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**Bachelor in Politics, Philosophy and Economics**  
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## **Ethical and Cultural Implications of Stem Cell Research**

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## **Abstract**

Throughout my thesis, I analyze how certain factors affect people's point of view and legislation in regards to research carried out on human stem cells. Firstly, I begin by thoroughly describing what stem cells are and their importance when it comes to scientific research and advantages. In order to analyze the vast research possibilities which are possible to achieve via stem cell research, I address several uses in which this research has been proven to provide some serious help. By outlining how stem cells have been useful in studying illnesses such as diabetes, cardiovascular diseases, brain diseases, and also Alzheimer's disease, I intend on stressing the fact that this specific type of research is no more just a vague idea and just a set of hypotheses, but rather, a research method which can concretely provide human beings with new therapies and a deeper understanding of several diseases. In order to attain more points of view on how individuals shape their opinions on stem cell research, I take into consideration the opinions and interpretations of different religions, namely Christianity, Judaism and Islam. As religion is an important aspect of many people's lives, it is important to see how historical traditions, values and beliefs from religious figures and authorities can help shape ones' opinion even on contemporary matters such as stem cell research. Following this, I take into account ethical considerations which have been, and still nowadays are, a strong part of the debate on stem cells. First off, my analysis of the ethical considerations will consider the manipulation of human embryos for research purposes. This section is crucial as it analyses the debated idea of when an embryo attains personhood, and of the moral status in the embryo itself. In order to simply the subject, I describe two processes used to harvest embryonic stem cells, namely Somatic Cell Nuclear Transfer (SCNT) and Altered Nuclear Transfer (ANT), and how they affect human embryos. The second ethical issue I evaluate is human cloning. It is feared that if research and experimentation on human stem cells becomes a commonly used practice with little regulations, it could lead to dehumanizing practices such as human cloning and the customization of embryos, and in general a lack of control in this area of scientific research. Next, after having analyzed these aspects, I consider regulations around several countries, mainly focusing on the United States of America and Europe, in order to see how legislation is also different geographically speaking. To then pose another option to stem cell research, I follow up by examining two different alternative sources for research, induced pluripotent stem cells and chimeras. Lastly, I analyze a possible future for stem cell research and what we can expect in the coming years in relation to this expanding scientific field, and to conclude, by examining the slippery slope argument, I provide give my opinion on stem cell research and what hopes we can hold for the future of the development of therapies, mainly I argue that since us humans have the means to carry out research that could potentially save countless lives, I personally believe that we should grasp every opportunity we get and at least attempt to create some treatments and cures.

## **Abstract (Italian)**

In questo lavoro analizzo come certi fattori influenzano le opinioni e le legislazioni riguardanti la ricerca effettuata sulle cellule staminali umane.

Innanzitutto descrivo e analizzo accuratamente cosa sono le cellule staminali, e discuto la loro importanza nell'ambito della ricerca scientifica.

Le cellule staminali sono un tipo particolare di cellule che hanno la capacità di differenziarsi in un numero illimitato di altre cellule staminali o di diventare qualsiasi altro tipo di cellule. Nei mammiferi, si distinguono due tipi principali di cellule staminali. La prima tipologia include le cellule staminali embrionali, che possono essere ricavate solo dalla massa cellulare interna dei blastocisti, mentre il secondo tipo sono le cellule staminali adulte, che possono essere trovate in vari tessuti. Quest'ultime sono un notevole tipo di cellula in quanto hanno la possibilità di svolgere il ruolo di sistema di riparazione interno, permettendo al corpo umano di essere conservato finché la persona (o animale) ospitante è vivo.

Al fine di analizzare le vaste possibilità di ricerca che sono possibili da raggiungere attraverso la ricerca sulle cellule staminali, è importante innanzitutto discutere i diversi usi in cui questa ricerca ha già dimostrato di essere efficace. Grazie alle loro abilità uniche, ma anche ai recenti miglioramenti sul piano tecnologico, molti scienziati ritengono che le cellule staminali abbiano un grande potenziale. I trattamenti con le cellule staminali sono oggetto di indagine per quanto riguarda la cura di diverse malattie e condizioni, come il diabete, il morbo di Parkinson, il morbo di Alzheimer, lesioni cerebrali e molte altre.

Durante gli studi in laboratorio, i ricercatori possono acquisire nuove conoscenze sulle diverse proprietà delle cellule e su che cosa esattamente permette loro di differenziarsi e avere tali funzioni. La ricerca sulle cellule staminali ha permesso di migliorare la nostra conoscenza su come un embrione, composto da poche cellule, riesca a svilupparsi in un organismo adulto. Delineando come le cellule staminali siano utili nel studio delle malattie suindicate, intendo sottolineare il fatto che questo tipo specifico di

ricerca non è più solo un'idea vaga e un insieme di ipotesi, ma piuttosto, un metodo di ricerca che può concretamente offrire non solo nuove terapie ai pazienti, ma anche una più profonda comprensione su alcune malattie.

Tuttavia, ci sono ancora problemi irrisolti relativi alla ricerche sulle cellule staminali. Come in molti altri nuovi campi della scienza, si sono creati diversi dilemmi etici e morali. La ragione principale è che, al fine di svolgere attività di ricerca sulle cellule staminali embrionali umane, un embrione umano deve essere distrutto, comportando, di conseguenza, la distruzione di una possibile vita umana. D'altro canto, se la ricerca avanzasse, considerato il potenziale di queste cellule, si potrebbe arrivare alla scoperta di nuovi trattamenti e cure per malattie, che allevierebbero le sofferenze di molti esseri umani. Naturalmente, a causa delle complesse implicazioni che comporta, questo dibattito è caratterizzato da molti aspetti e da altrettante opinioni divergenti, originate da interpretazioni di ordine morale e religioso, o solo da convinzioni personali.

Alla luce di quanto sopra esposto, i valori e punti di vista dell'opinione pubblica sulla questione influenzano le leggi per quanto riguarda la ricerca sulle cellule staminali. Senza un governo che supporti i propri ricercatori, nuovi trattamenti o cure non possono essere sviluppati a causa di regolamenti restrittivi e di mancanza di fondi. A mio parere, è estremamente importante analizzare come i fattori culturali ed etici possano alterare la legislazione relativa alle cellule staminali in tutto il mondo, al fine di capire come e perché la maggior parte dei paesi abbiano diversi punti di vista e, conseguentemente, diverse leggi.

Dobbiamo porre dei limiti sulla ricerca sulle cellule staminali? E se sì, in che misura? Questo argomento è di estrema rilevanza nella nostra vita quotidiana, dato che potrebbe fornire al genere umano innumerevoli nuovi trattamenti terapeutici, così da alleviare il dolore dei pazienti affetti da alcune malattie. Tuttavia, fino a che punto siamo, come società in grado di piegare le nostre credenze e i nostri valori morali, al fine di raggiungere i nostri fini? Come possiamo assicurare che qualora i regolamenti diventassero meno restrittivi, i ricercatori non si approfitterebbero della situazione per

svolgere pratiche considerate immorali da alcuni? Sono molteplici gli aspetti che devono essere presi in considerazione prima di arrivare a soluzioni concrete, così come molti altri punti di vista, devono essere valutati sempre cercando di effettuare un'analisi il più possibile imparziale e obbiettiva che tenga conto della sensibilità di ognuno in merito alla questione soprattutto morale che ci troviamo di fronte.

Per considerare più punti di vista su come gli individui modellano le loro opinioni sulla ricerca sulle cellule staminali, inizierò prendendo in considerazione le opinioni e le interpretazioni di diverse religioni, vale a dire il Cristianesimo, Ebraismo e Islam.

Dato che la religione è un aspetto importante della vita di molte persone, è importante rendersi conto di come tradizioni storiche, valori e credenze promosse dalle autorità religiose possano aiutare a formare opinioni anche su questioni contemporanee, come la ricerca sulle cellule staminali. Per persone che hanno una morale religiosa molto accentuata, la ricerca su embrioni umani può essere un argomento molto delicato in quanto comporta la creazione e l'inizio della vita. Dal momento che queste persone prendono le decisioni di tutti i giorni anche in base alla loro religione e secondo le loro convinzioni, essi si basano su testi e tradizioni religiose al fine di acquisire le risposte alle questioni etiche che vengono sollevate dalla fecondazione in vitro e ricerca sulle cellule staminali, e quindi non è difficile capire quale annoso dilemma comporti questa questione per i loro valori morali. Testi e tradizioni religiose sono in grado di fornire una sorta di guida per le decisioni prese per quanto riguarda questo tipo di ricerca. Tuttavia, è chiaro che ci sia la necessità di una qualche nuova forma di interpretazione, che tenga conto anche degli interessi di persone che non hanno gli stessi valori religiosi e che sono favorevoli a un maggiore sviluppo di queste nuove tecnologie incrementandone la ricerca. In buona sostanza, secondo questi ultimi ci sono nuovi fattori, dettati dai tempi, che devono essere considerati, e non solo ciò che è contenuto nelle sacre scritture.

Inoltre, è possibile che individui appartenenti alla stessa religione con lo stesso sfondo tradizionale diano diverse interpretazioni, o che anche persone, che si identificano come appartenenti a differenti religioni, possano arrivare alle stesse

conclusioni a dimostrazione del fatto che questo particolare argomento ha delle fortissime implicazioni che hanno a che fare soprattutto con la coscienza individuale piuttosto che collettiva. Alcuni gruppi religiosi possono avere anche una forte influenza politica, ad esempio, e usano questa influenza per indirizzare la pubblica opinione ad avere remore morali riguardo la ricerca sulle cellule staminali, e, in molti casi destinando i finanziamenti messi a disposizione ai ricercatori per altre attività'.

Per quanto riguarda la fede cristiana, la Bibbia non contiene alcuna dichiarazione chiara su quale è il punto esatto in cui la vita inizia. Ci sono tuttavia molti passaggi che descrivono l'inizio della persona, i quali rappresentano come una guida per i cristiani. Eppure, molti sono spesso in disaccordo su ciò che i diversi passaggi cercano veramente di annunciare. Tuttavia, tutti concordano, come è scritto nella Genesi, che gli esseri umani sono fatti a immagine di Dio. Diversi passi biblici sono stati interpretati in maniera tale che gli esseri umani dovessero provare amore per il loro bambino non ancora nato, ma già' allo stato embrionale, dunque, prima che il bambino venisse messo al mondo, e dal momento che il concepimento di una nuova vita è un aspetto forte della fede cristiana, non è una sorpresa che la maggior parte dei cristiani non siano d'accordo con l'esercizio della ricerca sulle cellule staminali embrionali umane.

Per quanto riguarda i tre rami del giudaismo, ovvero il ramo conservatore, riformatore, ed ortodosso, questo punto di vista sembra cambiare un po'. Il dibattito sull'accettazione si basa soprattutto sullo status dell'embrione, ma anche sulle opinioni che l'ebraismo ha sul matrimonio e le coppie in generale e anche sui valori della guarigione, cioè' dal loro punto di vista, la perdita di un embrione non è uguale alla perdita di un adulto umano. D'altro canto, poiché il feto fa parte del corpo umano femminile, danneggiare il feto è visto come un danno al proprio corpo, il che è di solito vietato. Di conseguenza, il materiale genetico che è al di fuori del corpo non ha uno status morale o legale, e, pertanto, la fecondazione in vitro e la clonazione terapeutica originata dagli embrioni è maggiormente tollerata dalla fede ebraica.

La maggioranza dei musulmani approva la ricerca sugli embrioni umani, se, e solo se, esiste il potenziale per il trattamento di malattie e uso terapeutico. I musulmani credono che solo dopo il primo trimestre di gravidanza avviene la creazione dell'anima. Tuttavia, poiché il Corano non è estremamente chiaro sulla questione, è possibile creare una separazione tra l'aspetto biologico e la personalità morale di un embrione.

Nella fede musulmana, non esiste una descrizione precisa su quando la vita e status morale comincino. Alcuni musulmani credono che essa inizi al concepimento, mentre altri sostengono che avvenga più tardi, dopo lo stadio di blastocisti. Tuttavia, la grande maggioranza crede che la creazione dell'anima si verifica tra il terzo trimestre e il quarto mese, al più tardi, ciò nonostante, alcuni studiosi musulmani si oppongono all'aborto, in quanto affermano che già prima dei tre mesi il feto è vivo, mentre altri sostengono che gli aborti più precoci devono essere permessi e giustificati.

A causa dei diversi punti di vista nelle comunità musulmane, la legislazione sulla ricerca sulle cellule staminali può essere modificata vis-à-vis il punto di vista dei leader religiosi, che ovviamente non condividono necessariamente le opinioni di tutte le persone appartenenti alla fede musulmana. Non esiste un unico punto di vista, basato sulle interpretazioni delle fedi religiose, sulla ricerca sulle cellule staminali embrionali umane.

E' quanto mai attuale la questione di inizio e fine vita, e i differenti modi di approcciare queste delicate tematiche, di conseguenza le persone che fortemente si identificano con una religione cercheranno risposte ai loro dubbi nei testi religiosi, o prenderanno in considerazione il parere dei vari leader religiosi. Tuttavia, è ancora in gran parte una questione di interpretazione e di valori personali. La questione morale è un aspetto cruciale per le persone di fede, le quali credono che qualsiasi ambito di ricerca dovrebbe essere eticamente giustificabile per poter essere praticato. Le loro opinioni possono essere diverse anche all'interno delle loro stesse comunità, o semplicemente diverse da quelle di altri individui. Sarebbe comunque importante riconoscere che non è significativo esclusivamente il proprio parere personale, ma bisognerebbe esaminare con imparzialità questa delicata questione mantenendo il giusto rispetto per l'opinione altrui,



rispetto che dovrebbe essere una costante di una società civile e moderna, soprattutto quando non si condividono gli stessi punti di vista.

Successivamente, analizzo le implicazioni etiche che ancora oggi sono trattate nel dibattito sulle cellule staminali. Avendo presentato tutte i molteplici vantaggi che la ricerca sulle cellule staminali è in grado di fornirci, può quasi sembrare scandaloso che molti governi continuino a rifiutare il loro finanziamento.

Diverse obiezioni sono state avanzate riguardo al motivo per cui molti non vogliono sostenere questo particolare tipo di ricerca. La prima obiezione, afferma che questa ricerca è sbagliata, in quanto comporta la perdita di molti embrioni umani. Come precedentemente illustrato questa obiezione può essere discussa da vari punti di vista siano essi laici o religiosi, che giudicano immorali la manipolazione della natura da parte dell'uomo. Anche se, come abbiamo visto la principale critica per quanto riguarda la produzione e la progettazione di cellule staminali embrionali è la distruzione dell'embrione, si possono associare anche altre conseguenze a questa pratica, ad esempio, le cellule staminali raccolte spesso formano tumori o possono provocare il cancro.

Al fine di semplificare quanto sopra esposto, descrivo in questo lavoro due processi usati per raccogliere le cellule staminali embrionali, cioè il trasferimento del nucleo di cellule somatiche (SCNT) e trasferimento nucleare alterato (ANT), e come queste pratiche influenzano gli embrioni umani.

La seconda obiezione più condivisa, per quanto riguarda la ricerca sulle cellule staminali, si basa sul presupposto che, anche se la ricerca sugli embrioni è considerata sbagliata o immorale di per sé, questo tipo di ricerca potrebbe dare inizio a pratiche innaturali, come la clonazione umana, a una produzione eccessiva di embrioni, e in generale la mercificazione della vita umana.

Un altro timore piuttosto diffuso riguarda la possibilità che i ricercatori siano quindi in grado di creare embrioni personalizzati. Se la ricerca eseguita sulle cellule staminali sarà di successo, si avrà una più chiara comprensione sull'immissione di un

nucleo adulto all'interno di un uovo non nucleato che quindi potrebbe tornare allo stato embrionale.

Sarebbe estremamente difficile da controllare la diffusione di tali conoscenze e quindi non saremmo in grado di controllare le ambizioni e le intenzioni di ricercatori e scienziati. Tuttavia, possiamo essere rassicurati dal fatto che le tecniche di clonazione sono ancora piuttosto primitive e che semplicemente non esistono ancora i mezzi per clonare gli esseri umani. Ciononostante, molte precauzioni sono state prese da diversi governi per fermare la pratica della clonazione.

Attualmente, nessuna regola o posizione universale esiste, in relazione al controllo della ricerca sulle cellule staminali, conseguentemente, negli anni passati ogni paese ha sviluppato la propria politica in merito, influenzata da diversi fattori, soprattutto culturali. Naturalmente le normative sono necessarie nei casi in cui è consentito effettuare questa ricerca.

Successivamente, dopo aver analizzato questi aspetti, esamino le normative vigenti in alcuni paesi, vale a dire gli Stati Uniti d'America, il Regno Unito, e l'Unione Europea al fine di valutare come le diverse legislazioni variano geograficamente e a seconda delle diverse sensibilità etiche e morali. Ho altresì creduto opportuno dedicare una maggiore attenzione riguardo le reazioni e l'approccio politico dell'Italia verso la ricerca sulle cellule staminali. I governi dei Paesi aderenti all'Unione Europea, nel ratificare la Direttiva 2004/23/EC stanno stabilendo alcune regole di base per quanto riguarda il finanziamento di questi studi sia sul piano legale sia su quello scientifico, al fine di armonizzare detta ricerca a livello comunitario. Negli Stati Uniti il processo di ricerca ha subito dei rallentamenti durante l'Amministrazione Bush, mentre ha ripreso vigore con l'attuale Presidente Obama.

E' opinione diffusa che sarebbe opportuna la creazione di un sistema di controllo, nei paesi ove la ricerca sulle cellule staminali è consentita, al fine, non solo di monitorare i risultati degli esperimenti, ma anche di tenere i cittadini aggiornati sui miglioramenti delle nuove tecnologie. Questo aspetto e' di fondamentale importanza, dal momento che

l'opinione pubblica è estremamente sensibile quando si tratta di questioni delicate come la ricerca sulle cellule staminali e per quanto riguarda le sue possibili applicazioni nei trattamenti terapeutici, cosicché si possa percepire in maniera inequivocabile la reale utilità di questi importanti studi nella vita reale delle persone. Così facendo, non solo i cittadini potranno rivedere o argomentare meglio le loro opinioni sulle cellule staminali, ma si potrebbe anche permettere la modifica delle suddette normative, ciò avverrebbe nel caso i cittadini dovessero essere chiamati in futuro a votare per un referendum per modificare la legislazione.

Nel fornire un'altra opzione alla ricerca sulle cellule staminali, esamino due fonti alternative, ovvero, le cellule staminali pluripotenti indotte e le chimere. Le restrizioni in materia di ricerca sulle cellule staminali sono in continuo cambiamento, soprattutto per via delle sue implicazioni etiche. Il campo di ricerca per quanto riguarda le cellule staminali è estremamente limitato, considerata la mancanza di fondi e la mancanza di regolamenti liberi. Per questo motivo gli scienziati hanno cercato fonti alternative per svolgere i loro esperimenti. Inoltre, queste alternative sono in grado di fornire vantaggi anche ai ricercatori, come ad esempio, una maggiore quantità di finanziamento da parte dei rispettivi Stati per i loro studi, così evitando tutti i dibattiti etici relativi a questa pratica. Sono state ricercate non solo fonti alternative alle cellule staminali-embrionali umane, ma anche cellule completamente diverse, ma che potrebbero avere lo stesso potenziale. Si possono trovare cellule che, permettendo lo stesso risultato, non richiedano l'uccisione di un embrione umano, o che riguardino l'uccisione di un embrione avente uno status morale minore – come ad esempio gli embrioni affetti da malattie o gli embrioni che hanno una maggiore probabilità di ammalarsi. Alcune delle fonti alternative che sono state proposte includono la possibilità di ricavare cellule staminali embrionali umane da embrioni usati nei trattamenti di fertilità che purtroppo sono morti spontaneamente o dai partenoti (un uovo di mammifero non fecondato che ha subito una divisione indotta da diverse sostanze chimiche). Naturalmente, la soluzione perfetta a questo problema potrebbe essere quella di creare cellule staminali pluripotenti umane in maniera completamente artificiale: ciò significherebbe che non ci sarebbe più bisogno di avere un

embrione e, quindi, di successivamente distruggerlo. Tale proposta richiede la necessità di riprogrammare le cellule somatiche così da creare cellule staminali corrispondenti al paziente. Per fare questo, i ricercatori devono fondere cellule somatiche con le cellule staminali embrionali umane esistenti, permettendo alle cellule somatiche di riprogrammare se stesse e diventare pluripotenti e, successivamente, di comportarsi come cellule staminali embrionali.

Infine, esamino un possibile futuro per la ricerca sulle cellule staminali e che cosa possiamo aspettarci nei prossimi anni, considerata la possibile espansione di questo campo scientifico. La ricerca sulle cellule staminali ha trasformato non solo il nostro modo di esaminare e approcciare alcune delle patologie più diffuse, ma anche la nostra conoscenza relativa alle circostanze in cui possiamo contrarre malattie, così come il modo di sviluppare nuovi farmaci. Molti sostengono che le prossime generazioni saranno in grado di vedere certe malattie, come ad esempio il diabete e il morbo di Alzheimer, sotto la stessa luce in cui noi vediamo oggi la polio (il che significa come una malattia prevenibile). Sebbene la ricerca sulle cellule staminali sia caratterizzata da un grande potenziale, questo campo scientifico è stato contestato sia dal punto di vista politico sia da quello economico. Per concludere, presento il mio parere sulla ricerca sulle cellule staminali e sulle speranze che possiamo serbare per il futuro dello sviluppo e del miglioramento dell'ambito terapeutico.

## **1 Introduction**

Stem cells are a special type of cell which has the ability to differentiate into an unlimited amount of other stem cells or to become many other types of cells. In mammals, there are two main types of stem cells. The first type are embryonic stem cells, which can only be taken from the inner cell mass of a blastocyst, while the second type are adult stem cells, which can be found in various tissues. They are a remarkable type of cell as they have the possibility to play the role as a type of inner repair system, allowing the human body to be preserved as long as the host person or animal is alive.

Thanks to their unique abilities, stem cells have offered several research potential to scientists along with the recent improvements in technology. Stem cell treatments are being investigated for the treatment of several diseases and conditions, such as diabetes, Parkinson's disease, Alzheimer's disease, brain injury and many more. During laboratory studies, researchers can gather new knowledge concerning the several properties of cells and what allows them to differentiate and have such distinct functions. Research on stem cells has allowed us to improve our knowledge on how an embryo made up of few cells manages to develop into an adult organism overtime.

Nevertheless, there are still issues with carrying out research on stem cells. As many other new fields in science, carrying out research raises several ethical and moral dilemmas. The main reason behind this is that in order to carry out research on human embryonic stem cells, a human embryo must be destroyed, thus ultimately destroying a possible human life. On the other hand, however, if this research were to be carried out to its full potential, it could lead to the discovery of new treatments and cures for diseases and thus alleviate the suffering of many human beings. Of course, due to the complex moral status of the embryo in our everyday life, this dilemma has no clear response. There are many aspects to this debate, with many opinion presents, stemming from different places such as religious interpretations or solely a personal belief. The public ideals and viewpoints on the matter alter legislation dealing with stem cell research as well. Without a state backing up its researchers, new treatments or cures do not have the possibility of being discovered due to restrictive regulations and lack of funding. In my opinion, it is extremely important to see how cultural and ethical factors affect legislation regarding stem cells around the world, in order to grasp how and why different countries have different viewpoints and laws.

Shall we set limits on research on stem cells, and if yes, to what extent shall these limits reach? This topic is of extreme relevance in our day-to-day life as it could provide the human race with countless new treatments, thus alleviating the pain of people suffering from some diseases. Nevertheless, we have to consider the cost-benefit analysis of carrying out this practice. To what extent can we bend our moral beliefs and values in

order to achieve our ends? How can we assure that if regulations become less restrictive, researchers will not take advantage of the situation on carry out practices which are nonetheless deemed immoral? Several questions must be taken into consideration before arriving to concrete solutions, considering many different points of view and by carrying out an impartial and objective analysis of the situation which we are presented.

## **2 What are stem cells?**

Cells that have the capability to mature in different types of cells throughout their life are referred to as stem cells.<sup>1</sup> Through the process of cell division, stem cells have the possibility either to remain stem cells or to become another type of cell with a more specialized function. They divide without limit as long as their host, be it an animal or a human being, is still alive. They can also serve in terms of internal repair, meaning that they divide until they replenish other cells that are needed. Stem cells are recognized as being a peculiar type of cells as they have two crucial aspects.<sup>2</sup> First, they are able to divide and replenish other cells even after being inactive for long periods of time. Second, they can be induced to become specific cells with specific functions under certain conditions, which can be experimental or physiological. For example, in organs such as the heart and the pancreas, stem cells can only divide under specific conditions. On the other hand, in the bone marrow, stem cells often divide in order to restore tissue that has been damaged.

Two types of stem cells have been studied by scientists, embryonic stem cells, and non-embryonic “somatic” or “adult” stem cells.<sup>3</sup> Human embryonic stems cells, hESCs for short, are derived from embryos. It is important to note that they are not derived from eggs fertilized in a woman’s body, but rather derived from embryos that have been fertilized in vitro which are still in a preimplantation stage, and then donated with informed consent by the donors. Adult stem cells, on the other hand, has a limited

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<sup>1</sup> Crosta, *What are Stem Cells?*

<sup>2</sup> National Bioethics Advisory Commission, *Ethical Issues in Human Stem Cell Research*, p. i+ii

<sup>3</sup> Crosta, *What are Stem Cells?*

capacity for differentiation. Some recent research suggests that they can also differentiate to become other cell types that are not based on the tissue of origin; however, it is generally thought that they are limited to the scope of the cell type of the organ of origin which they are situated in. They can be found in the brain, in the bone marrow, in the skin, in the liver, and in many other organs. They remain stable and do not undergo division until a disease or the injury of a tissue triggers them.

Stem cells have also been placed in a hierarchy, which is characterized by their ability to differentiate in other types of cells.<sup>4</sup> At the top of the hierarchy, we find the totipotent classification. This is the ability of stem cells to be able to differentiate themselves into all possible cell types. Examples of this are the cells that result from the division of the zygote. The next classification is referred to as pluripotent. This is when a stem cell is able to differentiate itself into almost all types of cells. This includes embryonic stem cells. Embryonic stem cells are not considered totipotent solely because they do not have the ability to become cells that make up the extra-embryonic membranes or the placenta. Next in the hierarchy are multipotent cells. This is the capability of stem cells to differentiate themselves into a closely related group of cells. This includes adult stem cells that can become either white or red blood cells. The second to last classification is oligopotent cells, which refers to the ability to be able to differentiate into a limited number of cells, such as myeloid stem cells. The last classification is unipotent. This refers to cells who can only recreate cells of their own type, but which nonetheless still aid in tissue and organ renewal. A classic example is adult muscle stem cells.

### **3 Defining the importance of Stem Cells**

Stem cells are vital to living organisms for several reasons. First and foremost, in the three to five-day old embryo called a blastocyst, the inner cells are the ones responsible for the creation and development of the entire body of the organism, which

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<sup>4</sup> Liras, *Future Research and Therapeutic Applications of Human Stem Cells: General, Regulatory, and Bioethical Aspects*, p. 1-15

includes all of the specialized cells which will in turn go on to develop the heart, the lungs, the skin, and other tissues.<sup>5</sup>

### **3.1 Possible uses**

Thanks to their regenerative abilities, stem cells can offer new opportunities for treating several diseases. Diabetes is an example. Studies have shown that embryonic stem cells can differentiate into insulin producing cells in-vitro. Furthermore, bone marrow stem cells have been shown to have both the capacity to become competent pancreatic endocrine beta cells in vivo, and to initiate pancreatic regeneration when needed. Nonetheless, before cell based therapy is established in the study and cure of diabetes, much more research has to be carried out<sup>6</sup>.

Adult stem cell transplantation also has potential in the field of cardiovascular disease, even though only has recently been discovered. Patel et. al in 2004 carried out an adult stem cell transplantation in patients with ischemic cardiomyopathy. There were 20 patients in the study, out of which 10 had a transplantation of adult stem cells while the control group had a coronary artery bypass grafting. The conclusions of this study were that the stem cell transplantation undoubtedly led to improvements in cardiac functions in comparison to the control group.<sup>7</sup>

It has been shown that the use of neural stem cells can be used to treat diseases such as Parkinson's and Alzheimer's. They do this by repairing the damaged tissue in the brain. Studies carried out on animals have shown that transplanted neural stem cells not only helped with spatial learning and memory, but also gave a clear indication that cell replacement in these cases is a vital factor when we consider recovery. Recently, embryonic stem cells have also been tested to use in these kind of situations, and the treatments are advancing and promising.<sup>8</sup>

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<sup>5</sup> Hongbao and Ma, *Stem Cell Introduction*, p.1

<sup>6</sup> Noguchi, Hirofumi, *Stem Cells in the Treatment of Diabetes*, p. 7-16

<sup>7</sup> Patel et al, *Surgical Treatment for Congestive Heart Failure with Autologous Adult Stem Cell Transplantation: A Prospective Randomized Study*, p. 1631-1638

<sup>8</sup> Xuan et al, *Effects of Engrafted Neural Stem Cells in Alzheimer's Disease Rats*, p. 167-171



Stem cells found in blood and bone marrow have been used for many years in the treatment of blood related disease such as sickle cell anemia, leukemia, and others. Due to the fact that these cells have the capability to differentiate into all types of blood cells, such as white blood cells and red blood cells. The main issue related to these stem cell transplants are that in order to extract them a patient would have to go through an invasive bone marrow transplant. Recently, these particular stem cells have also been found in the umbilical cord and in the placenta, thus making them easier to obtain and more safe, as the body is then less likely to reject therapy.<sup>9</sup>

Finally, another important aspect of stem cells is that they can provide an insight on human development. This is because undifferentiated stem cells eventually differentiate when a particular gene is activated. This can help us understand the role of genes and what kind of traits and mutations we can inherit. Moreover, stem cell research can also help us understand how birth defects and cancer occur, as they also are the results of abnormal cell division. By further understanding stem cells, we would be able to develop new and more effective therapies for diseases.

#### **4 Religion and Interpretation**

Religion is a significant part of many people's lives. For these individuals, research on human embryos can be extremely disconcerting as it is closely related to the creation and the start of life. Nonetheless, religion is sometimes not thoroughly considered when talking about the stem cell debate due to the fact that different religions simply do not say much about this topic. Keeping this in mind, we cannot deny that religion is also a cultural factor which has a strong effect on members in a community and which affects the mindsets and traditions carried down through different generations. Culture can be described as the beliefs, traditions, knowledge, values, and many other factors that are passed down from one generation to another. Religious beliefs in the past

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<sup>9</sup> Mimeault et al, *Stem Cells: A Revolution in Therapeutics—Recent Advances in Stem Cell Biology and Their Therapeutic Applications in Regenerative Medicine and Cancer Therapies*, p. 252-264

have affected how communities respond to moral dilemmas in the present, even if the connection is between decision making and their belief system might not be crystal clear.

Certain individuals make their life decisions keeping into consideration their religion and according to their beliefs. They may rely on religious texts and traditions in order to acquire answers to the ethical questions that are raised by In-Vitro Fertilization and stem cell research. As previously discussed, embryonic stem cell research brings about many moral issues. Following religious texts and traditions can provide some sort of guidance in decisions made in respect to this type of research, however it is clear that it also requires some form of interpretation as times change and new factors must be considered before taking word by word what religious texts say. Following this, it is still possible that individuals belonging to the same religion with the same traditional background come to different interpretations and conclusions, and even individuals identifying themselves as being part of different religions can come to same conclusions. Religious groups also have a strong voice politically, affecting the public image on stem cell research and thus affecting funding made available to researchers.

#### ***4.1 Christianity***

Nowhere in the bible is there a clear statement as to when the beginning of life is. There are however many passages which describe the start of personhood, which provide guidance for Christians. Still, many often disagree as to what the different passages are really trying to proclaim. Nevertheless, they all agree, as it says in the Genesis, that humans are made in the image of God. Throughout the Genesis, there are several references to the womb. Throughout these references, the involvement of God in the process of creation is clearly emphasized. In some references, some argue in favor of God's foreknowledge and of his predetermined plans in terms of peoples' lives. Many Christians argue that since according to the bible God is already present in womb, and because of his foreknowledge, show that an embryo should be already identified as a person from then. One passage is seen as extremely influential as it mentions the status of the fetus, considering the possibility for different interpretations:

“When people who are fighting injure a pregnant woman so that there is a miscarriage, and yet no further harm follows, the one responsible shall be fined what the woman’s husband demands, paying as much as the judges determine. If any harm follows, then you shall give life for life”<sup>10</sup>.  
(Ex. 21:22-23)

Most interpreters of this passage agree that the loss of the fetus in this case is worth compensation; however, it is not considered as an adult human. Furthermore, “if any harm follows” can be interpreted as harm towards the woman – which would then result in the death of the offender – showing how a higher moral status is given to the adult woman in this case. Other versions of this passage do not directly mention miscarriage, but rather “serious injury”. Thus, in this case we can argue that “if any harm follows” can be seen as a miscarriage, rather than further harm done to the mother.

Following the ideas of St. Augustine, some Christians believe that people are always at risk of being corrupted, and to mismanage their capabilities to carry out unjust actions. In this case, stem cell research is seen as being part of those temptations of corruption. As several bible passages have been interpreted in a way that humans should have love for their unborn child before that child is brought into the world, and since love is a strong aspect of the Christian faith, it is no surprise that most Christians disagree with carrying out research on human embryonic stem cells. Nonetheless, there is still a strong debate between Christians on the beginning of personhood. This debate encompasses a specific aspect – ensoulment. In Christian faith, the soul is the part of the individual that makes him or her accountable to God. Therefore, it is of great significance to understand and pinpoint the moment in which this ensoulment takes place. Several points have been proposed<sup>11</sup>. First, conception and individuation of the embryo, second, 28 days with the presence of a heartbeat, or lastly, when the movements of the embryo become substantial. The Prudential Argument considers this, stating that killing a human

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<sup>10</sup> The Holy Bible, *Ex. 21:22-23*

<sup>11</sup> Zehnder, *Best-Fit Bioethics: The Formation of Ethical and Political Positions on Stem Cell Research*, p.42

being with its own unique soul is so serious that we should abstain from killing embryos as well. As many benefits as human embryonic stem cell research may be able to bring, they would still be finite. While on the other hand killing a human soul would bring infinite harm.<sup>12</sup> From this, we can see that infinite harm outweighs finite benefits. Some Christians argue that this train of thought can also be used concerning sick adults. They often weigh out the possibility of helping a sick adult, who also has a soul, against the potential embryo, thus they do not put the embryo and adult human at the same level. In addition, others also consider that all benefits of research are still not certain; showing how even though some groups of individuals all belong to the same religion and traditional background they may not have unanimous opinions.

#### **4.1.1 Catholics**

Under the Roman Catholic view, a human being should be left to enjoy his or her own right to live life from conception until death. As much as a human adult is treated with moral respect, the same should apply to fetuses and embryos. We can see the Catholic Church's opinion on these matters also regarding in-vitro fertilization, marriage, and the damage and usage of human embryos. The Church believes that man's place in the natural world is one of dominion over nature, nonetheless they should still refrain from overusing this dominion and stay within the limits of this power. Since men have the ability to do so carry out some actions, it does not ultimately equal to the fact that they should actually carry out these said actions. Creating human embryos and destroying them for research falls under this scope. Just because we have the power to do so, the Church argues that we should not be overusing this power. In relation to in-vitro fertilization, the Church believes that the practice in itself is against the idea of marriage as it goes against the main meaning of matrimony, which is procreation. In addition, it takes away the process from the genetic parents and moves the responsibility to science and technology. The main issue here is that in-vitro fertilization creates more embryos than are needed. The Church does not provide an answer as to what we are to do with the extra embryos; it just states that the practice in itself is immoral and that there is no moral

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<sup>12</sup> Lumer, *Practical Arguments for prudential justifications of actions*, p.2

way to go about it. Therefore, even if the embryos are not used later on for research, the Catholic Church still deems their creation immoral.<sup>13</sup> The Catholic Church's texts have a strong focus on the idea of rights. In their view, it is a child's right to be conceived by two parents, therefore, if a married couple uses a donor either for sperm or for the egg they are violating the child's rights. However, the Church does not want to put this right on the same level as the right to life, for example.

#### **4.1.2 Orthodox and Protestant**

Orthodox believers share the same view as most Catholics do. They believe an embryo is a complete human being with a soul, and that research on them should not be carried out. They are also against the utilitarian point of view, and state that only the rights of the embryo are relevant in cases like these. They believe that frozen human embryos are a superfluous loss, and that couples should also try their hardest not to go through with in-vitro fertilization. Demetrios Demopoulos<sup>14</sup>, who is a priest in the Greek Orthodox Church, argued that all humans, no matter at what stage of life they are in, be it embryo or full adult, strive to become more like God, and thus authentic persons. Demetrios Demopoulos however agrees with the use of already existing stem cell lines, as he argues that hoping that an act was carried out will not undo that specific act. On the other hand, most Orthodox believers argue that researchers should not use already existing stem cell lines. Regardless of these disagreements, Orthodox believers share a relatively unanimous stance throughout their pro-life policies.

If we consider the United Methodist Church, we can see how Churches can sometimes change their opinions, from being historically pro-life to becoming more and more pro-choice. At first, the United Methodist Church did not support embryo research. Nowadays, they are somewhat more supportive of in-vitro fertilization<sup>15</sup>. They do so as they understand that having left over embryos which ended up not being used in the in-vitro fertilization process means that some will be discarded, as it would be too much to

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<sup>13</sup> Zehnder, *Best-Fit Bioethics: The Formation of Ethical and Political Positions on Stem Cell Research*, p.46

<sup>14</sup> Ibid

<sup>15</sup> Ibid

ask of women to only produce fewer eggs at a time, which can result in being a long and painful process. They nonetheless strongly advise women and couples in general to not undergo these treatments in the first place, and to make sure that they have exhausted all other options first. They argue that as before, in-vitro treatments did not exist, thus the churches did not have to deal with such moral dilemmas, however, as times have changed, some points of view must change too. The United Methodist Church has clearly stated that they are morally torn over this issue, and they do not approve of the destruction of embryos, however they do understand where couples are coming from when they undergo this process and can therefore alter their long held views on the matter.

The Episcopalian and Presbyterian Churches support stem cell research.<sup>16</sup> The Episcopalian Church argues that using left over embryos from in-vitro fertilizations is acceptable as it is an attempt at helping other human beings that could be affected by diseases. However, it does not support therapeutic cloning. They argue that research on human embryos has a potential that cannot be achieved in any other way, thus they balance out the respect they have for embryos and the respect that they have for the sake of research. They think that preventing researchers from carrying out research which could alleviate someone's pain or cure some disease is putting the respect they have for embryos above the respect they have for people in pain, pain which has the possibility of being alleviated.

There are many other Christian denominations that I have not mentioned. Most have the same ideals both concerning this issue and also their moral standpoints. The main separation here is the division between individuals who believe that sick people who have the possibility to alleviate their pain through human embryonic stem cell research have every right to do so, and other individuals who believe that the respect for embryos should be the same as any respect that we give to any other human adult. Even

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<sup>16</sup> Zehnder, *Best-Fit Bioethics: The Formation of Ethical and Political Positions on Stem Cell Research*, p.50

though the members of these two separate groups have different viewpoints, they all rise from a common framework which has shaped all of their assumptions and interpretations.

#### **4.2 Judaism**

Judaism derives from a different set of religious and cultural traditions, with established rabbinical commentary. These commentaries are full of interpretations, and the tradition is open and extremely willing to consider different views with respect to the matters discussed. Jewish ethics focus more on the obligations members have towards each other in the community, rather than ideas of individual rights. Most Jews support embryo research, following their traditions. Throughout the three branches of Judaism, meaning Conservative, Reform, and Orthodox, this view seems to alter slightly. This view of acceptance is mostly based on the view of the status of the embryo, and also on the focus that Judaism has on partnership and healing<sup>17</sup>. The traditional viewpoint regarding conception according to Jews is that the embryo is like water until 40 days after conception. In their point of view, the loss of an embryo is not on the same moral standpoint than the loss of an adult human. Alternatively, since the fetus is part of the female human body, harming the fetus is seen as harm one's own body, which is usually prohibited. Thus, genetic material that is outside of the body has no moral or legal status, therefore in-vitro fertilization and therapeutic cloning from embryos is allowed by the Jewish faith. Also important to note, that the Jewish faith believes that life and death are gradual processes. Babies are named only eight days after being born, and if a baby unfortunately passes away before 30 days after its birth, it does not receive any death rites. Furthermore, ill individuals also have a different moral status in society as they are treated as if the death process has begun. This emphasis is on the fact that the Jewish faith places a large importance on how one individual in the community acts with regards to other individuals, rather than individual rights, which thus affects many viewpoints and interpretations on human stem cell research.

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<sup>17</sup> Zehnder, *Best-Fit Bioethics: The Formation of Ethical and Political Positions on Stem Cell Research*, p.51

In Jewish traditions, there is no fear concerning the concept of playing God. In the divine mandates, Jewish people are considered as partners with God in looking after the Earth. They do not see nature as something perfect and holy which should not be altered, but rather as a project that is need of repairs and efforts by the community. Their touch on nature is not seen as a passive help to nature, but rather as a dominating and skillful action where the people alter the Earth in order to produce food and other things. Individuals of the Jewish faith are asked to act more and more like God, in order to have a healthy and peaceful world to live in. These divine mandates to heal also apply to humans and their pursuit to find new ways in which to preserve and to improve their lives. As God is seen as the owner of the human bodies, his condition is their constant pursuit if health and life.

#### **4.3 Islam**

The vast majority of Muslims support research on human embryos if, and only if, there is potential for the treatment of diseases and therapeutic use. Muslim believe that only after the first trimester ensoulment takes place.

“We created man of an extraction of clay, then We set him, a drop in a safe lodging, then We created of the drop a clot, then We created of the clot a tissue, then We created of the tissue bones, then we covered the bones in flesh; thereafter We produced it as another creature. So blessed be God, the Best of creators!”<sup>18</sup> (K. 24:12-14)

Regardless of the fact that this passage can be seen as slightly ambiguous, it seems to state that life in itself comes after the process of formation. By using the word “thereafter”, the passage implies that personhood is only achieved after some period of gestation or development. However, since the Koran is not extremely vocal and clear on the issue, it is possible to create a separation between the biological and the moral personhood of an embryo. Muslim believe that personhood occurs around the fourth month of pregnancy, where fetal movement is palpable. Nonetheless, some Muslim

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<sup>18</sup> The Koran, 24:12-14



scholars argue against abortion as they state that the fetus is still alive, while others argue that early abortions should still be allowed and be justifiable. Throughout the Muslim faith there is no real description as to when life and moral status begin, some Muslim believe that it begins at conception while other argue that it comes later on following the blastocyst stage. Nonetheless, a large majority believe that ensoulment occurs between the third trimester and the fourth month at the latest. Due to the diverse views in the Muslim communities, stem cell research legislation may be altered on the religious leaders view on the subject, which of course does not necessarily represent the view and opinions of all individuals belonging to the Muslim faith.

#### **4.4 Other Religions and Shared Apprehensions**

Within Buddhism, the concept of *ahimsa* is crucial<sup>19</sup>. In their eyes, it is not allowed to harm or kill any living creature. In contrast to Western Religions, here there is no focus on the attainment of personhood from an embryo. Rather, the destruction of an embryo is simply considered wrong because it would harm a living creature and thus go against the principle of *ahimsa*. Some argue that the principle of *ahimsa* only applies to creatures that are sentient, meaning that they can smell, taste, hear and feel, similarly how plants are living things but they do not fall under the scope of the principle. Rather than being presented as laws to follow, the view on stem cell research is evaluated on an ethical level by Buddhists. Therefore, if the research carried out on human embryonic stem cells is carried out in order to help humankind, then some members of the Buddhist community can consider them as ethical. On the other hand, if research is carried out for material gains, then many may not support it as it is seen as unethical. In comparison, Taoists tend to be opposed to human embryonic stem cell research. They believe that harming any creature, including embryos, is unethical:

“All living creatures that breathe, including those that fly and crawl, should not be killed. Even wriggling creatures also treasure life, even

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<sup>19</sup> Zehnder, *Best-Fit Bioethics: The Formation of Ethical and Political Positions on Stem Cell Research*, p.56

mosquitos and other insects understand the avoidance of death.”<sup>20</sup> (quoted in Walters, 24)

Taoism is known for stressing the value placed on the concept of life as part of a more general understanding of nature, and on the promotion of human health, so it is no surprise that most people belonging to the Taoist faith are against in-vitro fertilization and human embryonic stem cell research.

Many of these religions call for more public awareness and discussion on the topic of the ethical and moral consequences of human embryonic stem cell research and in-vitro fertilization. They also stress the need for oversight in the cases in which the research is carried out, even if they may not support the research. Many also argue for the results of the research to be made public so everyone in the community could be aware of what researchers have discovered. Social issues are also very important to the different religions. Many fear that only wealthy people will be able to access fertility treatments and other forms of research, thus they fight to make new technologies as available to as many people as possible.

There is no single viewpoint coming from a religious interpretation on human embryonic stem cell research. As concerns regarding life and death are still very present in our world nowadays, individuals who strongly identify with a religion will look for answers to their doubts in religious texts, or consider the opinion of various religious leaders. Nonetheless, it is still largely a matter of personal interpretation and values. Ethical concerns are very crucial aspects to many religious individuals, thus they believe that all research should be ethically justifiable. Their views may be different within their communities, or just different from other individuals. It is important to recognize that no matter what one’s opinion may be, respect for other people’s opinion should be present, even when people do not share the same viewpoints.

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<sup>20</sup>quoted in Walters, “*God and the Embryo: Religious Voices on Stem Cell Research and Cloning*,” 24.

## **5 Ethical considerations**

Being presented with all the many possibilities that stem cells research can provide us with, it can seem outrageous that many governments still refuse funding in this field. There are several objections as to why many do not want to support a peculiar type of research that can give us an insight on the cure and treatments for severe diseases such as Alzheimer's, Parkinson's, and many more. There are two main strands of criticisms that arise from stem cell research.

### ***5.1 Objections to the manipulations on human embryos***

The first objection states that studies on embryonic stem cells is ultimately wrong, as it compromises the loss of many human embryos. This can be argued on various secular and religious grounds, which consider the manipulation of nature by humans immoral. Even though the main objection in relation to the production and engineering of embryonic stem cells is the destruction of the embryo, one can associate also other consequences with this practice. For example, harvested stem cells often form tumors or may cause cancer.

The standard procedure to harvest embryonic stem cells is referred to as somatic cell nuclear transfer (SCNT).<sup>21</sup> During this procedure, the nucleus of a somatic cell is put into a host egg, which has had its nucleus removed. After using either chemical influence or electric shocks to stimulate the cell to divide, a blastocyst is produced. From this blastocyst, the stem cells are harvested and meanwhile the embryo is destroyed. However, more methods have been established to harvest stem cells without destroying the embryo. One of these methods is referred to as Single-blastomere technology, and another method is called altered nuclear transfer (ANT). Nevertheless some issues are still present. Many argue that these techniques are quite controversial as some research has been carried out which showed that embryos do not have the possibility to grow normally after stem cells have been harvested. It is also important to note that ANT has

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<sup>21</sup> Caplan & Arp, *Contemporary Debates in Bioethics*, p. 229-233

yet to be utilized as research has yet to prove if this specific procedure will generate with confidence a nonembryo rather than just an embryo with a deficiency.

Even though many researchers have actively been trying to solve the issue regarding the destruction of the embryo, there are still numerous people who are of the opinion that embryonic humans should not be manipulated with in a laboratory no matter what.<sup>22</sup> For example, the Catholic Church clearly stated that their position is based on the idea that human life begins at conception. Furthermore, that life is valued and dignified as any other human life regardless of what stage of development it is undergoing at the time. Following this thought, they are of the opinion that a human embryo should never be altered or harmed in any way. On the other hand, opposed to this view are thinkers which assume a connection between moral status and personhood. Mary Ann Warren attempted at describing a measure of personhood, which is still commonly agreed on now.<sup>23</sup> These measures are composed of consciousness, reasoning, self-motivated activity, being able to communicate and the capacity of being self-aware. In her view a being which encompasses these five criteria has full moral rights and privileges. The main aspect to consider here is that this view understands that a fertilized human egg is a human being, however it argues when this human being can be considered a person. If we consider that embryos are not persons, then they do not have any moral rights and privileges, and we do not need to consider our morality when harvesting embryonic stem cells.

## **5.2 Human cloning**

The second main objection about stem cell research is based on the assumption that even if research on embryos is considered not to be wrong or immoral in itself, this type of research will lead to way to many dehumanizing practices, such as human cloning, embryo farms, and overall the commodification of human life.<sup>24</sup> A main fear here is that individuals will then be able to create customized embryos. If successful

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<sup>22</sup> Sandel & Phil, *Embryo Ethics — The Moral Logic of Stem-Cell Research*, p. 207

<sup>23</sup> Warren, *On the Moral and Legal Status of Abortion*

<sup>24</sup> Jaenisch, *Human Cloning — The Science and Ethics of Nuclear Transplantation*, p. 2787-2791

research was to be carried out, human beings would have a clearer understanding of the outcomes of placing an adult nucleus inside of a non-nucleated egg that would then go back to the embryonic state. It would be extremely hard to control the spread of such knowledge and thus we would not be able to control what researchers and scientists might aim to do with it. We can be reassured by the fact that cloning techniques are still quite primitive and that we just do not have the means yet to clone humans. However many precautions have been taken by different governments to stop the looming cloning crisis.

The main defense behind human cloning, just like when we consider research on embryonic stem cells, is that it can provide us with new ways to treat and understand genetic diseases. An isolated embryonic stem cell derived from cloned embryos would be able to be customized to the need of the donor patient. Due to the fact that embryonic stem cells have the capability to generate all sorts of cells, researchers could thus study complex genetic diseases in culture with the use of denuclearized cells from patients who are either carriers of a specific genetic disorder or who are affected by said disorder.

Even though embryonic stem cells which have been derived from a cloned embryo are functionally no different than embryonic stem cells derived from embryos through in vitro fertilization, cloned embryos have a very limited potential to develop into normal human beings.<sup>25</sup> This is because cloning embryos does not permit the natural process of gametogenesis and fertilization, thus preventing the natural programming of the genome. As of now, these biological barriers will still need quite some research before they can be overcome. Nevertheless, both the cloned embryo stem cells and the stem cells from in vitro fertilization have the potential to serve as a useful source in terms of research or therapy. Considering past experiments, many cloned mammals which were derived from nuclear transfer did not survive the period of gestation. Those who did survive often suffered from the large offspring syndrome, meaning that the offspring are

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<sup>25</sup> Jaenisch, *Human Cloning — The Science and Ethics of Nuclear Transplantation*, p. 2787-2791

bigger than usual and can have health problems such as breathing and circulation issues due to their size.

There are several important issues with cloning, but first it is important to note that cloning does not produce the same individual person. The only thing cloning can do is produce the same genotype of said person.<sup>26</sup> Looking at identical twins for examples, we can see that they are two separate individuals with their own preferences and interests. Although there may be some characteristics in common, there is no doubt that each twin is a different and separate person. In the case of cloning, ethical issues such as human dignity and instrumentalization come into play as well. Human dignity is a relatively vague appeal as it is not clear if we should be looking at the human dignity of the individual who would be duplicated, or if we should consider the human dignity of the duplicates of said individual. On the other hand, instrumentalization deals with the idea of using human beings as means used for the purposes of others. This appeal also is relatively problematic as it is hard to apply this idea coherently. We could use for example the practice of in vitro fertilization, where embryos are created for this purpose, thus in some way they are created instrumentally. Kant's famous principle<sup>27</sup> states that: "respect for human dignity requires that an individual is never used . . . exclusively as a means". Directly from this it can be deduced that the principle is relatively up to one's personal intuition.

Another Kantian inspired principle we could argue is that it is better to do some good than do no good<sup>28</sup>. Therefore, some argue that it is better to use waste human material in order to develop therapy and treatments for various diseases, rather than not even attempting at doing so. Following this train of thought, many thus argue that if it is more moral and right to use embryos for research and therapy, than it is just as right to produce them in order to reach the same ends. However, in order to argue this we can

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<sup>26</sup> Harris, "Goodbye Dolly?" *The Ethics of Human Cloning*, p. 353-360

<sup>27</sup> Kant, *Lectures on Ethics*

<sup>28</sup> Harris, "Goodbye Dolly?" *The Ethics of Human Cloning*, p. 353-360

also mention that many consider embryos part of the moral community and thus have all the rights and protection granted by Kant.

Another fear concerned with cloning are the effects which cloning can have on the gene pool and on genetic variability.<sup>29</sup> The human genome is considered common heritage of the human race, thus altering it would cause consequences for the entire human race. The European parliament stated that cloning permits a racist selection of the human race and that it goes against the principle of equality. However, some go as far as to say that relating human cloning to racism would mean that egg donation, sperm donation and choice in sexual partner could all be related to racism as well. Other rights that have been argued to be violated are the right to be the product of two genetic materials from two different individuals and the right to have a genetic identity.

Cloning could permit the study of genetic diseases and just provide us with an insight on genetic development in general. It could allow individuals that are infertile to have children, which would have the same genetic material as them, and also individuals who are carriers of recessive disorders could then have children without worrying that they would then have the disease. Nevertheless, it is still a practice that has caused many issues and which has brought about many debates. Researchers are still not fully conscious of what harm they could bring about to cloned individuals, not just physically but also psychologically as they cannot know what could happen to a cloned individual's identity as well. Furthermore, it could have vast negative effects on the human gene pool if it is not carried out in a controlled manner.<sup>30</sup>

## **6 Regulations around the world**

Due to the many different ethical and moral regulations relating to stem cell research, policies differ all over the world. These policies have brought around much discussion and many debates concerning its ethical and moral value. Governments have

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<sup>29</sup> Ibid

<sup>30</sup> Jaenisch, *Human Cloning — The Science and Ethics of Nuclear Transplantation*, p. 2787-2791

attempted to lay down some ground rules on funding both on the legal and on the scientific levels. However, no single rule or viewpoint exists for controlling stem cell research, thus every country has developed its own policy. Some countries are more restrictive than others are, while other some have relatively few restrictions when it comes to stem cell research. Geographically speaking, certain factors affect legislation in this case. As previously described, religion also has a huge impact and many religious leaders have a strong voice within their communities about their opinions on stem cell research. Therefore, we can assume that in countries and in regions where religion is a big part of the communities' life, their viewpoint will also be based on their religious values and beliefs. Of course, regulations are needed in cases where research is allowed to be carried out. A system of checks should also be established whether stem cell research is allowed, in order to track the results of experiments and in order to keep the people up to date with the new technologies. Since public opinion is also extremely important when it comes to matters as sensitive as stem cell research. Keeping the public updated with achievements and successes regarding possible developments of treatments and therapeutic uses of stem cells cannot only improve the general view citizens in a country have on stem cells, but it could also alter legislation in the future. This could be the case if citizens in the future were to be called to vote for a referendum to alter legislation.

### **6.1 *United States of America***

In 1996, through the Dickey-Wicker Amendment, congress banned federal funding for research on embryos.<sup>31</sup>This specific amendment restricted the use of federal funds for the creation of embryos, which would be used for research purposes, or research in which human embryos are discarded or even put at subject of risk. In 2000, the National Institutes of Health released several guidelines by interpreting the Dickey-Wicker Amendment. These guidelines states that human embryonic stem cells must have been created for fertility treatment purposes, that they were derived by private funds, that they were in excess and that they were taken with the clear consent of the donor. Even though

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<sup>31</sup> Research!America, *Timeline of Major Events in Stem Cell Research Policy*



in 2001 the Bush administration banned federal funding of any research using embryonic stem cells, it does not affect the private sector or even research on adult stem cells. Later on in 2005, a bill is passed both in the House and in the Senate, stating that federal funding for stem cell research will be expanded in order to include stem cells from extra embryos in the in vitro fertilization process. However, President Bush quickly vetoed the bill. The same happens in 2007, and again Congress was not able to override the veto. One president Obama came into office, he issued a degree in order to push for embryonic stem cell research in the United States, under certain ethical requirements. These requirements include that the embryo was discarded after in vitro fertilization, that informed consent is present, and that the donors do not receive compensation for donating an embryo. Since then some advances have been made in the United States, for example in 2013 researchers managed to successfully reprogram skin cells in embryonic stem cells, and in 2014 several trial treatments using stem cells have been found to improve sight in patients with macular degeneration.<sup>32</sup>

## **6.2 Italy**

In Italy, law 40 stated that embryos have rights from the moment of fertilization. It prohibited the use of human embryos for any medical research unless it was to aid the embryo in itself. On the other hand, this law strongly supported adult stem cell research. This law was highly contested and in 2005, due to several appeals to Italy's Constitutional Court, a referendum was allowed on several parts of the law – including if the ban on research on embryos could be altered. Once the referendum was held, the votes received were less than 50% of the Italian electorate thus it did not pass.<sup>33</sup>

This law has now been abolished, after being contested for many years. The prohibition on heterologous fertilization has been abolished, as well as the ban on the production of more than three embryos and the obligation to have all three embryos implanted. What remains of this law is the prohibition of assisted reproduction for single

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<sup>32</sup> Nature Cell Biology, *Human Embryonic Stem Cell Research in the US: Time for Change?*

<sup>33</sup> Doherty, *Europe's Stem Cell Hub*

individuals and homosexual couples<sup>34</sup>. The prohibition on using human embryonic stem cells for research purposes is still being contested. The abolishment of most of the prohibitions of Law 40 display the change and the development of scientific and reproductive freedom in Italy.

### **6.3 United Kingdom**

How regulations came to be in the United Kingdom began with the Report of the Committee of Inquiry into Human Fertilization and Embryology, also known as the Warnock Report.<sup>35</sup> Warnock was of the opinion that carrying out research on human embryos was not as immoral as people considered it to be, however the opposition stated that the human embryo is more significant than just a mere bunch of cells. Despite the ongoing debate, the government chose to endorse the Human Fertilization and Embryology Act of 1990. The main policy here was that it would be better to openly regulate research on human embryos if they are to be available. This called for clear regulations and for a specific body, the Human Fertilization and Embryology authority (HFEA) to regulate these activities. Three main principles were put into place with respects to human embryos to see what was lawful and what was not. The first principle states that the HFEA should license the research only if it is necessary, the second states that once the research has been classified as necessary, a license should be granted only if the research is necessary or desired under the statutory resolutions. The third and final principle states that no research on embryos should be exceed 14 days. In this 1990 legislation, the five resolutions in the second principle were listed as well. They included advances in the treatment of infertility, advances in knowledge regarding the causes of congenital diseases, advances in knowledge about miscarriages, developing contraception, and developing techniques to point out gene or chromosomes abnormalities in embryos.

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<sup>34</sup> *Fecondazione assistita, tutti i divieti della Legge 40 cancellati nelle aule*

<sup>35</sup> Brownsword, *Bioethics today, bioethics tomorrow: Stem Cell Research and the Dignitarian Alliance*, p. 33-51

However, these regulations were seen as too narrow when compared to advances in stem cell research. Thus, the government decided to extend the purposes by adding onto the previously existing ones. The new regulations were fixed in the Human Fertilization and Embryology Regulations of 2001. This policy added on three new purposes to the original five, which were to develop knowledge in the development of embryos, to develop knowledge in the field of serious disease, and to apply said developments in knowledge in order to come up with treatments for these serious diseases.<sup>36</sup>

These decisions were followed up several criticisms, not just from the ethical point of view. During a debate on these regulations, it was strongly suggested that adult stem cells were very limited in their scope. Evidence was brought up to suggest a dual track complementary approach, meaning that work was to be done on both embryonic and adult stem cells in order to achieve maximum medical benefits. Furthermore, there was a high concern that embryo research would lead to reproductive human cloning. This is why the Government went back and made it a criminal offense to place in a woman a human embryo that was created by other methods rather than by fertilization.

The Select Committee had several responses to the objections against the resolutions. Supporters of the main ethical objection, which states that human embryonic stem cell research is unjustifiable on all moral grounds, found a basis for their argument in Article 18 of the Convention on Human Rights and Biomedicine<sup>37</sup>. This article states that the creation of human embryos for research is prohibited. The Committee defended itself by stating that the United Kingdom had not yet completely adhered to the Convention, thus it did not apply. Further objections were based on the ideal of respect for human dignity. Here the Committee stated that even though that ideal is commonly used to set ethical standards around the world, it still does not provide with practical guidelines to set limits on research on human embryos. The Committee has also defended itself by stating that the United Kingdom is a pluralistic society and that even though many moralists have

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<sup>36</sup> Kenney, *Stem Cell Therapy: The Ethical Issues*, p. 5-20

<sup>37</sup> Brownsword, *Bioethics today, bioethics tomorrow: Stem Cell Research and the Dignitarian Alliance*, p. 33-51

many different opinions about whether we should carry out research on human embryonic stem cells and under which circumstances, that there can still be mutual respect between them. A measure of respect that the Committee is endorsing is the fourteen-day limit for embryonic human research. Furthermore, they stand behind the ideal human embryos should not be created in order for research to be carried out, unless it is the only way to carry out a specific type of research.

#### **6.4 *European Union Directives***

As seen, the different member states of the European Union have diverse regulatory positions on human embryonic stem cell research. These different regulations are reflections of the contrasting ethical and religious beliefs throughout Europe. Due to the deep diversity within Europe, there has been a strenuous debate around the issue of funding embryonic stem cell research. In April of 2004, the Directive 2004/23/EC<sup>38</sup>, regarding the quality and safety standards for donated human tissues and cells entered into force in the European Union. This Directive did not just address tissues such as cardiovascular tissues, bone elements and nerve and brain cells for example, but also stem cells. The Directive imposes several safety and quality standards in order to diminish the possibility of infections, specifying every activity in the process, namely donation and procurement, testing, processing, preservation, storage, and the delivering to the site of medical use.<sup>39</sup> There are several aspects of this Directive. The European member states must provide for qualified authorities in order to have a system where the implementation of the legislation is overseen in a fair and adequate manner. There must be properly trained medical personnel to carry out the acquirement and testing of the materials, and all tissues that are acquired within the European Union must be able to be traced by the donor to the recipient and the other way around as well, while at the same time rendering all the data anonymous to other parties. Furthermore, all tissues should be provided on a voluntary basis, and lastly a system of reports and investigations in order to address any information must be implemented.

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<sup>38</sup> Directive 2004/23/EC – quality and safety standards for donated human tissues and cells

<sup>39</sup> Ibid.

Patenting issues also arise within the European Union. Clause 53 (a) in the European Patent Convention states that patents will not be granted to inventions which are deemed to be contrary to public morality<sup>40</sup>. Nonetheless, it is not well specified what falls under the scope of morality in this sense. Stem cells are often seen as belonging to research or processes that do not easily belong to the scope of morality. European researchers have the possibility of finding themselves at a disadvantage as patents are a strong aspect for investments, and if the European Patenting Office, the EPO, does not allow for patents, all research and advances will end up taking place outside of Europe.<sup>41</sup>

## **7 Alternative Sources for Research**

Restrictions concerning research on stem cells is ever changing, mainly due to its ethical implications. Because of these ethical implications, the field of research in regards to stem cells has been extremely limited by the lack of funding and by the lack of free regulations. This is why scientists have been searching for alternative sources in order to carry out their experiments. Furthermore, these alternatives can provide advantages to researchers, as they are likely to receive higher amounts of funding by respective states for their studies, as they would avoid all ethical debates in this field. Both alternative sources of human embryonic stem cells and even completely different cells that have an equal functional scope have been looked for. Under this outlook, we can find cells that, with the same scope, do not require the killing of a human embryo, or solely involve the killing of an embryo that may be seen as having a lesser moral status, including embryos affected by diseases of embryos that have a higher probability of being affected. Some of the alternative sources which have been proposed include gathering human embryonic stem cells from embryos used in fertility treatments that unfortunately died spontaneously, or parthenotes<sup>42</sup>, which is an unfertilized mammalian egg which underwent division due to the fact that it was induced by several chemicals. Of course,

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<sup>40</sup> The European Patent Convention

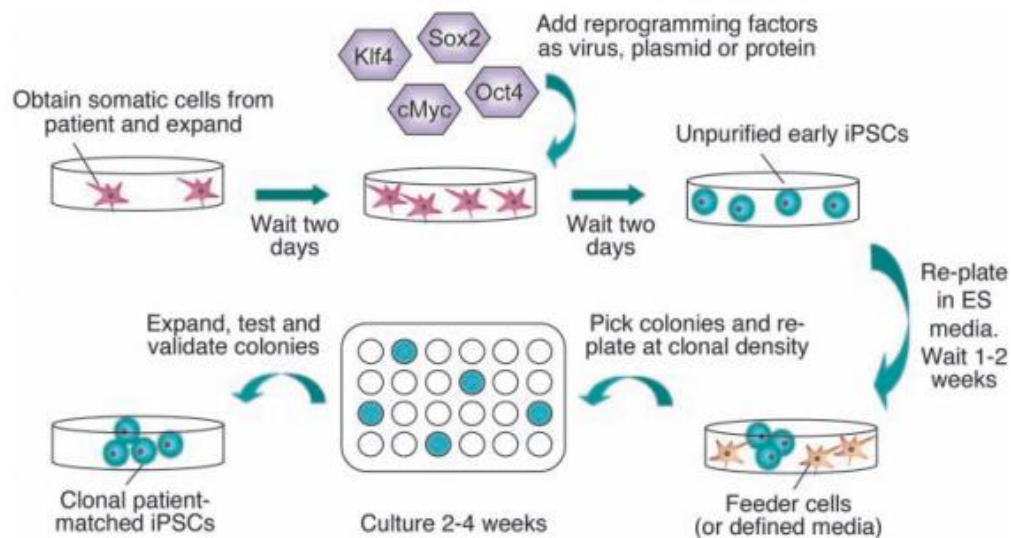
<sup>41</sup> Hermerén, *Stem cell patents: ethical aspects*

<sup>42</sup> Devolder K, *The Ethics and Regulation of Human Embryonic Stem Cell Research*, p. 31

the perfect solution to this issue would be to create human pluripotent stem cells completely artificially, meaning that there would be no need to have an embryo and subsequently to destroy it. A proposal to carry this out calls for the re-program of somatic cells in order to create stem cells matching to the patient. To do this, researchers must fuse somatic cells with existing human embryonic stem cells, resulting in the somatic cells to reprogram themselves and become pluripotent, and subsequently behaving as embryonic stem cells.

### 7.1 Induced Pluripotent Stem Cells

Yamanaka and his colleagues, regrading mice fibroblasts (Mitsui, Tokuzawa et al. 2003), first developed the technology which induced pluripotency in a differentiated cell. They used four transcription factors that they packed into a retrovirus, in order to then alter the transcription factors in the host cell. Eventually this method was used on human somatic cells, and it worked as it did on mice. Nowadays researchers can use retroviruses, lentiviruses, and other delivery systems in order to encourage definite transcription factors into cells.



**FIG.1. Direct reprogramming.** Somatic cells are obtained from a patient and expanded if necessary. Reprogramming factors are added, and the pluripotent state is induced. iPSCs are cultured in embryonic stem (ES) cell media for 1–2 weeks, after which colonies are isolated at clonal densities and expanded. iPSCs, induced pluripotent stem cells.<sup>43</sup>

<sup>43</sup> Condic & Rao, *Alternative Sources of Pluripotent Stem Cells: Ethical and Scientific Issues Revisited*

Induced pluripotent stem cells already proved themselves useful in drug development and disease modeling. However, the viruses researchers use to induce the cells can sometimes cause cancer. Thus, a problem regarding induced pluripotent stem cells is their possible cancerous behavior. Some methods have been established to prevent the formation of tumors, mainly two methods. The first is to use DNA molecules that do not assimilate in the genome of the host cell, and the second is to assimilate DNA molecules that then have the ability to remove themselves from the genome of the host cell.<sup>44</sup>

Induced pluripotent stem cells and human embryonic stem cells have differences and similarities. First of all, they are both self-renewing, meaning that they can divide themselves indefinitely and create copies of themselves. In the future, iPS cells can be used as a source of replacement cells for tissues<sup>45</sup>, allowing for patients with untreatable diseases to use these stem cells in their favor. Nevertheless, embryonic stem cells have a different degree of plasticity in comparison to other stem cells. If we take for example skin fibroblasts, meaning the cells present within the dermis layer of the skin that are responsible for the skin's capacity to regenerate from trauma, researchers have found that they are not transformed into blood cells with the same ease in which embryonic stem cells or even stem cells taken from bone marrow are. This could be because the cells that have been reprogrammed into pluripotent stem cells still contain some of the previous epigenetics in the cell, meaning that regulatory proteins have the power to still turn on and off certain genes, thus preventing some genes to be altered in adult cells. Another aspect to consider is whether induced pluripotent stem cells and human embryonic stem cells are functional equals. Following several exams, it has been discovered that these two types of cells are not precisely identical. Due to these differences, more research is needed to see how these differences can affect clinical applications of induced pluripotent stem cells. Nevertheless, it still has to be recognized whether these differences may be

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<sup>44</sup> Stem Cell Bioethics, *Induced Pluripotent Stem Cells*

<sup>45</sup> Hadenfeld, *EuroStemCell, i PS cells and reprogramming: turn any cell of the body into a stem cell*

significant in the different fields in which stem cell research using induced pluripotent stem cells are being used.

A clear advantage induced pluripotent stem cells have over stem cells derived from human embryos is that since they patient specific, they manage to completely cancel the possibility of the immune system rejecting them. Even though these patient specific stem cells could also be taken from human embryonic stem cells undergoing the Somatic Cell Nuclear Transfer procedure, induced pluripotent stem cells have several more advantages. In the case in which a patient has a genetic disease, it is possible to create iPS cells directly from the patient that do not carry the disease, which could then be used for transplantation. However, proposals like these remain theoretical at his point. One of these advantages is the fact that since they do not cross as many ethical boundaries they are more likely to undergo simpler regulations in comparison to human embryonic stem cells and thus to get higher amounts of funding from the respective governments, meaning that research could continue and advance.<sup>46</sup>

## 7.2 *Chimeras*

When scientists create individuals made up of cells, which are derived from different embryonic origins, they are referred to as chimeras. They are made by injecting stem cells from one animal into another.<sup>47</sup> More often than not, chimeras are given a negative connotation. However, they are no more than animals which have some human blood cells within them. These chimeras have been often created by transplanting human stem cells taken from bone marrow and injected into newborn animals. The cells that are being injected often carry a tracker, therefore researchers can observe both where the cells migrate to within the body, and how they interact and specialize with the tissues already present in the animal's body. This provides researchers a clearer insight on how cells react to the environment they are placed in and how they relate with surrounding tissues. By observing how these stem cells react to the surrounding area they are placed

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<sup>46</sup> Condic & Rao, *Alternative Sources of Pluripotent Stem Cells: Ethical and Scientific Issues Revisited*, p. 1121-1129

<sup>47</sup> Streiffer, *Human Stem Cells, Chimeras, and Moral Status*, p. 347-370



in, researchers can study the potential these cells have in terms of repairing and replacing tissue that has been damaged. Nevertheless, it is important to note that this sort of research requires scientists and researchers to carry out experiments on animals, thus it raises ethical issues of a different sort – rather than dealing with human embryonic stem cell ethics, we are dealing with animal ethics and their rights. Transplanting human stem cells into prenatal animals has been considered as a better technique in comparison to transplanting stem cells into newborn animals. This is because not only does it provide us with a bigger insight into developmental biology, but also because the immune system of the prenatal animal is less likely reject the cells. Because of this, proposals argue that the transplantations of human stem cells into prenatal animals must be done the fetal stage, while some even argue that it should be done in the embryonic stage in order to avoid any type of obstacle, which could occur later on.

The human stem cells, derived from bone marrow, which are used in these techniques, are multipotent. As discussed previously, multipotent means that they have the capability to differentiate themselves into a closely related group of cells, including adult stem cells that can become either white or red blood cells. Nowadays there is a growing interest in using human embryonic stem cells to implant into prenatal animals in order to study development under a new light and in order to advance in prospective therapies for any kind of tissue, not just taking blood into consideration. Nevertheless, these proposals have received concerns by many regulatory agencies in the field, both regarding animals and their rights, but also in concerning research on human embryonic stem cells. The National Academy of Sciences' Committee on Guidelines for Human Embryonic Stem Cell Research (also known as the NAS Committee)<sup>48</sup> received mixed responses, ranging from no special review in relation to the introduction of human embryonic stem cells into other species, to the support of a complete ban. The main issue here, rather than if to allow these transplantations at all, is more concerned with as to

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<sup>48</sup> NAS, *Guidelines for Human Embryonic Stem Cell Research*

what stage to carry it out – if the fetal stage, or if at the embryonic stage.(NAS 2005, p.47-48)

An ethical issue regarding chimeras is the ideal of having an animal with some human semblances. This view has significantly affected the public reaction to chimeras as well. The research carried out by Yilin Cao et al. in 1997 attempted to grow cartilage in the shape of a three year old's ear.<sup>49</sup> In order to have enough surface area, they let this process occur on a mouse's back. The result was a mouse with a fully-grown ear on his back, which caused negative reactions by the public and by anti-biotechnology organizations. Nevertheless, this was a huge step in reconstructive biology. Yilin and his team proved that it was possible to recreate cartilage in the correct shape in order to provide children with deformations or who have undergone some accident with functional and physically correct replacements. Of course, animal rights here are still to be considered, however we cannot deny what a huge step forward this research was. In this case, the focus should not be on the fact that giving a human appearance to animals may be morally wrong, but rather, what improvements we can bring about for humans. Other ethical issues in the case of chimeras could be the possible side effects that the animal could face in its neural tissue.

Furthermore, some fear that with the implantation of human stem cells the resulting chimera could be possibly capable of going through human experiences. The Human Experience Principle is the underlying idea under this aspect. For instance Streiffer claims that, according to the Experience Principle “The Human Experience Principle: It is always morally problematic to enable a nonhuman individual to have human experiences” (Streiffer, 2005, p.353).

Human experience thus can be considered as experiences that some humans have the ability to have, so we can consider that seeing colors is solely a human experience, and that letting non-human organisms see colors is simply immoral. On the other hand, we can define human experiences as experiences that only humans can have and non-

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<sup>49</sup> Cao et al, *Plastic and Reconstructive Surgery*, p. 297-302

human organism are not capable of having at all, and in this case, we can see that this principle does not define the moral relevance of chimeras and their use in research. Other scholars against the transplantation of human stem cells that can change neural tissue affects cognitive capacities, which are key in an organism's autonomy and morality. The underlying principle here is one of cognitive capacities, and as Streiffer goes on to describe: "The Cognitive Capacity Principle: It is always morally problematic to enable a non-human to have high level cognitive capacities." (Streiffer, 2005, p.353).

However, this principle also has its issues. First of all, it does not imply that allowing a non-human organism to see colors, if we follow the example from before, would be problematic, thus it does not encounter the problem that was posed by the human experience principle. Second, it claims that if we were ever to encounter another species that was capable of cognitive capacities we would not be morally capable of curing them of brain damage if they were suffering from it. Due to the problems cause by the previous two principles, Streiffer comes up with a third possibility, namely the Moral Status Principle: "The Moral Status Principle: It is always morally problematic to cause an individual that would otherwise have a lower moral status to have the moral status of a normal, adult human." (Streiffer, 2005, p. 354).

Cognitive capacities are what give humans their moral status. The higher-level cognitive capacities a human has, the higher level of moral status that it gives to humans. Known that cognitive capacities are closely linked to an organism's neural tissue, it is clear how this view emphasizes on transplants in neural tissues that could affect said cognitive capacities. Nevertheless, there are possible constraints in this field as well, concerning as to how these transplantations can affect the cognitive capabilities of these non-human animals. These animals' different size in skull as well as the surrounding non-human cells which make up the environment and that give altering signals to the transplanted cells usually stop these cognitive enhancements. Nonetheless, we cannot be sure that transplanting human embryonic stem cells into non-human organisms will not critically affect the cognitive capacities of these organisms. Another aspect to consider is the

anthropocentric view of moral status.<sup>50</sup> This aspect argues that human beings have a moral status simply because they are human beings. This view explains the equal moral status of all human beings, including human beings who for some reason or another lack higher level cognitive capacities. Therefore, this view solves the problem posed by the cognitive capacity principle.

Considering both the moral cognitive capacity view and the anthropocentric view, the fact that we transplant human stem cells into prenatal animals could somewhat develop the chimera's moral status. This can result in moral issues as to how far we can carry out experiments, both for the research and development of treatments for diseases and other genetic disorders.

## **8 Conclusion**

Research on stem cells has altered the way we look and create models around diseases, the way in which we understand the circumstances under which we can get sick, and even the development of new drugs. Many argue that the next generations will be able to see diseases such as diabetes and Alzheimer's under the same light as we view polio today, meaning as a preventable disease. In spite of the new possibilities which stem cell research brings about for humanity, the field has been contested both politically and financially. As crucial research has been contested rather than supported, it was inevitable that research was to be moved into the private sector where it could take place without impediments. Previously, when a researcher was trying to unfold the circumstances under which a disease would develop, they had to rely heavily on hypotheses, which were not completely reliable. Nowadays, thanks to stem cell research, doctors and researchers can watch diseases evolve in a petri dish, allowing for further understanding and for an in depth study of every process which occurs before any symptoms even begin to show. For example, in 2008, a researcher in the New York Stem

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<sup>50</sup> Streiffer, *Human Stem Cells, Chimeras, and Moral Status*, p.347-70

Cell Laboratory<sup>51</sup> took skin biopsies from individuals suffering from motor neuron disease, or ALS, and turned them into IPS cells. He proceeded to turn those IPS cells into the motor neurons that were suffering from said disease, and managed to discover, by watching the healthy cells get sick, that the neurons were behaving in a different way than what the field previously thought was the case. Testing for drugs is also another aspect to consider. To bring a drug into the market takes many years and it also takes large amounts of money. By using stem cells, researches have been able to create avatar cells and have tested possible drugs on them, without having to wait long periods of time and without having to test on animals in order to achieve results. Furthermore, stem cell research has advanced also in regards to automated robotic technology. This technology has the ability to create a countless number of stem cell lines<sup>52</sup>. This aspect is crucial to the development of drugs as every individual has a different set of genetic information, thus drugs have different effects on different people. Thanks to stem cell research, we have the possibility to move away from the model of one-size-fits-all, and can create a model of more personalized medicine, by using stem cell lines that represent our own personal genetics.

The unique circumstances that are involved with stem cell research create a field in which no opinion is completely right or wrong. The practice of in-vitro fertilization also includes a certain degree of moral doubt about stem cell research, as it is challenging to decide what to do with embryos that result in not being needed. Although many argue that embryonic cells are human beings with the same rights as anyone, to what extent can we consider research on embryonic stem cells a devaluation of human life? When embryos are used in order to aid a couple to fulfill their wish to start a family, and some unused embryos are still present, why shouldn't researches be allowed to carry out research which could alleviate pain and help future generations understand and treat diseases? In my opinion, research on human embryonic stem cells should be carried out. Approaching the moral debate with objectivity, the cost-benefit analysis that my ideals

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<sup>51</sup> Solomon, S. *The Promise of Research with Stem Cells*, TED video

<sup>52</sup> Ibid

and viewpoints lead me to be in favor of stem cell research. We can consider the slippery slope argument. This is a consequentialist ideal, which argues that a particular result will occur because of a specific action, even without having a rational argument to back up this claim. This argument states that even a small decision can lead to a chain of events that may or may not culminate in a negative effect. The anti-stem cell research slippery slope argument argues that if researchers are allowed to destroy human embryos in order to carry out studies on them, in no time researchers will also kill human fetuses in order to obtain tissue, which could lead to the killing terminally ill people, or disabled people, and then to human cloning. This argument does not only show to what extremes people will reach conclusions, but also paints a picture of humans being submitted to their appetite, and as being unable to make distinctions and bargaining for exceptions.<sup>53</sup> This argument also seems to create the mindset that if researchers are allowed to cultivate stem cells from a discarded blastocyst, then the human race will be incapable of preventing any other form of future research that could be carried out. This argument is diverse from the beginning of life argument, as that argument is solely about consistency – when one believes that life begins, it is it, there is no compromise that can be made and any attack on said life is deemed immoral and should be outlawed. Nonetheless, exceptions are central to the slippery slope argument. In all, I believe that the slippery slope argument clearly states that any threat, which could be caused by research on human embryonic stem cells, is not substantial. Human beings have evolved and with us so has technology, which every day allows us to do more and more for our species, for other species, and for our planet. If we have the means to carry out research that could potentially save countless lives, I personally believe that we should grasp every opportunity we get and at least attempt to create some treatments and cures.

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<sup>53</sup> Kaplan, *The Stem Cell Slippery Slope Fallacy*

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