

Analogous challenges for ethics in human reconstruction

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« His soul is his knife »
Everything flows (Vassili Grossman)

The many facets of human reconstruction

- Reconstruction after trauma (fracture) or extensive surgery, plastic surgery, bariatric surgery.
- Organ transplantation. Start in 1952.
- Transplantation of Hands (2000), Face (2005), Penis (2014)
Compassionate trials
- Cell therapy
A few prospective clinical studies, Safety
- Tissue/Organ bio-engineering
Preclinical research
- Genetic engineering: PGD, GMO, Gene editing,
- The improved man: prostheses, robots, biocaptors
- The augmented man
Fantasy ? Massive investments

Rules and ethics

Unsettled ethical issues

The decision-maker IS the individual to be reconstructed

Organ transplantation

Organ replacement - Life or death

Allogenic grafts from unrelated deceased or from living related donors

Kidneys (1952)

Liver (1963)

Heart (1967)

Lungs (1968) Heart/Lungs (1983)

Pancreas (1976)

Well recognized procedures

Rules and ethics of organ transplantation

National agencies (Agence de la bio-médecine)

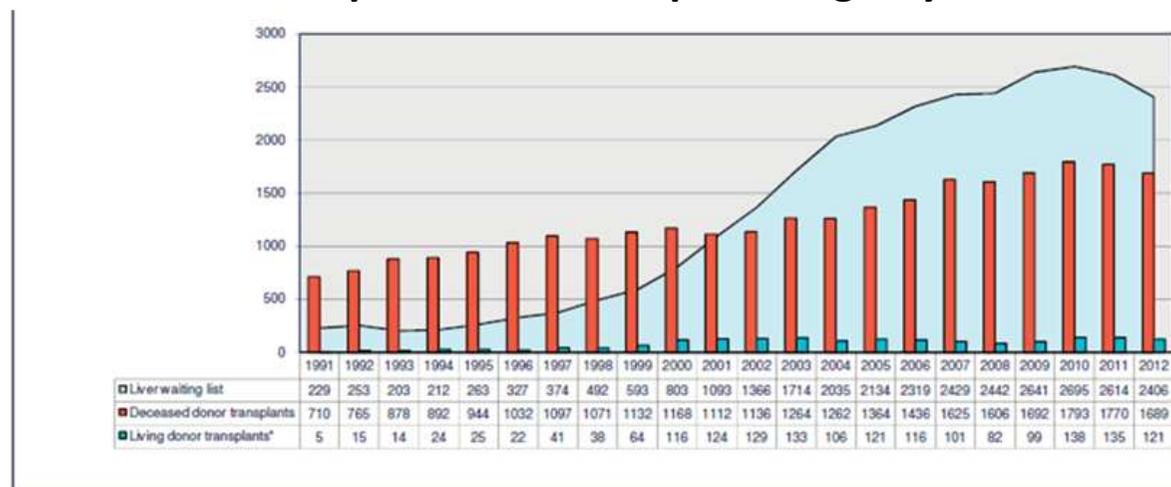
Recipient protection:

Increase availability of organs for recipients

Fair allocation of organs amongst patients in the waiting list (region/state/continent)

Chronic lack of organs

European Liver Transplant Registry



Rules and ethics of organ transplantation

Donor protection:

Precise definition of beating heart brain death

More yield permissivity

Except in Asia
Particularly Japan

Extension to death after heart arrest (Maastricht
criteria)

Kidneys
Liver
Lung

Living related donors

Upmost donor
protection

Free gift

Organ traffic:

Organ for sales in underdevelopped countries

Prisoners

Sentenced to death

Organ transplantation

Refusal of organ transplantation is refusal of treatment: life or death (risk/benefit ratio)

No contra indication to transplantation according to most religions (about identical ethical rules)

The case of Jehovah's witnesses

God servants should refrain from blood: The Holy Scriptures (Actes 15:28, 29 ; et Deutéronome 12:15, 16)

No condemnation of tissue grafting in the holy book

Although some blood may remain in preserved organs of living related donors

(Darwish A Curr Opin OrganTransplant 2011;16:326-30)

Limbs and face transplantation

Better life/Risky surgery

- Double transplantation of hands 1998-2000
- Partial transplantation of the face 2005, Total 2010
- Penis transplantation 2014 (functioning)
- [Utérus 2014 followed by birth]
- Head transplantation 2016?: an Italian surgeon and a Russian patient (all dog experiments failed!)

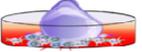
The fourth hand (John Irving)

Considerable amount of unsolved ethical issues
concerning donors and potential recipients
risk/benefit ratio

Competition with bio-engineering and prostheses

Tissue/Organ bio-engineering

On the shelves bioconstructed organs for transplantation

- Recellularization of decellularized scaffolds
- Cell seeding in a synthetic scaffold (biomaterial)
- Recapitulation of organogenesis in a Petri dish 
- Bioprinting 
- Mixed technologies 
- Assembly of building blocks

Stem cells (allogeneic, autologous)
Hydrogels, Matrices
Biomaterials

Almost ready for use: skin, blood vessels, bladder, ear, vagina...

Large acceptance by patients and relatives



Phase I-II clinical trials

ATMPs (ANSM – EMA)

Is man ready to accept foreign pieces?

Cross circulation / Exchange transfusion with baboons in the 70s

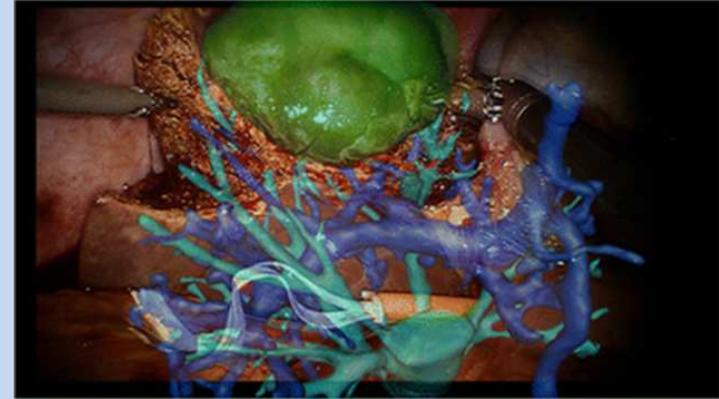
Xenotransplantation with pig livers
Moratory because of xenosis risk in 1999

Organ perfusion for transplantation with hemoglobin of a sea worm (arenicole). Hemarina Co



The improved man

Increased reality -
Connected glasses for surgery



Robots
Robot assisted surgery
Surgical robot Da Vinci by Intuitive



Prosthesis
Biocaptors,
Biochips

Long
distance
runner



Drum beater



The augmented man

The many facets of the augmented man

- Prosthesis, Powered exoskeleton
- Artificial organs: Heart (Carmat)
- 3D printing of tissues and organs
- Stem cells to improve organ functionality
- Deep brain stimulation to enhance brain function
- Gene selection
- Immortality gene
- Artificial intelligence



A lot of fantasies

A lot of money:
Google
Facebook

A lot of
unsolved
ethical issues

Transhumanism

The immortal (Jorge Luis Borges)

Summary/reflections

Progression in human reconstruction from its origins in transplantation scope of intervention moves from saving life to augmenting it

The progression is mediated both by possibilities opened by advances in technology and by desire: a move from necessity to choice

Opening up the possibility of change in the understanding of being human: hybridity in the face of an unknown future condition

We can contemplate hybridity as a choice or as a condition of life

Ethics and regulation/ understanding and behaviour

THANK YOU