shades into genetic enhancement. Some might see being short or myopic as problems that need fixing. But here, too, the right approach is to be cautiously liberal: the burden is on society to justify when and why it is wrong to edit the genome.

The Future Ahead

If CRISPR can be shown to be safe in humans, mechanisms will also be needed to grapple with consent and equality. Gene editing raises the spectre of parents making choices that are not obviously in the best interests of their children. Deaf parents may prefer their offspring to be deaf too, say; pushy parents might want to boost their children's intelligence at all costs, even if doing so affects their personalities in other ways. And if it becomes possible to tweak genes to make children smarter, should that option really be limited to the rich?

Thinking through such issues is right. But these dilemmas should not obscure CRISPR's benefits or obstruct its progress. The world has within its reach a tool to give people healthier, longer and better-quality lives. It should be embraced.

WE AIM FOR
GREATNESS

