Genetic trail to blood type

A longstanding mystery of a rare blood group has been solved, says s ananthanarayanan

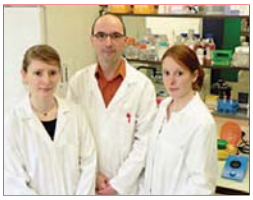
THAT people who need blood, because of loss of the same or for surgery, need the right type was discovered only in 1901. Till then, blood transfusion sometimes helped patients recover but often led to death because the body rejected the blood they received and created serious illness. But after the discovery that all people fell into just four categories of blood type, the right type has been used and transfusion has saved countless lives.

In addition to these four blood groups, there are many other features that need to match. These are significant only in rare cases but people who are affected need to find donors who have the same feature, or they need to store their own blood for planned surgery or emergencies. One such rare type, which was discovered in 1952, could not be identified by testing a blood sample — and a patient could no know he/she needed this type, and donors could not be identified for blood banks to stock this type of blood. The journal, *EMBO Molecular Medicine*, carries a report by Bryan Ballif of the University of Vermont and Lionel Arnaud of the French National Institute of Blood Transfusion, and their colleagues, that they have cracked the secret of this elusive and rare blood type that would help those who need it know that they need it and also help identify donors.

Blood groups arise from surface features, called *antigens*, of red blood corpuscles. The immune system in the body develops defences, called *antibodies,* against alien substances but not against its own blood cells, whose surface features it recognises. The most important of these features lead to all blood falling into one of four groups — *A, B, AB* and *O*. Blood of groups A and B have different features, while blood of group AB has both the features but the blood of group O has no feature. Thus, those with blood of group A, B or O need only that kind of blood, but persons of group AB can receive blood of both A and B and also of group O, which is not affected by any antibody. And blood of group O can be accepted by any person, as there are no surface features to invite attack.

In addition to the blood group, there is something called the *RH factor*, which can be positive or negative. Persons who are *RH+ve* can receive *RH-ve* blood but not the other way around. Those with group A, B or O, with *RH-ve* thus need a specific type of blood while those with *A+ve* can receive any blood. And blood of type *O-ve* is good for anybody.

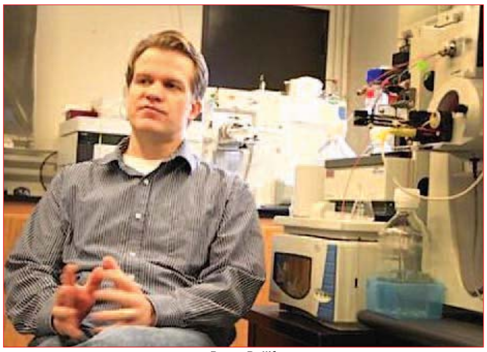
And there are further factors — there are 32 in all — that also need to match, but these are rare. Many of these factors also tend to occur in specific racial communities; for example, the *U-ve type* is found only with those of African descent, while *Vel-ve* and *Lan-ve* is found only in light-skinned races. As blood needs to be tested for these factors also, knowing a donor's race could save time while matching for a rare type in an emergency.



Carole Saison, Lionel Arnaud and Virgin Helias.

Vel Negative

One such rare feature is the Vel negative — so named after the patient, a 66-year-old lady of colon cancer, who was first discovered to have this kind of blood in 1962. Reporting on her case, the French medical journal *Revue D'Hématologie* identified her as, simply, "Patient Vel". After a previous transfusion, Mrs Vel had developed a potent antibody against some unknown molecule found in the red blood cells of most people in the world — but not found in her own red blood cells. Because this compound defied identification and



Bryan Ballif.

from this case, a new blood type — *Vel negative* — was named. Soon it was found that there were more similar cases, though rare, and it is estimated that about one in 2,500 people in Europe or North America are Vel negative.

But for 60 years now, what molecular feature identifies this blood type has eluded detection. As a result, there is no systematic method to identify a person who is Vel negative — it turns out to be the case only when he/she repeatedly shows adverse reaction to transfusion. As the blood type is rare, and also difficult to detect, many patients succumb to transfusion in emergencies and even in the case of known Vel negative patients it is difficult to identify blood donors or to create stocks of Vel negative blood products.

The discovery of Ballif and Arnaud and their collaborators has put an end to the difficulty to detect Vel negative. Arnaud and co-workers in Paris first collected stocks of the rare Vel negative antibody and used biochemical methods to partly isolate the mystery protein from the surface of human red blood cells. The work continued under Ballif in the University of Vermont. He and his colleagues used facilities funded by the Vermont Genetic Network — a high-resolution instrument that separates charged atomic or molecular fragments — to zero in on the mystery protein. "I had to fish through thousands of proteins," Ballif says.

The protein found is very small, as proteins go, and arises out of a small part of a person's DNA, and has been named "Small Integral Membrane Protein, or Simm1". Next, Arnaud's team in France tested 70 people known to be Vel negative. In every case, they found a deletion — a tiny missing chunk of DNA — in the gene that instructs cells on how to manufacture Simm1.

This was the proof the scientists needed to show that the Vel negative blood type was caused by a lack of the Simm1 protein in a patient's red blood cells.

The discovery of what causes certain people to be Vel negative provides us with a simple, DNA assay test for the blood type. "Identifying and making available rare blood types such as Vel negative blood brings us closer to a goal of personalised medicine," says Ballif. "Even if you are that rare one person out of 2,500 that is Vel negative, we now know how to rapidly type your blood and find blood for you — should you need a transfusion."

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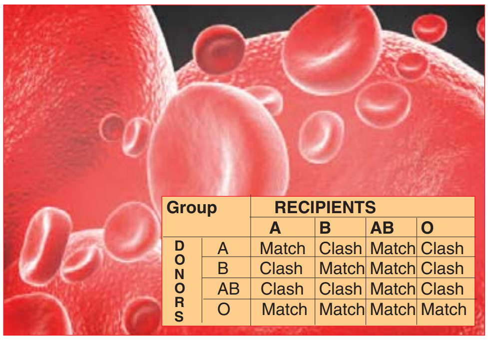


Group		RECIPIENTS			
		A	B	AB	O
DONORS	A	Match	Clash	Match	Clash
	B	Clash	Match	Match	Clash
	AB	Clash	Clash	Match	Clash
	O	Match	Match	Match	Match

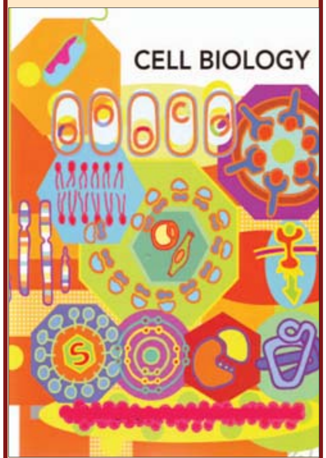
Historical strands

tapan kumar maitra **explains the emergence of modern cell biology**

MODERN cell biology involves the weaving together of three distinctly different strands into a single cord. Each strand had its own historical origin, and most of the intertwining has occurred only within the last 75 years. Each strand should be appreciated in its own right, because each makes its own unique and significant contribution. Contemporary-cell biologists must be adequately informed about all three strands, regardless of their own immediate interests.

The first of these historical strands is cytology, which is concerned primarily with cellular structure. (The Greek prefix *cyto* means "cell", as does the suffix *cyte*.) As we have already seen, cytology's roots go back more than three centuries and depended heavily on the light microscope for its initial impetus. The advent of electron microscopy and several related optical techniques has led to considerable additional cytological activity and under-sending.

The second strand represents the contributions



of biochemistry to our understanding of cellular function. Most of the developments in this field have occurred within the last 75 years, though, again, the roots go back much further. Especially important has been the development of techniques such as ultracentrifugation, chromatography and electrophoresis for the separation of cellular components and molecules. The use of radioactively labelled compounds in the study of enzyme-catalysed reactions and metabolic pathways is another very significant contribution of biochemistry to our understanding of how cells function.

We will encounter these and other techniques in subsequent chapters as we explore various aspects of cellular structure and function and an understanding of relevant techniques becomes necessary.

The third strand is genetics. Here, the historical continuum stretches back more than 150 years to Gregor Mendel. Again, however, much of our present understanding has come within the last 75 years. An especially important landmark on the genetic strand came with the demonstration that DNA (deoxyribonucleic acid) is the bearer of genetic information in most life forms, specifying the order of sub-units and, hence, the properties of the proteins that are responsible for most of the functional and structural features of cells.

Recent accomplishments on the genetic strand include the sequencing of the entire genomes (all of the DNA) of humans and other species and the cloning (production of genetically identical organisms) of mammals, including sheep, cattle and cats.

To understand present-day cell biology, therefore, means to appreciate its diverse roots and the important contributions that each of its component strands has made to our current understanding of what a cell is and what it can do.

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Between installed capacity & generation figures

This is where the devil lies, says aritra bhattacharya **in the second part of his series on the wind energy sector**

GOING by figures, India seems to be scripting a success story as far as wind energy is concerned. According to numbers from the Union ministry of new and renewable energy, the installed wind energy capacity in the country touched 18,551 MW this year, making India the third highest generator in this field in the world. Wind energy now accounts for nine per cent of the country's total installed power capacity, with other forms of renewable energy contributing just 3.5 per cent. The ministry has set an aggressive target of 15,000 MW of capacity addition during the 12th Plan period, but these figures tell only part of the story. The devil lies in the actual power generation figures.

In 2011-12, wind turbines produced 23.353 Billion Units, as against an installed capacity of 17,351.54 MW. Had the installed turbines produced at their full potential, they would have generated 137.96 BU of power. But since wind is a variable resource — wind speed is high during the monsoon months, when a considerable amount of power is generated; while very little power is generated in winter, when wind speed is slow — the full potential can never be realised. Taking this variability into account, wind power projects function along a parameter known as plant load factor, which is basically the total power generated divided by the potential power that could be generated.

In 2011-12, the plant load factor across all wind power projects in India was 16.93 per cent, while the global benchmark plant load factor is between 25-30 per cent. Further, the plant load factor in 2011-12 (16.93 per cent) was considerably lower than that of 2009-10 (18.84 per cent). In other words, as installed capacity increased, power generated decreased (see table).

One of the primary factors for this, of course, was the investment in wind farms by large corporations that sought to avail of the accelerated depreciation benefit without really bothering about power generation through the wind farms per se. However, industry insiders also point to a couple of other factors that are responsible for the installed capacity-power generation figure mismatch.

Shreelal N Jha, director-technical (SFRCI), under the Department of Physics in Gujarat's Sardar Patel University, and the maker of indigenous wind turbines that are sold through a company called Supernova Technologies, says that government policies on certification of windmills — a must for companies seeking to operate in India — are dictated by international norms. The problem with this practice is that global norms require turbines to work at annual mean wind speeds ranging 10-11 metres/second; while in most places in India, the annual mean wind speed is around 5.5 metres/second. This is one of the reasons why windmills never achieve their true potential in the country and function at plant load factors way below the global benchmark. In other words, there aren't enough windmills that cater to local climate conditions.

In addition, at least some amount of the installed capacity pertains to wind farms/turbines that are non-functional. One of the main reasons for this, sources in the industry who spoke on condition of anonymity mentioned, is the modus operandi of global companies that operate in the country through local licencees. When the turbines they install develop glitches and fall by the wayside, they snap their connections with the local licencee, only to function in the country through another licencee and, therefore, another name.

Jha, for instance, mentioned the case of global wind power giant Southwest that had a licencing arrangement with Unitron. When turbines installed by Unitron developed glitches and, consequently, were informally "blacklisted" by several entities in the states looking to set up wind farms, Southwest ended its agreement with Unitron and entered into a new arrangement with Luminous Renewable Energy. Representatives of Luminous, however, say that Southwest snapped ties with Unitron owing to the latter introducing "unapproved changes" in turbine design to make a quick buck. In any case, projects initiated by Unitron, like the 11 turbines that it installed for the Manipur Renewable Energy Development Agency (Mainreda), were accounted for in the installed capacity of wind power in the country. That the Mainreda turbines are no longer functional, along with similar cases, also accounts for the lag, partly, in installation and generation numbers.

Further, allegations of underhand dealings plague the wind energy sector. Suvendu Dutta, manager – sales and service (east and north) at Luminous Renewable Energy — mentioned that government tenders for setting up wind energy projects were routinely tweaked to suit manufacturers who were willing to bribe officials. He mentioned the example of an upcoming wind farm in Odisha where tenders were issued for turbines of 4.2 kW each. "It was done so as to facilitate the contract going to a company that made turbines of 4.2 kW," he said. Other players in the industry, like Gitanjali Solar Enterprises, which works on the installation and maintenance of small wind turbines, corroborated his view. In addition, Jha mentioned that tenders specified that those bidding for a project must have a minimum turnover — Rs 2 crore, for instance — that immediately disqualified smaller players.

Boral also says that the ministry and the central certifying agency, C-Wet, is less proactive in renewing certifications for small turbines when they lapse. "There is a bias in the certification and renewal of certification of large turbines by C-Wet, compared to small turbines," he says.

Other government agencies also carry the stamp of this bias for large turbines and suppliers. For instance, the Rajasthan Renewable Energy Corporation Limited, in its "Request for Proposal: Document For Setting up of Grid Connected Wind Power Projects" during 2013-14, specifies that "the bidder is allowed to installed only models of wind turbines of unit capacity 500 kW and above".

RRECL's move is in line with practices of most government entities across the country, says Kanchan Kumar Agrawal from the Centre for Science and Environment's Renewable Energy Team. "New wind power projects mostly veer towards higher capacity turbines, and through documents like that of RRECL's, the policy environment is also in favour of bigger turbines," he says. This, he notes, is because larger turbines produce more economical wind power. Yet, there are several problems with making economics the sole prism through which one examines the wind energy sector, as the ensuing part of the series will show.

Year	Capacity added (in MW)	Cumulative capacity (in MW)	Energy generated in Billion Units	Potential Generation capacity (in BU) if functioning at 100%	Plant Load Factor
2005-06	1,716.17	5,350.77	5.991	39.34	15.23%
2006-07	1,742.05	7,092.82	9.547	54.48	17.52%
2007-08	1,663.32	8,756.14	11.413	69.40	16.45%
2008-09	1,484.90	10,241.04	13.334	83.19	16.03%
2009-10	1,564.60	11,805.64	18.188	96.55	18.84%
2010-11	2,349.20	14,154.84	18.735	113.68	16.48%
2011-12	3,196.70	17,351.54	23.353	137.96	16.93%
Global benchmark plant load factor:			25-30%		

Data sourced from the Union ministry of new and renewable energy

Next week: Beyond the pursuit of profit

The writer is on the staff of *The Statesman*, Kolkata, and this article has been written under the aegis of a CSE Media Fellowship