

## In this issue

### Phases of nuclear matter

Matter around us exists in distinct forms, like solid, liquid and gas. Apart from these three, the plasma is often called the fourth state of matter. The nuclear matter, similarly, exists in different forms or phases under different thermodynamic conditions. The nucleus in its normal state exhibits liquid-like characteristics. When heated up, the nucleus may transform into a gaseous state, which is an indication of a liquid–gas phase transition. Further increase of heat results in high temperature and



high energy density conditions of the nuclear matter, where a system of deconfined quarks and gluons, known as quark–gluon plasma (QGP), is formed. The QGP state is relevant to understanding the origin of the Universe and how matter behaved immediately after the Big Bang. Under circumstances of high baryon densities, matter behaves much like the interior of neutron stars, which has been predicted to contain QGP matter. Thus, the phase diagram of nuclear matter spans a vast region of temperature and

baryon density. Similar to the existence of critical point in case of phase transitions in water, there have been predictions of critical points corresponding to the phase transitions in nuclear matter. The study of the nature of liquid–gas and the QGP phase transitions and the search for the critical points have been at the forefront of research for last several decades. The article (page 888) gently introduces the concept of phase transition and then gives an overview of the nuclear phases, phase diagram and discusses how these phases are probed under laboratory conditions in dedicated facilities around the world. It gives an account of very active participation of Indian scientists in such endeavours with VECC cyclotrons and high energy accelerators at RHIC, LHC and FAIR.

### Marine mammal brucellosis

Brucellosis is a contagious bacterial disease caused by members of the genus *Brucella*. It is one of the most widespread zoonoses and around 500,000 new cases of human brucellosis are reported worldwide each year. The overall burden of brucellosis remains underestimated since cases of brucellosis are often misdiagnosed as typhoid or tuberculosis or categorized as pyrexia of unknown origin. Brucellosis in human beings manifests itself through relapsing fever, night sweating, malaise, insomnia, anorexia, headache, arthralgia, sexual impotence, nervousness and depression. The complications of

human brucellosis include endocarditis and meningitis. *Brucella* species are highly infectious through aerosol route and can be used for biological warfare or bio-terrorism purposes. High rates of relapse and treatment failures are common in brucellosis and it can be attributed to intracellular colonization of reticuloendothelial cells by brucellae.

Brucellosis is a continuously evolving disease and brucellae can adapt to changing social, cultural, travel and agricultural environment. Identification of new *Brucella* species in recent years from terrestrial and marine mammals has added new dimensions to the pathogenesis and epidemiology of this disease. Although marine *Brucella* strains were recognized recently, *Brucella* infections appear to be widespread and endemic in marine mammals. Infected marine mammals shed brucellae actively and pose direct threat to other healthy sea mammals and occupationally exposed human beings. Zoonotic importance of these newly discovered marine *Brucella* strains can be realized from the fact that already four cases of human brucellosis have been linked to this novel *Brucella* species. Marine mammal *Brucella* strains affect reproductive system of hosts, which is a concern in threatened or naïve marine mammal species. Marine mammals inhabit vast marine areas and do not recognize international borders during migration. This can further introduce marine *Brucella* species to new hosts and newer regions across the world. See page 902.