Preface

New areas of medical science are emerging every year, opening new vistas, stimulating new thoughts, and finding cures for age old diseases for which cures were not available earlier. Regenerative medicine is one of these areas, and interestingly, this field is focusing more and more on what is available from within the human body itself, particularly the fetal body, which can be used to regenerate and rejuvenate failing systems. While global attention is on the use of stem cells in regeneration, other fetal items like the fetal tissue, cord blood, placenta and placental tissue, and amniotic fluid, all of which contain stem cells of different types as well as things like growth factors that are important in the development of the fetus, have the potential to regenerate ailing organs. The implication is that stem cells do not have to be separated to be inserted in a host; the fetal tissue or cord blood or amniotic fluid can be transplanted in its totality or in a partial form in the patient, and the impact could even be more because of the additional growth elements in these items.
The issue, of course, has been the cause of a controversy in the West, where ethical issues are raised regarding the problem of acquisition of the fetal item. The fact is that approximately 205 million pregnancies occur each year (Cheng L Surgical versus medical methods for second-trimester induced abortion. The WHO Reproductive Health Library. World Health Organization. 2008. http://www.webcitation.org/5zVk3OSM4. Archived from the original on 17 June 2011. Retrieved 17 June 2011). Over a third of which are unintended, resulting in the abortion of around a fifth of all pregnancies annually. The numbers, therefore, amount to about 42 million abortions per annum, 20 million of which are done in unsafe circumstances (Shah I, Ahman E Unsafe abortion: global and regional incidence, trends, consequences, and challenges (PDF) J Obstet Gynaecol Can. 2009; 31(12):1149–58. PMID 20085681). The 22 million safely aborted fetuses are normally incinerated or buried underground (in societies that have such traditions or where incinerators are unavailable) or simply disposed of by throwing the fetus into a river (this too may be a custom, or it could be done to get rid of any sign of an unwanted pregnancy). These fetuses are unwanted (this is the cause of the abortion in the first place) and got rid of at the earliest in all societies; yet, they have the potential to serve the cause of medical science and human health, if they could be utilized for medical purposes.

Fetal tissue is an ensemble of varying stage and grade of differentiated and undifferentiated cells including fetal stem cells and stem cell-like progenitor cells, not necessarily identical, but from the same origin, that together carry out a specific function. Cell therapy is the process of introducing new cells into a tissue to treat a disease. These new cells can be obtained from fetal tissue, neo-natal tissue or any other growing tissue. Fetal tissue contains mostly immunologically naïve cells, depending on the stage of gestation. Along with their protective microenvironment, they constitute the niche for the fetal cell/tissue. Transplantation of fetal tissue can have unique results. Experiments have shown that fetal tissue transplanted to an accessible site in a human body, and then retrieved and examined after 10 years, showed the persistence of a group of primitive progenitor cells. This suggests that the transplanted tissue may have created its own microenvironment at the site of its transplantation in the adult host for its own survival. This also suggests the possibility that the primitive cells, which survive in the transplant site for long periods, may actually be migrating to the site of requirement/injury. Experiments in mice models have indicated that fetal cells similarly survive and sometimes differentiate to host cells. Thus, transmigration to the site of injury and differentiating to required cells would mean that this is an ideal form of cell therapy. Transmigration to the site of injury fulfills the requirements of an ideal cell therapy (Zeng XX, Tan KH, Yeo A, Sasajala P, Tan X, Xiao ZC, Dawe G, Udolph G. Pregnancy-associated progenitor cells differentiate and mature into neurons in the maternal brain. Stem Cells Dev. 2010;19(12):1819–30. Epub 2010 Sep 13.). This therapy has huge potential for treatment of intractable medical problems in human beings, particularly because it is noninvasive since it can be placed in a vascular site under the fold of the skin surface.

Every major discovery or invention in medical science has been fraught with controversy. For instance, vaccinations for different diseases, which are
so well accepted now and have led to the complete or partial eradication of
dreaded scourges like small pox and polio, generated a lot of debate on vari-
ous issues including ethical and safety concerns, during the early phases of
experimentation. If the scientific community accepts the potential of fetal tis-
sue transplant at a heterogenic site as an easy procedure for cell therapy,
many currently intractable diseases can also be faced with their nemesis in
the future as the matter is explored further and procedures are incrementally
refined.

Since Western countries, which have the funds and facilities to carry out
more research in this area, are bogged down by ethical concerns regarding the
use of placental and fetal substances for cell therapy, it may be pertinent to
say a few words here on medical ethics from ancient to modern times. In civi-
lized societies, be it ancient India which produced the Ayurveda or ancient
Greece where Hippocrates produced the Hippocratic system from which
modern medicine is derived or be it the modern world which has produced the
British Medical Association and the World Health Organization, which set
the norms for medical practices today; the basic guideline for medical ethics
is to benefit society and do good by it in general and the patient in particular.

The Oxford English Dictionary defines ethics as “the moral principle by
which a person is guided,” as well as “the rules of conduct recognized in cer-
tain associations or departments of human life” (Hawkins JM Oxford English
Sanskrit term “dharma” has some equivalence with “ethics” in that dharma
implies those principles that “support” or guide an individual in the passage
through life (Monier Monier-Williams. A Sanskrit dictionary [Searchable
Ran`es C Chakravorty. Some aspects of the ethics of stem cell research. In:
Bhattacharya N, Stubblefield P, editors. Frontiers of cord blood science.

Medical ethics has to be seen in how far society can be served by curing
the world of diseases, intractable or otherwise. Anything new is initially
resisted, normally for safety concerns but sometimes for “ethical” reasons,
until the benefits of the treatment are proven beyond question. Sometimes,
they are still resisted on grounds of religion, but if it does not harm society,
and on the contrary, cures particularly difficult diseases, the question is,
should rational science be rejected by nonscientific irrationality?

Surgically aborted human fetal tissue is one of the most important sources
of fetal stem cells, progenitor cells, and other stem cell-like cells with
immense potential for clinical utilization in modern translational research,
especially for end-stage degenerated human organs or tissues or systems.
Stem cells may someday provide the means of treating and possibly curing
diseases such as diabetes, Parkinsonism, Alzheimer’s etc., which can only be
symptomatically palliated currently. The promise of stem cell research prod-
ucts (medically and financially) is so great that in July 2005 the prestigious
journal Scientific American devoted an entire section to stem cell research in
conjunction with Financial Times.

We leave it to the judgment of the reader to decide whether the surgically
aborted fetus should be thrown into a holy river like the Ganges for the eternal
bliss of the unborn, or just cremated or incinerated – as a waste that will be of no use to anyone – or should it be donated so that it and its contents can help some poor suffering patient overcome intractable diseases like Parkinsonism, myopathy, motor neurone disease, Alzheimer’s, cardiomyopathy, and cirrhosis of the liver. More research needs to be done using human fetal tissue to perfect the mode of treatment, and donated fetal tissue can be of great help here. The fact is that fetal tissues have immense potential in rejuvenating degenerated cells because it is from the stem cells of the small human fetus that a fully grown baby with eyes, nose, limbs, and functioning organs takes shape, and it is magical how the transformation from a zygote to a baby takes place. When a healthy fetus is surgically discarded because the mother does not want the baby, instead of destroying it altogether, it can help in prolonging human life and give hope to many patients who have given up all hope of ever leading normal lives.

We would lastly like to salute one of the pioneers in reproductive medicine and in vitro fertilization, the legendary Sir Robert Geoffrey Edwards, CBE, FRS, who received the Nobel Prize for Medicine in 2011. In 1992, he published the first multiauthored book on human fetal tissue transplant. He understood the potential of this method of treatment in medicine. Science has moved forward since 1992, and sea changes have taken place in regenerative medicine in two decades since Prof. Edwards published his novel book. The present edited volume is an attempt to update the research work done in this field and integrate and bring together current findings in the field of research initiated by Sir Robert Edwards. We also salute Prof. B E Tuch (Australia) and Prof. JL Tourane (France), eminent scholars who participated in both the publications, Prof. Edwards’ and the present one.

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Human Fetal Tissue Transplantation
Bhattacharya, N.; Stubblefield, P. (Eds.)
2013, XXIX, 462 p., Hardcover