参考資料１

英国医学アカデミー報告（*Animals containing human material*）による「ヒトの要素を持つ動物（ＡＣＨＭ）」の分類

第１種（動物実験として規制）

一般的な動物実験と異なるところのない大多数のＡＣＨＭを用いた実験については、他の動物実験と同様にＡＳＰＡ（Animals Scientific Procedures Act　動物科学的処置法）により規制すべきである。

第２種（追加的規制の対象）

一部のＡＣＨＭを用いた実験については、本報告書が提案する国の専門機関による追加的審査に基づいて認められ得るものとすべきである。現在のところ以下のような研究が含まれるが、これらは研究の進展に応じて見直されるものである。

① 動物、特に大型動物の脳の「人間のような」機能を持つ脳への大幅な改変
② 動物体内で、機能するヒトの生殖細胞を生成し、または増殖する実験
③ ヒトと近縁種とを区別する上で最も重要な特性となるような外観や行動を著しく改変する実験
④ ヒトの遺伝子や細胞をヒト以外の霊長類に加えることを伴う実験。ヒト以外の霊長類を用いる研究は適切であり、特に臨床上の有用性につながる場合には不可欠なこともあるが、このような研究は厳格な規制に服すべきである。

第３種（当面禁止）

極めて狭い範囲のＡＣＨＭ実験については、重大な生命倫理上の問題を生じ、かつ、十分な科学的正当性も欠いているため、現段階では認めるべきではない。現在のところ以下のような研究が含まれるが、これらは国の専門機関によって定期的に見直すべきである。

① 移植したヒト細胞が、発生する胎仔の「センシティブ」な表現型を変化させないことについて確実な根拠なしに、ヒト以外の霊長類とヒトのＥＳ細胞または多能性幹細胞を混合して得られた胚を、発生から１４日以降、または原始線条形成の最初の兆候が現れた段階（どちらか先に生じた方）以降も発生させること。
② ヒト由来神経細胞のヒト以外の霊長類への移植であって、国の専門機関において、「人間のような」ふるまいを生み出す等ヒト以外の霊長類の脳の重要な機能的改変をもたらす可能性があると判断されたもの。このような実験で生じ得る表現型については、霊長類間での幹細胞移植を含む他の種を用いた研究やヒト細胞を段階的に霊長類へ移植した際の影響から判断する。
③ ヒト胚またはハイブリッド胚の産生につながる可能性がある、生殖腺にヒト由来生殖細胞をもつ、または発生させる可能性のある動物の繁殖

Categorisation of ACHM

We propose that experiments involving ACHM could be usefully classified into three categories:

Category 1

The great majority of ACHM experiments, which do not present issues beyond those of the general use of animals in research, should be subject to the same oversight and regulation under ASPA as other animal research.

Category 2

A limited number of types of ACHM research (outlined below) should be permissible, subject to additional specialist scrutiny by the national expert body we propose[1]. Although we would expect this list to evolve over time as knowledge advances, the major types of research that we would currently include in this category are:

- Substantial modification of an animal's brain that may make the brain function potentially more 'human-like', particularly in large animals.
- Experiments that may lead to the generation or propagation of functional human germ cells in animals.
- Experiments that could be expected to significantly alter the appearance or behaviour of animals, affecting those characteristics that are perceived to contribute most to distinguishing our species from our close evolutionary relatives.
- Experiments involving the addition of human genes or cells to non-human primates (NHPs). We recognise that research on NHPs is appropriate, and in some types of research probably essential if it is to lead to clinical benefit, but such research should remain under a high degree of regulatory scrutiny.

Category 3

A very narrow range of experiments should not, for now, be licensed because they either lack compelling scientific justification or raise very strong ethical concerns. The list of such experiments should be kept under regular review by the proposed national expert body, but should at present include:

- Allowing the development of an embryo, formed by pre-implantation mixing of NHP and human embryonic or pluripotent stem cells, beyond 14 days of development or the first signs of primitive streak development (whichever occurs first); unless there is persuasive evidence that the fate of the implanted (human) cells will not lead to 'sensitive' phenotypic changes in the developing fetus.[1,2,3]
- Transplantation of sufficient human-derived neural cells into an NHP as to make it possible, in the judgement of the national expert body, that there could be substantial functional modification of the NHP brain, such as to engender 'human-like' behaviour. Assessing the likely phenotypic effect of such experiments will be informed by prior work on other species (possibly including stem cell transfer between NHPs) or by data on the effects of 'graded' transplantation of human cells into NHPs.
- Breeding of animals that have, or may develop, human derived germ cells in their gonads, where this could lead to the production of human embryos or true hybrid embryos within an animal.[4]

1 Such experiments should be approached with caution. Strong scientific justification should be provided to the national expert body, who should closely consider the ethical and any safety issues in addition to the potential value of the research. Authorisation may require studies to adopt an incremental (graduated) approach. Proposed studies should be assessed on a case-by-case basis, at least until experience allows the formulation of guidelines

2 This applies whether the embryo is implanted within an animal uterus or maintained as an intact embryo in vitro. Equivalent statutory restrictions are applicable to human and human admixed embryos under the HFE Act (see 6.2.2).

3 This supplements the 14 day provision applied to human admixed embryos under the HFE Act, so that mixed embryos, which are judged to not quite meet the criteria for being 'predominantly human', should nevertheless be regulated on the basis of the likely phenotypic effect on the embryos created. Currently, any mixed origin embryo judged to be 'predominantly human' is regulated by HFEA and cannot be kept beyond the 14 day stage, whereas an embryo judged to be predominantly animal is unregulated until the mid-point of gestation (likely to be increased to two-thirds on implementation of the European Directive 2010/63/EU) and can in principle be kept indefinitely. As to whether or not an admixed embryo is predominantly 'human' is an expert judgement, including an assessment of likely phenotype, but neither the precise eventual composition of an individual embryo nor the phenotypic effect of the admixture will be easily predictable in the current state of knowledge.

4 Placement of human embryos into animals is prohibited by the HFE Act, which seems likely to be interpreted to include placement of human embryos into animals modified to contain human uterine tissue.