GURPS® Fourth Edition

TransHuman™ SPACE

BIO-TECH 2100™

Written by PHIL MASTERS
Edited by NIKOLA VRTIS
Illustrated by ERIC DESCHAMPS, RICHARD TAYLOR, and WILEY WIGGINS

Additional Material by JAMAIS CASCIO, DAVID MORGAN-MAR, KENNETH PETERS, DAVID L. PULVER, SEAN PUNCH, WILLIAM H. STODDARD, CONSTANTINE THOMAS, and JONATHAN WOODWARD

GURPS System Design ▌STEVE JACKSON
GURPS Line Editor ▌SEAN PUNCH
Assistant ***GURPS*** Line Editor ▌JASON "PK" LEVINE
Transhuman Space Line Editor ▌PHIL MASTERS
GURPS Project Manager ▌STEVEN MARSH
Production Artist and Indexer ▌NIKOLA VRTIS
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Reviewers: Roger Burton West, David Chart, S.A. Fisher, Vicky "Molokh" Kolenko, and Christopher R. Rice

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Rules and statistics in this book are specifically for the ***GURPS Basic Set,*** *Fourth Edition.* Page references that begin with B refer to that book, not this one.

Introduction

"Are you done, Hassan?" Mahmud as-Sulaymi spoke through his wearable system as he sat on a rock outcrop, surveying the stark beauty of the lifeless landscape.

"Almost, Father," Hassan replied politely. Mahmud glanced toward him and saw that his son was emptying the last bag of genemod grain onto the bare rock platform. The bioroid camels were already responding to the sight and to the attractor pheromones that Hassan had sprayed into the air moments before. They were ambling over to eat; soon, they could be tranquilized and herded back to the camp, where the family's robots had already finished repairing the damaged holding pens.

Hassan turned and stepped away from the scattered fodder, folding the bag to tuck it into his pack. Mahmud felt a surge of fatherly pride; Hassan was a handsome boy as well as reliable. His heavy build and thick pelt of mid-brown fur marked him as truly adapted to the family's new home. Mahmud shook his head, reflecting that Hassan's genetic modifications would make him illegal, even an abomination, in the family's old homeland. Did those conservative fools in the Caliphate not see that Allah had gifted men with intelligence for a reason?

"Hey!"

Mahmud looked up at Hassan's cry, in time to see his son diving hastily aside as one of the camels charged his back. He must have heard the creature coming at the last moment. It looked as though only the low Martian gravity had saved him from being knocked down and trampled; even an involuntary leap carried him meters aside.

Hassan rolled and scrambled to his feet, scrabbling for the tangler weapon at his belt as the camel lurched to a halt and turned. Mahmud jumped from his rock and ran toward him.

"Mahmud! Hassan!" It was Soraya on the radio. "I have analyzed those grain samples. They have been tampered with – some kind of psychoactive agent, I think."

Mahmud cursed himself silently as he ran. He was sure that his wife was correct, and now Hassan was in danger of suffering for his father's foolish feuds.

Transhuman Space: Bioroid Bazaar completed the conversion of the game-mechanical treatment of all the bioroid and parahuman types, and some of the more intelligent uplifted animals, from Third Edition ***Transhuman Space*** supplements to ***GURPS*** *Fourth Edition*. However, in creating that supplement, an additional need became clear: an in-depth treatment of the whole subject of biotechnology in Transhuman Space.

That's what you're reading now: a discussion of the history and social consequences of advanced biotech in Transhuman Space. Of course, ***Bio-Tech 2100*** is a supplement for a ***GURPS*** setting, so it also offers appropriate game mechanics where relevant, including game details for some radically nonhuman creatures produced by the biotechnology it describes.

Nomenclature

In this volume, the series of supplements that defines the game world are cited as ***Transhuman Space*** (in bold italics). The setting itself – the solar system in the year 2100 – is referred to as Transhuman Space, without boldface or italics. However, campaigns exploring that setting are ***Transhuman Space*** campaigns, because they are based on those supplements.

Publication History

The historical and social background discussions in this supplement, and some of the game-mechanical details, draw on multiple previous ***Transhuman Space*** books, but extend and adapt those ideas. A little of this material also derives from ideas in ***GURPS Bio-Tech,*** but substantially adapted for this specific use. Some of the new perks are borrowed from ***GURPS Power-Ups 2: Perks.***

About the Author

Phil Masters is the ***Transhuman Space*** Line Editor and the author of several previous supplements for the line, including ***Changing Times*** and ***Shell-Tech.*** He is British, has been a roleplaying game writer for over 30 years, and has worked with Steve Jackson Games for over 20 years, as well as writing for Hero Games, White Wolf, Posthuman Studios, Osprey Publishing, and others. His credits also include the ***Discworld Roleplaying Game,*** the new edition of which should be out real soon now. His website is at **philmasters.org.uk**.

His own biomods are strictly limited to a few repair jobs.

Chapter One

Bioengineering in the 21st Century

Numerous technologies have undergone impressive and radical advances in Transhuman Space, but the application of advanced biotechnology to sapient beings has had perhaps the most startling and often disturbing consequences. On the one hand, it may be making human beings *better,* in small but useful ways. On the other hand, by creating children who belong to whole different *species* from their parents, it may be bringing about the end of humanity – or at least its fragmentation. It has also created completely new sapient entities, which some humans see as partners but others treat as slaves.

Early Days

The craft of creating variant life forms is almost as old as agriculture, in the form of selective breeding. It was put on increasingly scientific footing by work such as that of Gregor Mendel in the 19th century, but the most crucial developments were probably the discovery of the structure of DNA in the 1950s, and later the development of sequencing using the polymerase chain reaction. Almost as important were developments in medicine, such as blood typing in the early part of the 20th century and transplant surgery in the latter part. Medical scientists now could see the human body as an assemblage of systems – hugely complex and subtle, to be sure, but susceptible to manipulation nonetheless. Living things, including human beings, might be *engineered.*

With the mapping of the human genome (and others) at the end of the 20th century, would-be genetic engineers had a sketch map of the territory in which they would be working. By then, they also had a developing toolkit for the actual manipulations they wanted to attempt. Their next task was to interpret that map and to prove that they could work on human subjects while doing more good than harm.

Genetics is all about inheritance, but inheritance is certainly not all about genetics.

– Steve Jones, ***In the Blood***

Genetic Screening

The first applications of the new knowledge were more passive than active. Even before the human genome had been fully mapped, scientists had identified some genetic features as being associated with specific medical problems. Often, these were points on the genome that were especially prone to damage or deleterious mutations. They could also be genes that were usually harmless, but which caused problems in particular combinations or circumstances, including "recessives" that were only expressed and caused trouble if two copies were present.

Once these vulnerable points in the genetic code were identified, the next step was to look for them before they could create difficulties – perhaps in infancy, perhaps even sooner, in the womb. (The tool set used for this may be considered one of the defining features of TL8 biotechnology.) If a potential problem was detected, it might be possible to apply preventative measures, or at least early treatment. Unfortunately, other applications of the knowledge were more controversial. Insurance companies would want to know if a possible client had any potential health issues, which could lead them to refuse coverage or charge higher prices. Likewise, if a problem was detected in the womb, the fetus might be aborted. Any policy involving abortion was controversial enough, and things became even more challenging if the genetic markers only indicated the *possibility* of a problem, rather than the certainty of a serious disease.

To make matters even more complicated still, genetic screening could look for other factors besides unambiguous problems. One large and obvious issue was sex; allowing parents to insist on boys or girls was highly controversial at best, especially insofar as might imply the termination of large numbers of unwanted (but perfectly viable) fetuses.

Some parents might even be interested in trivia such as hair or eye color – or issues such as sexuality, if they were convinced that this had a significant enough genetic component. For that matter, some "bad" genes could actually serve useful purposes in particular circumstances; for example, the recessive gene that causes sickle-cell anemia also grants a degree of resistance to malaria when only one instance is present. Screening out everything that shortsighted or fashion-driven parents happened to dislike could be quite dangerous for humanity in the longer term.

Hence, the early decades of the 21st century saw biotechnology both developing rapidly and becoming mired in controversy. At times, it seemed that development might be stopped dead by the social and legal issues. However, in an increasingly globalized world, campaigners for the status quo faced one overwhelming problem: Researchers, would-be genetic tinkerers, and their clients could always go elsewhere, to whichever jurisdiction limited them least.

Genetic Tweaks

Meanwhile, the tools and knowledge that allowed examination of genetic structures were being adapted and enhanced to also permit those structures to be *changed* – edited, in fact. Making alterations on a molecular scale requires great subtlety and precision, but the trick turned out to be entirely possible. And once the tools existed to manipulate the genes in a fertilized ovum, it became increasingly tempting to apply the knowledge of "good" and "bad" genes. The obvious first step was to identify any deleterious genes, edit them out, and replace them with something better – the method that became known as "genefixing." This could even be presented as a way around the problems caused by more passive screening technologies; it was no longer necessary to abort a fetus if any faults in its genes could be fixed instead. However, this was tampering with human life at the most basic level, so it was guaranteed to lead to arguments.

Actually, genefixing was *relatively* uncontroversial so long as the methods were used to eliminate life-threatening genetic diseases. The techniques rapidly became an issue if the dangers involved from the genes were subtle or remote (e.g., a 10% greater chance of contracting cancer late in life). The technology turned *seriously* problematic if the "dangers" were of "conditions" such as below-average height or male-pattern baldness. By 2050, most simple, unambiguous flaws were fully understood, and genefixing to correct them was widely regarded as the sort of thing that should be included in any comprehensive health plan, but lesser and subtler concerns would remain outstanding for decades to come. The matter isn't entirely resolved even in 2100. However, by then, humans who *weren't* genefixed suffered widespread prejudice, primarily in the form of higher health insurance premiums, but also in the widespread assumption that their families were eccentric or reactionary.

Nor were all the opponents of "genetic editing" cranky or anti-scientific. One big concern among knowledgeable scientists and doctors was that genes rarely code for specific features in the adult organism. What they do is code for *proteins,* or regulate the transcription of the ones that do code for proteins, controlling how much is produced, when, and where. The presence of a protein at the right or wrong time can have all sorts of consequences – some more obvious or easily predicted than others. Some genes could cause problems in one set of circumstances and benefits in others, depending entirely on what *other* genes were present, or even on the external environment. Overconfident tinkerers could easily cause all sorts of bizarre damage, then plead that they couldn't have predicted these results.

Hence, the early days of human genetic engineering involved the application of increasingly massive computer resources in attempts to reduce this uncertainty – and more than a few dangerous experiments by scientists who didn't want to wait, or who had wealthy clients who were in a hurry for their "perfect" children. The period from about 2015 to 2055 saw, in effect, a race between scientists trying to model everything that genes might do, and sponsors demanding faster results. It was a race that produced some casualties and disasters – some of whom are still alive in 2100.

Sapientogeny

"Sapientogeny" is a neologism occasionally encountered in 2100, a term created to describe the whole subject of artificial sapient biological creatures and, especially, the creation thereof. It is not really a science or a field of study, except in very broad terms. Rather, it is a label that can be applied to a range of subjects related by their relevance, including parts of several biological, medical, and psychological sciences. Sapientogeny also can be regarded as a new kind of engineering – a practical craft drawing on those sciences.

Sapientogeny is a broader but shallower topic than human genetic engineering ("HuGE"); the creatures and genes involved do not have to be human in origin. In ***GURPS*** terms, the word can be used for an Expert Skill; see p. 21.

Synthetic Transplant Organs

Medicine also tackled the subject of "making life" on a different level. All too often, generally healthy humans were still suffering or dying through the failure of individual organs, due to accident or disease. Organ transplants had been developed from the 1960s on, and had saved many lives, but there was a perpetual shortage of donors, and in any case, transplant recipients usually had to spend the rest of their lives on a regime of drugs to suppress their immune systems, which was in itself quite dangerous.

Hence, the idea of creating new artificial (but biological) organs was immensely appealing. One useful tool for this consisted of stem cells – "undifferentiated" cells that can develop into many types of tissue. Not only can these be used to create new tissue for the person from whom they are extracted, but by implanting new genes in them, they can also form the basis of new organs that can safely be implanted in other recipients. Unfortunately, in the very early days, one of the best sources for stem cells was aborted early stage embryos, which made early work in this field controversial. Even so, it proceeded anyway, and alternative sources were soon identified; in 2100, this work always uses "reprogrammed" adult cells.

The first safety tests with a transplanted lab-grown retina took place in 2014, and the creation of the first lab-grown human hearts for transplant in 2023 marked the maturity of the initial stage in this technology. By that point, almost every organ in the human body (apart from the brain!) could be replaced, and some biotechnologists quietly boasted that they could sometimes *improve* on the original organ, although long-term dangers remained uncertain and the risks of surgery were still not entirely trivial. The technology continued to evolve through the century, merging with the newer field of medical nanoengineering along the way; organs could be designed and built from the cellular level up (usually using the patient's skin cells, reprogrammed), and eventually the new designs could be made to integrate smoothly with the recipient's body.

. . . And they want to be useful, my little noses. Bio-artificing for the next century . . . None of that outmoded cutting up of old bodies –
– Terry Pratchett, ***The Fifth Elephant***

Improving the Human

"Genefixing" is usually portrayed as a *passive* process; the new fetus is checked for problems, and if any are found, they are corrected. Genetic problems are often referred to as "damage," but this is slightly misleading; some of them may have been present, if not expressed, in the parents' genomes for several generations. Still, ethicists and advertising standards bodies have managed to enforce the principle that the only effects deliberately "edited out" in a process sold as genefixing should be those that are more or less universally classed as problems. Likewise, synthetic transplant organs were originally designed to emulate the behavior of an optimally healthy organ as closely as possible, but no more.

As biotechnology advanced, though, the applications increasingly moved from *repairing* patients and preventing sickness by eliminating flaws to actually making humans *better.* The right combination of genes might produce offspring with potential near the limits of normal human capabilities. By throwing ever more computer power at the subject – especially once quantum computers were available for work on the complexities of genetic expression and on protein folding – scientists could suggest new gene sequences, never seen in nature, that could make offspring better still (for some personal definitions of "better"). Likewise, synthetic organs could be designed to improve on the products of evolution – inspiring the temptation to transplant them into *healthy* recipients.

This was all very well, but as with genefixing, the possibility of unintended consequences (maybe emerging years down the line) tormented thoughtful researchers. Treatments were even developed that could grant major benefits at the expense of needing regular medical attention – a price that some customers were prepared to pay, but which raised questions about long-term costs, possible failures of medical infrastructure, and restrictions on the patient's life choices. Needless to say, cynics assumed that medical companies would be delighted to provide treatments that guaranteed them repeat business, and sometimes they were right.

"Human genetic design" continued to advance in theory even when law or ethics restricted it in practice. Likewise, replacement organ design became increasingly sophisticated and generally safer. At worst, in 2100, enhanced organs merely degrade to the same level of performance as the normal version over a period of years without maintenance, and are very unlikely to fail catastrophically.

Disease Immunity

One area of research that has been a lot more successful by 2100 than pessimists feared is enhancements to the immune system. Biomods and genetic adjustments can make recipients more resistant to infectious agents than their ancestors, producing considerable improvements to general quality of life. But this is harder than many people realize, and these successes are a credit to *numerous* diligent medical scientists.

Unfortunately, a creature's immune system can be quite dangerous to the creature itself. There is a whole category of "autoimmune disorders" – such as pernicious anemia, lupus, and rheumatoid arthritis – which are just as bad as most infectious diseases. Bioengineers have become adept at sidestepping these problems and producing safe immunity boosts, but they can't afford to become complacent. Several horror stories from the early days of enhancement research served to set the standing of the field back quite badly (see, for example, *J7-S53,* ***Bioroid Bazaar,*** pp. 15-16), and supervising committees will quote them freely when faced with overenthusiastic researchers.

Upgraded Children

By the late 2040s, parents in some areas could pay to have their unborn children genetically *upgraded* – upgrading being defined as the inclusion of genetic sequences which were neither derived from the parents nor corrections to proven problems, but which were expected to produce advantageous effects. Mostly, these sequences came from other human genomes (which was sometimes described as giving the child three or more parents), but in a few cases, details of a sequence might be designed from scratch, with no known human precedent.

Still, "upgrades" are fully human and naturally interfertile with other humans, occasional odd genetic compatibility issues notwithstanding. However, they are not *guaranteed* to be superior; plenty of "natural" humans outperform the majority of upgrades in every respect. Unpredictable genetic synergies, upbringing, and sheer luck always count for a lot, whatever the clinics' advertisements might like to hint.

Even so, upgrading gave enough of an edge that it was bound to be politically controversial, especially as it was very expensive to begin with. It seemed that the wealthy had found a new way to extend their privileges to their children. This objection, mostly heard from political radicals, along with simpler conservative objections to "meddling," made life difficult for the first couple of generations of upgrades. Inherited wealth meant that few of them exactly grew up feeling downtrodden, but plenty of older upgrades still won't admit to their own genotype if they can help it. Additionally, a number of middle-aged individuals, often from very wealthy families, suffer from serious genetic problems caused by overambitious genetic adjustments. At one time, it was joked darkly that genetic diseases were becoming diseases of prosperity.

However, the controversy declined in the 2070s as upgrade treatments not only became quite reliable, but fell sharply in cost, putting them within the reach of more than the wealthy – just in time for it to be replaced by an issue that made concerns over upgrading look completely trivial.

The Parahuman Controversy

The creation of "parahumans" was almost an inevitable consequence of advances in practical genetics. Having moved on from simply eliminating problems to ensuring the presence of desirable traits, researchers dreamed of designing *completely* new genetic sequences which made the resulting offspring much "better" (that is, closer to someone's arbitrary objectives). The exact meaning of "parahuman" is occasionally disputed, but the usual working definition is a new human-derived being not naturally interfertile with normal unmodified humans. This usually implies the presence of completely new genetic sequences, or configurations which result in an automatic mismatch when such a couple tries to have children. This makes parahumans members of a different species from *Homo sapiens,* by most biologists' definitions.

Even so, borderline cases exist. Some genetic templates using unusual but not completely synthetic sequences merely make interfertility highly unlikely or lead to technically viable but disabled offspring. For that matter, a few unmodified human couples find that they have problems having children together due to some kind of genetic incompatibility. Definitions of "species" are debatable, too.

Hence, parahuman engineering made even people who were comfortable with genefixing and upgrading uneasy. The paranoid concern was that this would lead to the existence of multiple sapient species, who would then "inevitably" come into "Darwinian" conflict, leading to bloody wars until only one was left. A slightly less extreme but no less serious concern was that the most advanced and hence expensive parahuman templates would inevitably become the preserve of the rich, producing a "genetic elite" who would mostly confine themselves to other members of the same group for marriage and parenthood while regarding the mass of humanity – *correctly* – as a different, "lesser" species. Another, long-term concern was that making humanity into multiple species would make it more difficult for any of them to survive large-scale catastrophes; the survivors would have a much harder job restoring the human population without access to lost technologies.

This last concern is exacerbated by the fact that most advanced parahuman designs actually incorporate "Genetics Rights Management" features, making them entirely sterile without high-tech intervention. The tools to permit such a parahuman to reproduce are only legally accessible to whoever holds the copyright on the design. This gives parahuman engineering even more of an image problem among some political radicals who aren't necessarily too concerned by the theoretical threat to human survival; many templates are very explicitly the property of the intellectual property-monopolizing capitalist elite. Of course, parahuman designs created or pirated and modified in the Transpacific Socialist Alliance lack these features; general TSA policy is actually broadly favorable to parahuman engineering, proclaiming that nanosocialism will make it available to the downtrodden masses – which in turn gives political conservatives grounds for suspicion of the whole idea.

Throw in the older, simpler aversion to "meddling with human nature," and worries about parents imposing their prejudices on their unborn offspring, and it was inevitable that parahuman development work would often be prohibited or severely restricted. However, it proved impossible to stop. People – some of them *very* rich – wanted "the best" for their children, or wanted children as beautiful status symbols, and the black and gray labs were by now experts at evading legal restraints.

Some of the earliest development took place off Earth, or at least was aimed at the space market, as "normal" humans were obviously unfit for various environments which human factions wanted to settle. Hence, Mars-adapted and zero-gravity types appeared in the later 2050s.

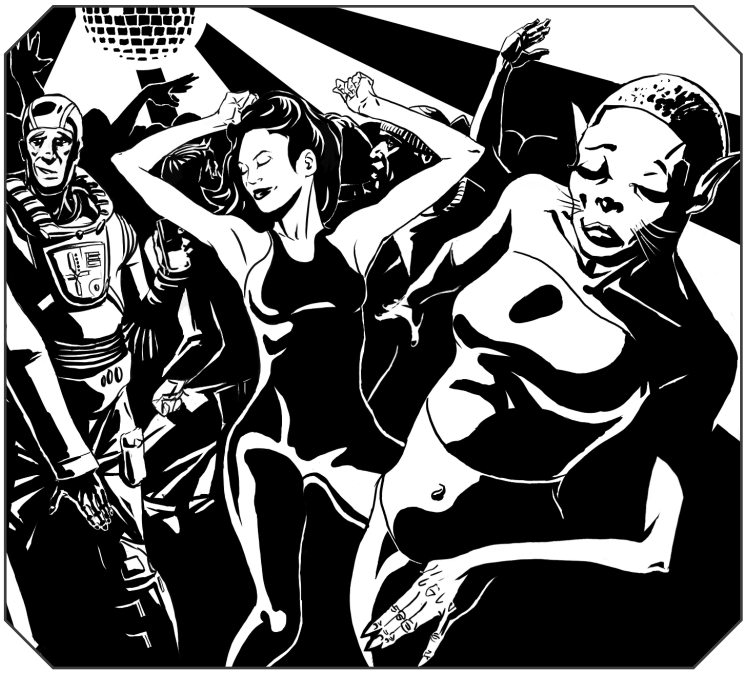
Nature, Nurture, and Unintended Consequences

The depiction of human genetic engineering in ***Transhuman Space*** tends to combine optimism with genetic determinism. That is to say, doctors in the setting have identified genes responsible for a wide range of problems and engineered them out without too many undesirable side effects. This is a *feature* of the setting, taken from "transhumanist" thinking and hopeful predictions about genetic research.

However, it's perfectly possible to play up the likely problems and limitations with all this. A GM seeking to take this approach might want to look at the notes on *Nature Versus Nurture*, *Unintended Disadvantages,* and *Linked Traits* in ***GURPS Bio-Tech,*** p. 40 and pp. 61-62.

On Earth, though, having one's children made parahuman looked too troublesome and controversial for most parents – who would want children who might not be able to have children of their own without medical intervention, when normal children with ordinary medical treatments could be about as healthy and capable? Brief fads for odd designs such as the Brownie (***Fifth Wave,*** pp. 115-116) and government-backed "econiche" projects like the Misha (***Fifth Wave,*** p. 115) actually did more harm than good for the idea, as however healthy Brownies were, and however well-suited Mishas were to cold conditions, they just looked *weird*.

This set of attitudes remained widespread on the home planet until 2075, when the Ziusudra "ideal" design gave parahuman technology the good publicity it needed. Despite careful triple-checking of the published gene sequences, no respectable expert could deny that Ziusudras would grow up a small but significant bit better than ordinary humans, on average. However many of the old doubts persisted, a substantial number of rich parents were prepared to pay for this design. Over the following years, many (though not all) remaining legal systems "bowed to the inevitable" and legalized the process, albeit usually with various controls and restrictions. In bioconservative regions such as Europe, it is still difficult or impossible to arrange for one's offspring to be parahuman, but the rules are more relaxed elsewhere. Wealthy "HuGE tourists" often are happy to pay for the services of clinics in those less restrictive nations.



Nonetheless, concerns about parahuman engineering are still widespread in 2100, although they are a lot less prevalent than they were a few decades earlier. People have simply become accustomed to the presence of parahumans in global society. While some of the worries about them forming a wealth-based elite are looking partly justified, enough wealthy people are sufficiently conservative to ensure that many rich children are still born *Homo sapiens*. (Those living in places like Europe who don't wish to go elsewhere for treatment have no choice.) Meanwhile, human-parahuman (and parahuman-*different* parahuman) romances are not only happening, but they are producing offspring – with assistance from genetic engineers, of course. Most of these children are the same species as the parahuman parent. However, a few are born human, and others use completely different genetic templates. Still, bioconservative opposition to human-germline modification remains a common political position.

People who think that way frequently make an exception for off-world development, though. Members of the public who see Brownies as weird and Ziusudras as sinister elitists are often prepared to regard Tennins and Red Bears as heroic – and safely distant – pioneers. Hence, parahuman engineering is often much less regulated off Earth than on, whatever the national jurisdiction.

Uplifting Animals

In the early decades of the 21st century, from the point of view of researchers who were interested in pure science, all the controversy around human genetic technology often made it seem far too much effort – especially when other areas of research avoided those problems. Admittedly, research using animals remained differently controversial throughout the century, and the sometimes-violent protesters became ever more uneasy the more radical the genetic work became. At least it was easier to get funding for animal work; those protesters had less clout with the politicians and institutions than the ones who were worried about "monster children." The animal-rights activists also were slightly less internationally mobile, which meant that researchers who were prepared to move from country to country in search of the most relaxed regulatory authorities could usually get away from them.

Hence, a whole branch of applied genetic research using complex nonhuman animals developed away from the spotlight of controversy which had focused on human-oriented work. A large subset of that group of researchers developed an interest in questions such as the nature of consciousness, or more practically, the creation of genetically modified animals better suited to complex tasks. Breakthroughs in the understanding of human brain function lead researchers to look at animal brains with an eye to working out what was *different* there – and genetic engineering was becoming powerful enough that the temptation to explore the topic by practical experiments began to look irresistible.

The first real innovation in the field of "animal uplifts" (a term borrowed from science fiction) came in the 2030s. Biotech Euphrates, a genetic-engineering company which had pioneered the art of avoiding regulation through international mobility, had made a large fortune by selling genetically engineered crops to the developing world, and the corporate owners were now looking for places to invest it.

Pushing legal and ethical limits had made the company a lot of money, so the controversial nature of uplift work actually made it *more* tempting for them. In 2033, they produced their first more-or-less sapient dog.

It was an early design, of course, with its full share of problems. The company never made more than modest profits from customers who wanted smarter pets, more versatile guard or search animals, or intimidating but fully trainable (and more disposable) troops. Still, that first "super-dog" is universally acknowledged in 2100 to be the direct predecessor of the modern K-10A.

Uplift engineering then slowed down, though the work never stopped entirely. Biotech Euphrates wasn't making much money from dogs, and better computer modeling made physical experiments in brain design look expensive and clumsy. Additionally, other species offered fewer possibilities. Dogs are trainable and already quite smart; have breeding generations short enough to allow projects to achieve useful results in just a few years; and were already familiar in biotech laboratories. Other animals looked to be a lot more work for less profit. By the 2040s, various companies were working hard on dolphins, partly because they were naturally smart creatures with big brains, but mostly because the U.S. Navy and some of its counterparts elsewhere offered generous research budgets (and ways around annoying ethics boards) for the creation of aquatic soldiers. Even so, reliable dolphin uplift methods were only developed in the late 2050s. For the most part, animal uplifts are the product of the last couple of decades of the 21st century, when the costs of genetic engineering fell to the point that the creation of worker animals for quite specialized markets finally looked economically viable.

Mental Symbionts

Genetic uplift is still a young technology with serious limits, even in the runaway-science world of 2100. One of the most severe is that giving a modified version of a nonsapient species a larger, more powerful, *functional* brain is *hard*. Even where designers seem to succeed, regression or other forms of instability may emerge as the uplifted creatures mature, or metabolic stresses or neurological problems with the brain's connections to the body can be catastrophic. Some designers mutter that rules preventing them from using human genetic sequences don't help, but actually, that's a small issue; it wouldn't be possible simply to give a dog or an octopus a human brain, after all.

Hence, some projects go for a quick workaround. By installing implant computers with specialist AIs in young animals, and training the creature and AI to work together, they aim to increase the creature's useful abilities by handing off a proportion of mental processes to software. War-dops (***Under Pressure,*** p. 102) and rat kings (***Deep Beyond,*** p. 114) demonstrate two versions of this approach.

However, AIs have problems and limitations of their own. Computers can't simply integrate with organic brains; they work in completely different ways. Hence, they have to *interface* – which is a complex problem and not something that can be part of a quick workaround. Humans mostly interface with implant computers using language, but animals don't have human-level language centers in their brains. Less competent designers rely too much on pleasure and discomfort as response induction mechanisms, which rarely leaves the adult animal psychologically stable; a better solution seems to be to install subtle connections to the creature's sensorium and then take years to train the creature and its enhancement software to understand each other.

That in turn runs into other problems, though. Artificial intelligences built on standard architectures are mostly designed to understand *human* thought processes; they can suffer a sort of mental stress through extended attempts to deal with a nonhuman mind. Conversely, an AI that does become used to working with a boosted creature may adopt some of its priorities and cognitive modes, so that the gestalt becomes, at best, a fairly smart animal with a Web connection, rather than a sapient being. Likewise, attempts to program AIs to serve as emotionally detached "super-egos" can produce deeply confused beings which act like unthinking animals with digital observers inside their heads.

Research is ongoing, but this is *not* a mature technology in Transhuman Space. Mental symbiont characters should always be treated as unpredictable. If they are PCs, an unusually high level of mental disadvantages may be *required,* and many of those disadvantages should be the sort that other players will dislike.

Bioroid Technology

The creation of bioroids – artificial biological beings, at least potentially capable of full sapience – was partly an accident, arising mostly from advances in artificial organ production. Essentially, as biotechnology advanced, medical scientists determined that they could produce working facsimiles of every organ in the body, as well as "wet nanotech" systems which could replicate many metabolic functions. Further, medical scientists had gained considerable experience in combining multiple synthetic organs, originally in order to perform repairs on the victims of especially severe accidents.

That mostly just left the brain, as artificial brains obviously weren't needed for transplants – but academics had worked on constructing organic brains from scratch, for purposes such as abortive "biocomputer" projects and as test beds for neural interface systems and other fields of research.

Researchers then proved that they could "program" them with "direct neural education" technologies, which worked far better with constructed brains than they ever could with naturally grown organs, because the former had well-documented, regular structures that could be designed from the start to receive these inputs.

The idea of putting all of this together to build a complete "artificial person" was bound to occur to someone. Although ethical considerations deterred many researchers, biotechnology was hotly fashionable in the 2050s and 2060s, with a lot of money pouring in and backers looking for new sources of profit. Hence, the first bioroid animals were created in several different labs in 2064, followed by the first humanoids in 2067. Again, much of the development was done in space, avoiding a lot of inconvenient regulation.

Actually, Biotech Euphrates researchers largely conducted this work, despite the fact that the company saw little profit in that direction and still in 2100 regards genetic engineering as its most important line of business by far. It says much about both Biotech Euphrates and bioroid development work that the latter happened essentially as a *side effect* of the former's research program.

Many people saw these creations as faintly distasteful curiosities with no real function – after all, it wasn't as if the world was short of *real* humans, or cybershells to do the jobs that humans couldn't – but others saw interesting possibilities in the idea. "Bioroids" (the term was coined in a series of early academic papers, and avoided being trademarked because too many companies tried to lay claim to it) were usually described as "organic robots" rather than as synthetic life forms, but with some of the same advantages as "true living things." They were self-repairing, could run on the same "fuel" as humans, and looked human enough that human workers were sometimes easier to convince of their "friendliness" than was the case with mechanical robots. (Bioshell robots, which were developed in parallel with organic-brained bioroids, ultimately turned out to be a harder sell; see *The Bioshell Memetic Problem*, pp. 14-15.) Their human appearance also made them suitable for use in the sex industry – something that was not mentioned much in early promotional campaigns.

Hence, although uptake of bioroid technology was quicker in some areas than others, and large pockets of strong antipathy or ethical doubt never disappeared, bioroids were in use in many parts of the globe by 2080. They were also quickly adopted by parts of the burgeoning space development industry, as they avoided some of the medical problems to which human workers were subject while standing in usefully for humans in applications where cybershells still didn't perform quite well enough.

Campaigns and Scandals

The expansion of the bioroid industry was fast and poorly controlled, despite numerous ethical debates. Ensuing problems were inevitable, and surprised few observers. The most important single incident was the Clarke-1 scandal, as described in ***High Frontier,*** pp. 89-90.

In brief, Clarke-1 is an orbital factory, constructed by the German company Spitzbergen Vakuumfabrik in 2067. In 2073, the company commissioned a vacuum-adapted bioroid design to work there, despite which, the company subsequently hit serious business problems. In 2080, it was discovered to be exploiting and maltreating its bioroid staff, and the reports and images produced by investigators shocked Europe.

This led directly to the prohibition of the bioroid industry throughout the E.U., which has persisted to 2100. Europeans have come to think of bioroid production as modern slavery, and they often believe that their laws make them morally superior to other nations. Bioroids in Europe are treated as free sapient beings and are much more widely pitied than despised; they usually are assumed to be remnants of the "bad old days" or refugees from "slave-owning" regions. Nonetheless, a nontrivial fraction of the E.U. population retains older, more hostile attitudes, sometimes with a preservationist tinge, sometimes just human-chauvinistic. (This may rate as the Intolerance disadvantage or just as a quirk.) Conversely, non-Europeans are often still accustomed to regarding bioroids as "robots made of meat," and see the European attitude as sentimental and delusional.

In fact, European attitudes sometimes clash with practical realities. Some bioroids feel badly condescended to in the E.U., while others, arriving there after being created for service elsewhere, find the adjustment to freedom impossibly hard. Additionally, occasional problems arise with bioroids who would like to create more of their own kind as companions or "children," which is illegal under E.U. law. If anything, though, the problem is worse in the South African Coalition, where radical philosophies which treat bioroids as fully equal sometimes rub directly up against Third Wave cultures which don't know what to make of them at all.

. . . we are endowed, with the same Faculties, with our Masters, and there is nothing, that leads us to a Belief, or Suspicion, that we are any more obliged to serve them, than they us . . .

– Petition of 1779 by slaves of Fairfield County, Connecticut

Chapter Two

Nonhuman Biosapients in 2100

The tangled history of biotechnology in the 21st century has left Transhuman Space with an equally tangled set of attitudes, laws, and ethical codes. Humanity has had plenty of opportunity to get used to most of these developments, but that doesn't mean that everything is accepted everywhere, or that rules and customs have fully adapted yet.

Attitudes

Tinkering with the basics of life provokes a lot of taboos and instinctive responses, challenging people's basic sense of identity. It also interacts with countless established customs and beliefs. Religious leaders, politicians, and lawyers are still struggling with the implications, and sometimes, people resort to simple responses which have unexpected ramifications. Even when two people both declare themselves "in favor of" or "hostile to" a particular implementation of biotechnology, their motives and logic may be completely different.

> *Everybody's always in favor of saving Hitler's brain. But when you put it in the body of a great white shark – uuuh, suddenly you've gone too far!*
>
> *– Professor Hubert Farnsworth, in* ***Futurama*** *#2.15*

Views of Bioroids and Bioshells

For example, some people oppose the creation of bioroids because bioroids are created as "slaves" and they regard slavery as wrong; others because it is "meddling in God's domain"; still others because bioroids might one day decide to revolt and wipe out humanity; and others again because bioroids may take paying work away from impoverished humans. Some people realize that *legalized* bioroid creation will undermine their own profitable *illegal* operations, but they mask attempts to stop it with other justifications. Conversely, different people may campaign for bioroid construction to be permitted because bioroids will save humans from having to perform dull or dangerous work, because they think that maximum diversity of intelligent life is a good thing in itself, or because existing bioroids should have a fundamental right to have "children" of their own.

Furthermore, although *players* may see bioroids as sapient beings very similar to humans – after all, they might play them as PCs! – that opinion is *not* universal in the setting, even among humans who know bioroids. The fact is, bioroids *were* conceived and designed as "biological robots," and although their brains, being modeled on the human (or at least mammalian) pattern, tend to work in a somewhat human way, anyone who has extended dealings with *typical* bioroids will tend to get the feeling that they have shallow, sketchy personalities, all run off the same production line. Exceptions exist (including, no doubt, the majority of bioroid PCs), and some of these make forceful and convincing speakers for the cause of bioroid rights, but opponents of that cause can be sincere in their doubts.

The existence of so many combat-model bioroids muddies the waters further, especially as repressive governments often employ them. Too many people see bioroids not only as robots, but also as *killer* robots, or have more personal, visceral reasons to fear or hate them. Such people may have had friends or family slain by bioroid soldiers, or have faced bioroids in combat, and although bioroids in general are capable of displaying restraint and even compassion, it's very easy for their makers to educate them to kill without mercy or compunction.

All of this helps explain why official positions on bioroid rights are so often confused, overcomplicated, or plain strange.

The "Reference Society"

Any ***GURPS*** campaign must have what ***GURPS Social Engineering*** calls a "reference society." This is the society within which the characters live, or where they conduct most of their social interactions; hence, it determines what Social Stigmas and forms of Status are appropriate for PCs, sets the baseline tech level, and so on. This is very important in ***Transhuman Space*** games, where neighboring societies may treat the same person very differently. For example, a media team based in the E.U. might include a youthful bioroid (with an interesting backstory) with Social Stigma (Minor), and a full citizen SAI with no social disadvantages and high personal wealth. But if the team travels to, say, the United States, the bioroid might find itself treated as having Social Stigma (Minority Group), while the SAI could be classed as Valuable Property. Furthermore, if the SAI develops a taste for occupying rented bioshells while abroad, it will need to keep the fact quiet when it gets home to avoid acquiring a negative Reputation. There are often workarounds for such things – the bioroid might be assigned a nominal "supervisor" from within the team for the duration of the visit, while the SAI might be registered as the property of an E.U.-based company (whose sole shareholder is the SAI), but it is still a significant aspect of the setting.

The reference-society concept usually works well, but it can hit problems with full-on globetrotting campaigns, in which PC groups regularly travel between areas with very different attitudes and perhaps include citizens of several different societies. The GM and players may find a way to agree on appropriate social traits for protagonists based on how they can usually expect to be treated in practice, but in some cases, it may even be necessary to take multiple traits, each with a limitation "Only when in (Area X)," with a value determined by what proportion of their time the group expects to operate in that area.

Regional Variations

Attitudes aren't even automatically consistent within national populations, and can change over time. For example, in China as on much of Earth, bioroids are treated as social inferiors, lacking full civil rights; as bioroid manufacture is not heavily restricted, they are seen as mass-produced "drone workers," giving them Social Stigma (Minority Group) in ***GURPS*** terms. However, in the Chinese colony on Mars, bioroid workers are seen as an essential part of the effort to render the planet habitable, and are generally treated with respect. This is encouraged by the Martian Chinese government, which wants a harmonious workforce and knows that they can't operate without a lot of contented bioroids; government sources refer to them as *zhongdian renkou,* the "special population." Bioroids still suffer enough restrictions and occasional prejudice to justify Social Stigma (Second-Class Citizen), but no worse.

A similar situation is developing in Japan, where an aging-but-technophile human population has come to see bioroids as immensely *useful,* respectful, efficient "helper-workers," worthy of a certain amount of paternalistic affection. SAIs have already moved from Minority Group to Second-Class Citizen status in that country, and bioroids will surely follow soon.

Elsewhere, policies are driven by philosophy or theology, heavily modified by circumstances. Notably, in the Islamic Caliphate, the creation of bioroids is now permitted, after originally being prohibited as a blasphemous imitation of the work of God. However, the ruling that allowed this specified that bioroids had to serve in menial, inferior roles. Also, most are specifically designed *not* to appear human (see the Busr, ***Broken Dreams,*** p. 121), to avoid the taint of blasphemy; exceptions such as the Houri (***Broken Dreams,*** p. 122) have severe problems, and human-seeming bioroids entering the Caliphate from outside are likely to find themselves hunted. While bioroids in the alliance are nominally given some rights and receive a little respect from more liberal, sophisticated citizens, they rate as having Social Stigma (Subjugated) in ***GURPS*** terms. But even here, attitudes vary by location; sophisticated city-dwellers tend to be more relaxed about bioroid technology than devout backwoodsmen.

Legal Complications

The law tends to follow public opinion on biotechnological matters in most places – after all, it's made by politicians who know the benefits of keeping the population happy – but it has to be *slightly* more logical, and sometimes, hard lobbying by corporations or even scientists can modify things. There are also places where the people in charge don't have to care about popular opinion. And, sometimes, the details of the law are complicated by accidents of wording or eccentric precedents.

Hence, for example, the South African Coalition is dominated by the Fifth Wave power of South Africa. Its successful biotechnology corporations in turn heavily influence this country, and its citizens pride themselves on a nigh-transhumanist social philosophy and a contempt for prejudice. As a result, bioroids are granted full citizenship throughout the Coalition, which has one of the most liberal policies on this subject in the world. However, in some member states, public attitudes are a lot less liberal than the laws; bioroids may be seen as weird and as threats to the jobs held by poor human citizens, while local religious beliefs may be hostile. Worse, bioroid soldiers have been employed in wars in the region and have been used to commit their share of atrocities, while unsophisticated locals may confuse bioroids and bioshells, especially "necromorph" bioshells made from human corpses (see p. 14), which are a frequent subject of outrage. Hence, citizen bioroids may run into people who regard them with Intolerance, and in some places, a Social Stigma could represent their functional standing.

Conversely, bioroids suffer from routine if mild legal restrictions in India. This country mostly follows more negative international ideas on the subject, with an extra twist of hostility from the large local Muslim population, which tends to see bioroid construction as blasphemous.

However, popular attitudes are *heavily* influenced by the highly active, fashion-prone Indian InVid industry. All it seems to take is a few productions with "romantic outsider" bioroid protagonists, or heroes battling against the evil of bioroid slavery, and a large proportion of the population will treat any bioroids they meet (which admittedly is few outside of the big, wealthy cities) with much more sympathy. These are notoriously transient memes, but fashions have turned that way often enough that a definite undercurrent of mild pro-bioroid feeling runs through the population at large. Unfortunately, this sometimes serves as a badge of distinctiveness for anti-Muslim elements, which in turn means that government memeticists, tasked with maintaining social stability, rarely encourage pro-bioroid feeling.

Why Buy Bioroids?

All these complications may make someone wonder why anyone would purchase or commission a bioroid, even in an area where this is legal and socially acceptable. After all, bioroids are usually quite expensive; require food, air, and attention; and occasionally rebel or run away. A cheap cybershell is often more robust and nearly as versatile (especially if it has an LAI installed), and few people will object if you scrap it at the end of its useful life. Even if someone develops a sentimental attachment to the controlling AI, the owner can always transfer that to a newer shell.

There are actually several reasons why the bioroid industry survives. Despite their sometimes complicated social situation, bioroids are often more acceptable in human society than AIs; many people prefer to deal with a smiling organic face than a metal box. The sex bioroid industry takes this principle to an extreme – although VR and slinky sex can be impressively realistic, many customers still insist that it's "not the same." Bioroid servants and bodyguards have become status symbols in some circles, being associated with rich, high-status (and often ruthless) employers.

The Genetic Regulatory Agency

The Genetic Regulatory Agency (GRA) was founded in 2056 as an office of the European Union, although Switzerland also worked with it from the outset – indeed, its first headquarters was in Geneva. Its original mission was to police abuses of human genetic engineering (HuGE). This required agreement as to what *was* abuse, and harmonization of national laws; the creation of the GRA represented a major accomplishment in both idealism and politics.

It might have remained just another E.U. office, but the preservationist movement of the period produced a lot of idealists and a few fanatics within the regulatory community. Some countries saw the new agency as a good place to divert those people's energies, while others wanted a strong GRA to counterbalance other factions. By the early 2060s, Ukraine was persuaded to join, mostly – as with Switzerland – to show good will. However, the GRA was still primarily seen as an information clearinghouse.

Then, in the wake of its Civil War, Russia found itself struggling to suppress a hyperactive "biotech underground" and to shed a reputation for lawlessness; signing up with the GRA looked like good politics. However, the Russian government didn't want to seem to be surrendering *too* much authority, so part of the deal required that the GRA's operational offices move eastward, to the neutral city of Kaliningrad, in 2067.

This expansion changed the personality of the agency. Its new Russian agents were keen to see *action*, not just to file reports, and many of the older preservationist E.U. staff were happy to go along. The GRA managed to acquire comprehensive powers within signatory states, and an efficient intelligence section to monitor biotech globally. Rumors began to spread that this section's agents weren't above a bit of extraterritorial, extralegal sabotage. This has always been denied, but GRA "spies" certainly sometimes stretch legal limits or abuse diplomatic status.

Over time, the GRA's effectiveness in dealing with problems within its ambit was globally acknowledged. Some preservationists came to idolize it, while authorities in other power blocs became happy to consult its experts. After all, it was known to be rigorous about not favoring any one nation's interests. A series of diplomatic agreements gave agents "visiting rights" far beyond Europe, although they usually are accompanied by a local liaison, who may be more or less assertive. (A century previous, this sort of thing would have been handled through the United Nations, and would have been explicitly international in its administration, but with the decline of the U.N., everyone has had to improvise much more.)

The GRA's international role might have remained purely advisory, but a series of biotech accidents and artificial-disease outbreaks in less advanced areas panicked several nations into giving GRA agents free rein. Biotech crimes can be truly horrible occurrences, and anyone offering a solution – and *trying* not to overreach themselves – could find welcome in many places. Not everywhere, of course – the GRA can't walk into Kazakhstan or the TSA – but widely enough that some people forget that this is a European body, with a European cultural bias.

The agency also has become involved in policing international bioroid crime, which often involves the same criminal groups as illegal HuGE. This sort of thing, and the need to expand its operations into space (see ***High Frontier,*** p. 25) and the oceans, leaves the GRA stretched, administratively and financially. The desire to preserve a polite image, to make it easier to acquire funding and diplomatic privileges, often conflicts with agents' fiercely preservationist attitudes. The GRA is frequently accused of bullying its way around Third Wave countries; certainly, agents may care more about biotech safety standards than they do about local sensibilities.

GRA agents are something of an elite, and they know it. See ***Transhuman Mysteries,*** pp. 10-11, for a character template.

Perhaps more importantly, bioroids are easier to keep going in remote locations with poor resources; organic flesh is essentially self-repairing for moderate levels of damage, a trick that has still not been managed with inorganic smart matter. Bioroids can also operate on the same supplies as human operatives, so employers don't have to set up separate fuel supply chains. Indeed, bioroid troops, explorers, and wilderness staff can live off the land in a way that few cybershells can match.

In any case, while cybershells may match bioroids for versatility and adaptability, as well as beating them for robustness and short-term endurance, the machines have only recently become that good. There's a large bioroid legacy industry, with investments in production and infrastructure. Competition may be driving bioroid manufacture profits down, but it's rare for any industry to vanish overnight – especially one that still claims to offer superior benefits in specific cases.

The Bioshell Memetic Problem

While bioroids are merely controversial, for the most part, *bioshells* – bioroids or surgically modified organisms with their brains replaced by computer hardware – are actively, violently *hated and feared* in some places. This hostility is enshrined in law in Europe and India, and may show up among individuals (as some kind of Intolerance, in ***GURPS*** terms) elsewhere, especially in more conservative communities. Only transhumanist or otherwise marginal cultures tend to regard bioshells casually, and some of them only do so because they regard *all* bodies as disposable tools.

This response puzzles and irritates some people, especially those infomorphs who see bioshells as, potentially, a useful cybershell choice and who suffer deep suspicion for so much as campaigning for a change in attitudes. The reason for the prejudice is summed up in the term "techno-zombies." A bioshell *looks* like a living thing, often a human being, but is essentially a machine. Some humans see this as somehow fraudulent; the AIs involved are suspected of "pretending to be people," infiltrating human society to replace or subvert humanity. Rare cases where rogue AIs did exactly that don't help, and emergent intelligences that somehow get into bioshells are more or less automatically assumed to be *very* sinister. Even human-teleoperated bioshells are widely suspected of being commonly used for fraud or identity theft. Bioshells challenge basic human assumptions about personal identity too much!

To add to the problem, in a few places, ruthless factions create *necromorph* bioshells (***Transhuman Space,*** p. 126) from kidnap victims, convicts, or prisoners of war. Replacing a human being with an edited shadow or a well-trained AI and using that to subvert or destroy an opposing group is effective but macabre – and it appears often enough in popular fiction and conflict reporting to reinforce the anti-bioshell meme among people who are already susceptible to it.

All this mostly applies to humanoid bioshells. Animal and radically strange bioshells suffer far less prejudice; few people feel threatened by, say, an NAI operating a cyborg tuna to conduct ecological research. However, nonhumanoid bioshells aren't entirely immune to suspicion, and they are often caught by broad-brush laws.

Legality Class

In ***GURPS*** terms, virtually all significant biotechnology, especially anything involving biosapient design or human-embryo modification, is at least LC4 and often LC3, especially where it produces sapient individuals who require special or unusual environments to live comfortably, or who have really *strange* physical forms. These technologies are widely available but are open to abuse, and accidents can be catastrophic, so most societies impose licensing systems or mandatory professional codes. The GM can also throw in odd regulations, perhaps left over from earlier periods when the technologies were untested or controversial.

Some technologies and biosapient templates are more strictly controlled. Anything rated as LC2 can only be produced by licensed, regulated organizations in most societies. Bioroids of these types are probably manufactured for specific paramilitary or police roles, while parahuman designs with this rating are controversial. Individuals known to embody such technologies may be viewed with caution or prejudice.

LC1 types are specifically military, or at least dangerous. Anyone working on them is subject to the same sort of restrictions as a heavy weapons manufacturer. Beings of these types may well have severe Social Stigmas, and they can't expect to live normal lives in civilian society if they are recognized.

Those rated LC0 are viewed as abominations or menaces. If they can be legally created at all, it usually will be for specific, probably military purposes, and even that will be controversial. Often, though, such bioroids and parahumans are seen as *victims,* the products of abusive criminal activity. They thus may be treated with pity – unless their abilities make them dangerous, or they are in some way repulsive.

Also, some societies in Transhuman Space have higher effective Control Ratings with regard to specific elements of biotechnology, or treat certain things as having lower Legality Class. (The effects are much the same either way.) For example, the European Union has effectively declared all sapient bioroid manufacture as LC1 within its jurisdiction – not because it is seen as military, but because it is classed as akin to slavery. The only work being done in that area is in tightly regulated research institutions, and even they are unlikely to produce many sapient bioroids. However, bioroids themselves are mostly regarded with sympathy rather than dislike. In the Caliphate, conversely, human-seeming bioroids would officially be classed as LC0, though in practice some are held on private property without too much trouble, so LC2 might be more accurate; "nonhumanoid" bioroids such as the Busr (***Broken Dreams,*** p. 121) are definitely LC2.

Formal and informal restrictions on human-like bioshells are likely to remain widespread for the foreseeable future. The E.U. and some other societies make an exception for ghosts running clones of their former organic bodies, because there's less sense of deception there, and many people can understand why a ghost would want their old body (or rather a good facsimile) back. Smart cynics note a peculiar consequence of this loophole – cosmetic body alteration, up to and including gender change, is rather easy given Fifth Wave medical technology and can be conveniently applied to a bioshell during manufacture. Numerous European ghosts have come out of the clinic in a bioshell with a different sex, build, and apparent ethnicity to their old body, but carrying an unimpeachable digital certificate saying that this is perfectly legal, because they still have most of the same DNA in their cells.

That sort of thing may *eventually* lead to more flexible attitudes to the whole bioshell issue, even in morphologically conservative regions. However, for now, PCs who want to use humanoid bioshells should note that they risk breaking social taboos as well as laws, especially if they travel to the wrong places.

"And that," put in the Director sententiously, "that is the secret of happiness and virtue – liking what you've got to do. All conditioning aims at that: making people like their unescapable social destiny."

– Aldous Huxley, ***Brave New World***

Bioroids in Society

Despite established public hostility, reinforced by memetic campaigns launched by the bioroid industry, bioroids have attained full civil rights in some jurisdictions, notably the European Union and the South African Coalition. However, citizenship for bioroids cannot work exactly as it does for humans and parahumans.

The obvious difference is that bioroids are made, not born, and emerge from the production process with seemingly adult bodies and full language skills. However, as opponents of bioroid equality are quick to put out, this doesn't mean that they are truly functional "adults." Newly decanted bioroids can walk, talk, follow instructions, and use tools and weapons, but they often seem terribly naïve and shallow. They are also gullible and manipulable; standard bioroid personality designs allow for further education once they are deployed, but this means that bioroids tend to believe anything they are told, sometimes becoming downright fanatical about it. Designers generally try to give bioroids a sense of humor – it makes humans happier to work with them – but this is rarely subtle or sophisticated.

All of which makes many people describe bioroids as "childlike." This is a bit of a simplification, but it is not far from the truth. A new bioroid can seem much like a very bright child – not an infant (they know too much for that), but perhaps a 10-year-old. However, unlike children, few bioroids are prone to wild mood swings, and they certainly don't tend to throw tantrums. On the contrary, they are often rather unemotional and dispassionate. They *do* learn quickly – about emotions and social skills as well as practical matters – if they are permitted and encouraged, but not all of them receive that encouragement.

Hence, even where bioroids are allowed full citizenship, they tend to be treated initially as minors, requiring legal guardians and having to pursue a mandatory program of education. Further complications arise if a young bioroid is a refugee from an area where they *don't* have citizenship (as is frequently the case in the E.U., where bioroid manufacture has basically been prohibited for several years). New arrivals are assessed for their ability to function as full members of society, and are almost always classed as minors or otherwise unprepared for full independence and thus assigned a guardian for a period determined by a court. The bioroids themselves don't always appreciate this, and other bioroids and sapient-rights activists often consider that some individuals – or all bioroids – are being treated horribly condescendingly by the legal system. However, given that many new arrivals are genuinely unable to function as free citizens and may have weird or even dangerous features in their prior psychological conditioning – possibly buried deep – there really doesn't seem to be much alternative, and few voters or politicians want the system to change.

It's important to note that "minor" status for a "proto-citizen" bioroid is never quite akin to the legal status of a human child. Bioroids are "adult" in too many ways; in particular, they are often constructed with a full set of sexual capabilities and inclinations. The general belief among people who have studied bioroid psychology is that prohibiting them from expressing this would tend to damage them psychologically. Hence, they are permitted a lot of "adult" behaviors, mostly under careful but "hands off" supervision. Most are monitored by one or several specialist psychologists with quasi-guardian status, and almost all have specialist AIs in their implants, which are mostly quiet when the bioroid is "off duty" but which can jump in with strong advice or even commands at any time. (These tend to be LAIs, as NAIs are insufficiently empathetic or flexible, and SAIs are too expensive and might develop idiosyncratic ideas about the task.) Unfortunately, this in turn all too easily makes bioroids dependent on their AIs. At best, this can develop into a kind of genuine friendship, but at worst, the bioroid may become passive and acquiescent, while the AI runs not only their work but also their private life. The development of bioroid-supervisor AIs has become a specialist industry in itself.

A "proto-citizen" bioroid may be granted full citizenship automatically at a particular date (which runs the risk of turning an insufficiently prepared personality loose without supervision), or may only receive full rights after convincing a panel or tribunal of their competence (which runs the risk of looking oppressive and patronizing). E.U. law, for example, grants full citizenship automatically after six years of supervised independent life in E.U. society "or a comparable social context." Bioroids can petition for it to be granted sooner, if they can persuade at least three psychologists to support them, which happens in perhaps 5-10% of cases.

On rare occasions, supervisory psychologists can apply to a court for the grant to be deferred due to "exceptional incompetence"; such court hearings are invariably emotive and controversial, unless the bioroid is blatantly badly psychologically damaged.

In the SAC, on the other hand, the law varies from nation to nation, leading inevitably to cross-border legal complications. Some member nations regard others as treating young bioroids as virtual slaves, and many arguments arise about appropriate ages of "majority." There are even a few minor "underground railroad" arrangements within the Coalition, shipping young bioroids to places where they can attain citizenship more easily. Of course, these are nothing like as significant as those between "citizen bioroid" and "noncitizen" jurisdictions.

The Outer System

Biotechnological development has a curious decades-long relationship with space industrialization. This is partly because of space-oriented biotech; the legendary "calcium hack" that facilitated the colonization of Ceres was one of the first examples of this, and the Void Flyer and related programs (***Deep Beyond,*** p. 116) are currently the most dramatic case in point, unless that title is granted to Avatar Klusterkorp's development of the Europan bioroid (***Deep Beyond,*** p. 112).

However, another important element is the fact that outer-system facilities are safely out of the view of most of the human public and of all but the most diligent of regulators. Research in such locations is "safe" in that it's highly unlikely to get out and cause trouble beyond the facility. It also frequently takes place under whichever nominal national jurisdiction has the fewest rules or applies them with the least effectiveness. Even respectable corporations such as Biotech Euphrates (whose image has changed considerably over the decades since their early, corner-cutting days) run research stations in deep space. Their work may be termed "groundbreaking," "radical," or "horrific," and often all three – but only if anyone who cares finds out.

But stories and pictures do get back to Earth, despite the best efforts of corporate security. Many governments are especially keen to publicize the more extreme activities of the "Trojan Mafia," whose biotech operations often seem almost *designed* to shock. Hence, space beyond Mars is widely viewed among planet-dwellers as rife with ruthless mad science and oppression of new sapients.

That said, not *every* biotech lab in deep space is an amoral hell of exploitation and neglected rules. Aside from the fact that certain Earth governments are keen to carry (their) law out to the frontier – a project currently spearheaded by Britain's Royal Navy – *some* researchers retain recognizable ethical codes, and much of the work done in the outer system is immaculately high-minded medical research on space-oriented topics such as radiation protection.

For the record, incidentally, Biotech Euphrates has nothing to do with the Red Duncanites, although the Greens are clients of theirs, and they were the first to license the famous Tennin space-dweller gene sequences from the Greens. The company cultivates that respectable image these days, and finds that while this can survive dealings with Green Duncanites, the Reds have too much of a dubious image.

The Deep New Frontier

In 2100, undersea societies and research centers are often hotbeds of "biosapient posthumanism." Nonhuman sapients can be well-fitted for underwater life – *much* better than unmodified humans – and this environment can support biological life without bioengineers having to get *too* radical. (Space, by contrast, really isn't a very suitable place for biological entities, which, in 2100, simply cannot be designed to live there for very long without mechanical support.) Some aquatic bioroids, like aquatic parahumans, are designed on the basic human pattern, so that they can also operate in environments suited to nonaquatic humans. (It's widely assumed that they are also intended to propagate a relatively conventional version of human culture in this new setting.) Others, such as the Gillmorph (***Under Pressure,*** p. 94), are radically nonhumanoid, being optimized for aquatic operations; most of these are generally regarded as tools rather than as potential citizens.

However, aquatic posthumanism is seen as a symbol of human hubris by preservationists. Their argument is that humanity has already done immeasurable damage to the ocean environment over the last couple of centuries; now, full-scale posthumanist projects may overwhelm what's left, and threaten an undersea population explosion. The more enthusiastic the posthumanist idealists get, and the more profits aquaculture and deep-sea mining corporations promise investors, the more their opponents accuse them of disregarding any pretense of caution. They may have a point; it certainly doesn't help that it's all too easy to hide dubious projects in deep international waters. Hence, transhumanist aquatic operations are often attacked directly and sometimes violently by groups such as Blue Shadow (***Under Pressure,*** pp. 77-80).

Rules Considerations

Advanced biotechnology can have significant effects on in-game activities and may be reflected in details on character sheets. Hence, this section is largely concerned with character features, in ***GURPS*** *Fourth Edition* terms. The traits discussed below relate to matters of biotechnology, but are generally available to anyone, simply as the result of upbringing or conventional training. For characteristics specifically used on variant biosapient templates, see ***Changing Times*** and ***Bioroid Bazaar***.

The Meaning of "Species"

GURPS rules sometimes talk in terms of *species*. This is usually a synonym for "racial template"; a species is simply a group of beings who more or less all share a set of game features. However, *in play,* "species" can mean something else. From the point of view of skill use, members of the same "species" are beings so similar that someone trained to perform medical operations on one member of the group can work just as well on any other member. A single racial template probably will define them, but that's not guaranteed.

This still doesn't necessarily correspond to the definitions of the word found in biology textbooks. It *can,* but equally, a cluster of "biological species" can be so similar that the difference only matters for purposes of interbreeding and the most subtle biochemical operations, making them all one "species" for game purposes. In other cases, a game "species" is actually a *model* of synthetic organism (such as a bioroid type) or a set of similar models. It is also possible, though very rare, for two biological *sub*species (or synthetic model variants) to be so different that they have to be treated as two distinct game "species." Distinctions unavoidably become fuzzy sometimes when dealing with variant parahuman patterns or bioroid designs.

In practice, in Transhuman Space, most people with "species-specific" skills are used to a fair bit of variation, exotic biotech modifications, and so on. To sidestep arbitrary or excessive penalties, games should avoid including too many distinct "species" categories. Conversely, treating a design as its own species can be a good way of emphasizing the radical nature of the biotech involved. Anyone also may suffer familiarity penalties (p. B169) – treating a biotech design as analogous to a piece of equipment – if, say, they encounter variant features that they've only read about in books or seen once in training (but those features could plausibly have been mentioned in books or courses).

Physiology Modifiers

As is explained on p. B181, people are normally assumed initially to learn Body Language, Diagnosis, First Aid, Physician, and Surgery (and Pressure Points and Pressure Secrets, in campaigns where these exist) as they apply to members of their own species. (Detect Lies might be included on the list in some games, but this shouldn't be the case in Transhuman Space.) Then, when applying them to other species, they must either first roll successfully against another skill, usually the appropriate specialty of Physiology, or take a penalty. However, some ***Transhuman Space*** PCs learn those skills primarily for use with a *different* species, working freely on members of that species but encountering the above complications when working on others including *their own* species. For example, bioroid rescue workers or AI surgeons may be trained to work on humans, while technicians in bioroid-production facilities may focus on the bioroids they have to look after. Learning any of these skills primarily on a different species is a 0-point feature; where this applies, note the fact with the skill.

Skill penalties for working with a different species depend on the degree of physiological similarity. For example, "ordinary" humans, upgrades, and parahumans designed for standard terrestrial environments count as the same species, while switching between that pattern and parahumans designed for arctic or desert conditions, or bioroids designed to resemble humans fairly closely, gives -1. Switching between baseline human physiology and aquatic parahumans or moderately exotic bioroids gives -2, while bioroids designed for *very* unusual environments give -3. Working with uplifted animals and completely nonhumanoid bioroids ideally needs Veterinary skill (or Animal Empathy to get any use out of Body Language), but such creatures can be tended to with humanoid-oriented medical skills at -5; Europan and Void Flyer bioroids also give -5 to those not specifically trained to work with them, as they have broadly human anatomies but wildly different metabolisms.

A little focused training or experience can also eliminate some cross-species problems entirely; this is represented by *Cross-Species Expertise* (p. 19).

> *They're toys. My friends are toys. I make them. It's a hobby. I'm a genetic designer.*
>
> *– J.F. Sebastian, in* ***Blade Runner***

Psychology Modifiers

As is noted in ***Changing Times*** (pp. 46-47), Psychology skill, which specializes by "species," is simply divided into Human, Bioroid, and AI specialties in this setting, plus one more for each type of uplifted animal, with cross-species defaults as described there.

Bioshell Concerns

Bioshells can be treated as bioroids for purposes of medical treatment; they are, basically, bioroids with computer brains. However, they tend to have subtly *strange* body language, unless teleoperated by a human or controlled by a ghost, a good-quality shadow, or an AI which is well-trained at faking humanity. Someone who attempts to use Body Language or Psychology (Human) skill on an AI-run bioshell in what would normally be an appropriate way can roll a Quick Contest of the skill against the AI's Acting at -2. If the observer wins, he detects that something disconcerting is going on which prevents the skill from working normally. Successful use of Empathy or Sensitive (p. B51) also can detect that the subject is somehow "fake." An observer who doesn't already know that this is a bioshell *may* then guess the full truth, if the situation makes that plausible – which can sometimes trigger a Fright Check!

When dealing with a *known* AI running on a bioshell, whether Empathy or Sensitive work in the usual way depends on how the GM has chosen to handle interactions with AIs generally; see *Indomitable AIs and "Machine Empathy"* on p. 52 of ***Changing Times.***

Spot the Bioroid

Most bioroids are made to look like human beings. A few, such as various "cat person" types, are aesthetically exotic in ways that would require a *lot* of cosmetic surgery for a human to match; have very visible adaptations to specific environments; or are simply made distinctive (e.g., the Rodosha, ***Wings of the Rising Sun,*** p. 15, and ***Bioroid Bazaar,*** pp. 25-26). Nonetheless, designers generally take the simple option. However, bioroids usually are immediately identified as such by anyone who meets them. How does this happen?

Firstly, many are visually standardized. All the bioroids of a given low-cost model don't usually look *identical,* but they tend to be very similar, and most humans are familiar with bioroid models that are common in their society. Still, a bioroid which is not of a deliberately nonhuman or highly standardized type, and which is not dressed distinctively, *can* pass as human on sight unless the observer makes a Per roll at -3 or a Per-based Bioengineering (Tissue Engineering) skill roll. The GM may permit a Per-based roll against some other skill instead when the skill is appropriate (Current Affairs when the bioroid model is one that's been in the news, say, or Expert Skill (Military Science) for a combat model). This roll is at +3 if the bioroid is very lightly dressed or naked; engineered musculature, nonstandard body hair patterns, and "artificial" skin textures can be very recognizable. However, a bioroid with the Passing Appearance perk (p. 19) or with the Concealed Bioroid Body meta-trait (***Changing Times,*** p. 43) can never be recognized solely on sight. The GM also may permit Disguise skill (or cosmetic surgery) to produce the same result.

Second, all bioroids have VIIs, which are almost always active, and even those few who turn their implants off may have wearables. This makes them visible in local open communications networks, and their systems will usually have flags showing their status; in many societies, this is mandatory, and obfuscating tags may be illegal for bioroids. Hence, anyone with an augmented reality system can see any bioroid who is tagged as such, although the GM may require busy or distracted observers to make an IQ roll for them to be paying enough attention to their AR environment. In Fifth Wave societies where appearance and dress style can vary dramatically and whimsically, this may be the usual way that bioroids are identified.

Third, *acting* like a human is a challenge. Bioroid behavior and speech reflect their "programmed" psychology, including especially a tendency to subservience (or, in the case of some combat bioroids, calm assertiveness verging on brutality). Anyone who closely observes a bioroid who is trying to pass as human for at least a few minutes has a chance to see through the act; roll a Quick Contest between the bioroid's Acting skill and the best of the observer's Psychology (Applied/Bioroid *or* Human) or Detect Lies. If the observer wins, he notes that *something* is "off" about the bioroid's behavior; if the roll was against Psychology (Applied/Bioroid), they recognize exactly what they're dealing with. For daily, extended contact, roll the Contest again once per day, although should the observer ever roll a critical failure or the bioroid roll a critical success, the observer becomes convinced that the bioroid is human, and can't roll again.

Lastly, most bioroids will be detected as such by even a cursory examination using TL10 medical equipment. The only reliable way to defeat this is by having the Concealed Bioroid Body meta-trait.

Advantages

Biotechnology and its consequences can interact with some ***GURPS*** advantages in significant ways.

Empathy

see p. B51

Anyone with the Empathy advantage (or the lesser Sensitive version) can "read" most humans, parahumans, ghosts, and bioroids. However, nonsapient uplifts and some nonsapient bioroid animals (that is, any being with base species IQ 5 or less) require Animal Empathy. Whether Empathy works on AIs (including any running on bioshells) may depend on whether the GM has chosen to include "Machine Empathy" from p. 52 of ***Changing Times.*** See p. 17 for rules for interactions between Empathy and bioshells.

Resistant

see p. B80

Bioroid Bazaar, p. 5 and pp. 9-10 points out certain problems with the idea of human-influencing pheromones, and this makes various levels of treatment of the subject optional in ***Transhuman Space*** games. This has various game-level consequences.

If pheromones are in use in a campaign, a few people might possess some level of Resistant to their effects, through genetic engineering, nanomods, or just natural variations in neurochemistry. (This might also accompany the No Sense of Smell/Taste disadvantage!) "Pheromones" would usually count as a *Rare* effect, making Immunity a 5-point advantage; they might count as *Occasional* in campaigns where several different synthetic pheromones are heavily used for social manipulation. Immunity to one specific type (e.g., "Eros bioroid sex pheromones") would just be a perk.

However, the GM may rule that attempts to block pheromones have unfortunate neurological side effects. For example, a lack of response to oxytocin is linked to psychopathic behavior; someone seeking such treatments could also end up with the Low Empathy disadvantage, or the advantage could have that as a Temporary Disadvantage limitation – a person's defenses might respond to chemicals intended to make him more emotionally responsive by shutting down his social responses altogether for as long as the attack persists.

Some people will consider this an acceptable trade-off, of course.

Perks

Perks marked † require specialization.

Appearance Perks

Skilled TL10 cosmetic surgeons and bioroid designers can and do work to produce a wide range of visual effects in their subject matter. Sometimes, this is simply represented by a given Appearance level (with the Off-the-Shelf Looks limitation if the designer was lazy, or the results are too successful and too soon copied), but some specific effects are best represented by perks. Here are two common examples.

Classic Features: You have a well-defined set of features in quintessential form. You might, say, be the epitome of a blonde, a Maasai tribesman, a muscleman, or a well-known bioroid design. You're not really better looking than anyone else, necessarily, but you push all the right buttons. Whenever you interact with an NPC who has a particular fondness for your "type," you are treated as one Appearance level higher, cumulative with any specified reaction bonuses. For example, if you're a Classic Redhead with Average looks, an NPC with the quirk "Likes redheads (+2 reactions)" reacts to you at +2 for the quirk *and* a further +1 because you count as Attractive – and you may land occasional modeling jobs for cosmetics aimed at redheads.

Passing Appearance: You are a member of a minority or subpopulation which can normally be identified by appearance – but you don't look it. If you're a bioroid, you can pass very easily as human; your designers avoided any of the subtle visual cues that might have distinguish you, including too-perfect facial symmetry. Among humans, this perk is appropriate for members of some ethnic groups, although rather less ethnic prejudice is prevalent in Transhuman Space than in previous eras, if only because cosmetic biotech treatments are widely available that make distinctively ethnic appearance largely optional and often a matter of fashion. You might, say, be a member of an oppressed group in an area where such treatments are either unaffordable or illegal. If so, with this perk, you can find acceptance among your own group (although you may sometimes have to convince suspicious individuals that you're genuine), but people with Intolerance toward your group don't respond to you negatively on sight. If you'd normally be required to take a Social Stigma, this perk may function as a small Unusual Background that allows you to not take it or buy it off freely with points.

Cross-Species Expertise†

Prerequisite: See below.

Generally, those with skills to which physiology modifiers apply can work freely on one species (usually their own; see *The Meaning of "Species,"* p. 17, for more on this), but have problems with others; see *Physiology Modifiers,* p. 17. This perk removes that problem for *either* all skills as applied to one specified species, *or* one skill for all species of the same basic body pattern (usually "humanoids"). In the former case, you must also have at least 1 point in Physiology skill for the species involved; in the latter, you must have at least 2 points in the chosen skill. In effect, you are treated as automatically succeeding at the relevant Physiology skill roll.

Hyper-Specialization†

You're an expert in an area far narrower than *Optional Specialties* (p. B169) allows. You get +5 to one skill in a specialty so obscure that it takes at least three words to describe and is unlikely to matter more than once in an adventurer's career; e.g., Hyper-Specialization (Avian/Ichthyic Metabolic Pathway Interfacing) for Bioengineering, or Hyper-Specialization (Mexican Academic Bacteriophage Research) for Current Affairs (Science & Technology). Academic experts can build whole careers on such specialties, but they rarely come up in play in most campaigns.

You must specialize by skill *and* area of expertise. Hyper-Specialization is only possible for IQ-based "knowledge" and "scientific" skills, unless the GM makes an exception. In Transhuman Space, this trait is common among specialists working in complex fields such as bioroid development or genetic uplift.

Disadvantages

In a world with widespread bioengineering, some disadvantages found among the general population need special consideration.

Intolerance

see p. B140

Intolerance of every sapient type/species except your own, or merely of every genetically defined species except your own, is the -10-point version of the disadvantage. Intolerance of a *specific* type such as "bioroids" or "parahumans" is usually the -5-point version, assuming that you don't live somewhere where the subject of your dislike rarely appears. If you do, or if you are merely intolerant of one specific type or model (such as "Rodosha bioroids" or "uplifted dogs"), that's just a quirk. Such Intolerance is, if not common, then sadly not *rare* in Transhuman Space.

Phobia

see pp. B148-150

The following new Phobias are valid disadvantages in Transhuman Space.

Bioroidophobia: You're *extremely* nervous about bioroids. Maybe you think that they're out to get *real people,* or maybe you just believe that they're all secretly crazy-vicious; it doesn't make much difference – you don't dare turn your back on them. This isn't quite the same as Intolerance; your response is based on fear rather than hate. Your self-control rolls are at -3 for *crowds* of those monsters, and -3 for heavily armed bioroids – making a cumulative -6 for fully equipped bioroid armies. NPCs with this disadvantage react to bioroids at -1, even if they make their self-control rolls, but they will always try to give any bioroid a wide berth; a good reaction simply means that they assume that this bioroid looks safe *for now* and can't be blamed for how it's probably been programmed. *-10 points.**

Synthogenetiphobia: Other people may put up with advanced genetic technology, but you know better! You can just about tolerate the oldest and simplest medical stuff, but you can see that deliberately meddling with genes or building artificial "life" can only end in disaster – and that disaster could strike at any time, in the form of hideous plagues, artificial life forms running amok, or more insidious but utterly horrible effects. Large quantities of biotechnology, such as crowds of bioroids or being required to enter a modern hospital, give you -3 to your self-control roll. You don't respond to bioroids in general quite the way that people with Bioroidophobia do; they fear bioroids as individuals, expecting them to be vicious or untrustworthy, but you know that it's the technology used to *make* them that's wrong, and they could go bad in all sorts of ways – some may go berserk, but others probably carry weird diseases, exude subtle nanotoxins, or just let real people down at the wrong moments. Best to keep them at a distance. You've probably learned to tolerate genefixed or "upgraded" humans – you may be one yourself, even – but you find the technology involved creepy, and you won't let your own children be genefixed if you can help it. Meeting a known parahuman triggers a self-control roll at +2; if you make it, you can treat this individual as human, but a human being with a black mark against them. NPCs with this Phobia react to known parahumans and bioroids at -1, even if they make their self-control rolls, but always try to steer well clear, especially of bioroids; with a positive reaction, they simply think that it's not the parahuman or bioroid's fault that they're probably some kind of walking time bomb. *-15 points.**

In the case of protagonists who spend all their time in Third Wave areas or radically bioconservative isolate communities, where bioroids and other manifestations of biotechnology are very rarely encountered, the GM may reduce the base value of both these Phobias by -5 points, to -5 and -10 points respectively.

Note also that individuals with *Technophobia* might not have that Phobia triggered by any but the most blatant products of biotechnology. One thing to be said for biotech, from their point of view, is that the products aren't *machines*.

Bioroid behavior and speech reflect their "programmed" psychology . . .

Quirks

Slightly flawed or whimsical biotech treatments can induce a wide range of physical or mental quirks. In addition, one quirk of appearance can have a significant effect in this society.

Looks Like a (Bioroid): Only humans and parahumans can take this! By some oddity of fate, or through deliberately deceptive cosmetic treatment, you happen to resemble a common bioroid type with a standardized appearance (specify the model when you take the quirk); you haven't had your appearance changed to eliminate this effect (because of lack of funds or time, sheer stubbornness, etc.); and your mannerisms do not contradict the appearance dramatically or reliably enough. Hence, some people who see you and don't perceive anything that prevents the confusion (such as AR tags) react to you initially as a bioroid, with hostility, condescension, sympathy, or whatever. If you try to eliminate the effect by dressing distinctively and not behaving at all like a downtrodden servant, fewer people will be confused, but some will become doubly hostile, perceiving you as a *self-important, pretentious* bioroid. This is usually only mildly inconvenient, especially as most humans will recognize their error after a few minutes – and you may be able to use the confusion to your advantage from time to time – but a few people will persist in irrationally, reflexively treating you as a bioroid, especially if they have deep-seated Intolerance.

Skills

Bioengineering is a complex subject. People may have to master various skills to deal with it effectively.

Bioengineering

see p. B180

The primary practical skill in this field is complex and requires specialization, and TL10 projects can impose significant skill penalties; the Hyper-Specialization perk (p. 19) is widespread among biotechnology professionals in 2100, and often effectively required to hold down a serious job in the field. There are also several new specialties of the skill present in the setting.

Biogadgets: A relatively uncommon specialty, dealing with the creation of living equipment or vehicles. Typically, designers collaborate with specialists in tissue engineering and microbioengineering (below), who create components for the devices; the biogadget engineer then combines and integrates these.

Microbioengineering: The specialty of creating new strains of microbes for commercial, medicinal, or hostile purposes. In Transhuman Space, this is related to Engineer (Nanotechnology), as almost all nanotech is "wet," and involves the creation of pseudobiological forms; the two skills default to each other at -4.

Uplift: A spin-off of genetic engineering, focused on the specific problems and requirements involved in granting species increased intelligence and secondary modifications to exploit it. This and Bioengineering (Genetic Engineering) default to each other at -3.

Vaccines: The specialty involved in researching and developing new vaccines. This is widely seen as a rather dated field in 2100, as protection against diseases is often accomplished using nanotechnology and broad-spectrum enhancements to patients' immune systems rather than vaccination – but a well-designed vaccine can still sometimes be cheap, effective, reliable, and faster to develop than fancy modern nanotech.

Practical Uses

Different types of biotech require different specialties to create or maintain functional designs or systems. Here are two practical cases.

Upgrades and Parahumans: Enhancements to the human genome require specialists in genetic engineering. Most teams also include specialists in cloning, as a lot of prototype embryos are clones, and that part of the project needs as much skilled management as the rest. Any respectable team implementing even the simplest upgrade design in the field will include at least one consulting genetic engineer, although physicians do most of the work.

Bioroids: Typically, design and production of a new bioroid or bioshell type requires numerous specialists in tissue engineering to create and integrate the various organs, plus smaller teams with expertise in microbioengineering and Engineer (Nanotechnology) to design and construct the artificial glandular and hormonal systems that feature in every bioroid model. Additionally, team members with Physiology and Surgery are responsible for creating the final overall design and then working out how to put it together. Creating a design based on an individual human being also requires specialists in cloning, but must have tissue engineers and physiologists to integrate the finished product. Radical new designs often involve genetic engineers, who are needed to create completely new self-sustaining tissue and organ variants. A new project will need experts with Psychology (Experimental/Bioroid) skill as well, to design and test the new type's education and training regime, and to advise on the consequences of any innovations in neural anatomy or brain chemistry. Running a bioroid production line typically engages a few people trained in basic tissue engineering, Physician, and Surgery, to handle routine problems.

Expert Skill (Sapientogeny)

see pp. B193-194

See p. 5 for the definition of "Sapientogeny." This skill represents knowledge of underlying theories, bioengineering techniques, and current industry practices in all forms of biosapient creation. When you need to know about the broad practicalities of the field, it can stand in for Bioengineering, Biology, Current Affairs, Physician, Physiology, Psychology, or Surgery. It also includes a little knowledge drawn from various Law specialties regarding the legal niceties. However, it is broad but shallow, and does *not* cover practical laboratory work; hence, it is of little use to bioengineers, but it is beneficial to their managers, scientific journalists, and specialist lawyers.

Medical Skills

See p. 17 for notes on physiology modifiers and how they affect medical and other skill uses in ***Transhuman Space*** games.

Physiology

see p. B213

See p. 17 for notes on physiology modifiers and their effect on various skill applications.

Psychology

see p. B216

As is noted on pp. 46-47 of ***Changing Times,*** in Transhuman Space, Psychology skill, which is normally specialized by species, is simply divided into Human, Bioroid, and AI specialties, plus one more for each type of uplifted animal, with cross-species defaults as described there. Also, division into Applied and Experimental specialties is mandatory.

Passing as an Imitation

On the opposite side of things to the fakery discussed under *Spot the Bioroid* (p. 18), it is possible for a skilled human to pass as a bioroid (and to do so seriously, not just as a bad comedy routine, though that's common too). Criminals, spies, and investigative journalists sometimes do this, usually for much the same reasons that such people sometimes got jobs as low-ranking servants in ages past. Many espionage organizations teach operatives appropriate tricks and provide them with suitable cosmetic treatments from time to time. Bioroid-faking operatives can be very useful for infiltration work, and some dedicated agents keep the same appearance for multiple missions.

Passing as a bioroid to initial visual inspection requires either successful use of Disguise skill or superficial but extensive cosmetic surgery. Note that bioroids often have relatively "bland" looks, usually reflected by either Average Appearance or above-average levels with the Off-the-Shelf Looks limitation. "Bland" doesn't *have* to be unimpressive, though; many bioroids are built to be quite attractive, after all, and some are high-quality bespoke designs. Still, anyone who is normally Handsome/Beautiful or better can usually pass only as a high-quality "social interface" model or an expensive sex toy – unless they deliberately suppress their attractiveness with an extensive disguise. Similarly, anyone with Ugly or worse Appearance will have problems, as bioroids are rarely made that unappealing unless they are radically nonhuman; they'll at least need a heavy disguise. Someone with the Looks Like a (Bioroid) quirk (p. 20) will always pass a visual check.

Even without strong visual plausibility, the easiest way to pass as a bioroid on a first encounter is often simply to wear digital tags identifying you as one in augmented reality. This is an area where most people in 2100 will trust their computer systems more than they trust their senses – especially as most people will subconsciously assume that no one who can avoid it wants to be treated as a bioroid. Of course, faking AR tags will be illegal in some jurisdictions, against local computer system rules or commercial agreements in many more, and taken as evidence of illegal intent almost everywhere. It may sometimes require high levels of access to local systems to set the cryptographic keys.

Acting like a bioroid in personal interactions follows the same rules as on p. 18, except that an observer may spot behavior as being "un-bioroid-like" rather than nonhuman. If the individual *wasn't* taken for a bioroid on sight, but successfully acts the part, he will have to provide a plausible excuse for the "deceptive" appearance (e.g., "My owner prefers me to look this way").

Chapter Three

Enhanced Nonhumanoid Creatures

This chapter provides templates for a number of uplifted or enhanced nonhumanoid species and a few creatures which are technically bioroids. They are designed much more as tools or vehicles than as thinking beings – interesting products of Transhuman Space biotechnology, but not likely to be used as PCs. Types that are more likely to see service as viable PCs are covered in ***Bioroid Bazaar.***

These creatures you have seen are animals carven and wrought into new shapes.

– H.G. Wells, ***The Island of Doctor Moreau***

Because these creatures *are* likely to be encountered as pets or wildlife, for each type, an accompanying *Just the Stats* box details a typical creature of the type in the format used for animals rather than characters.

Uplifted and Adapted Animals

These uplifted animals are generally too unintelligent, unimaginative, and socially limited to make good PCs, but they can make very interesting Allies. Smaller creatures, such as smartcats, may be best treated as property and purchased for cash. Note that the templates generally include Social Stigma (Valuable Property), as that is pretty much the universal situation for such created beings, and Dead Broke, because a creature which is regarded as property cannot itself own anything. Some creatures, especially those with IQ 7 or higher, might be able to make a case for greater civil rights in broad-minded jurisdictions, in which case they could have a different Social Stigma (or even none at all) and a higher Wealth level.

New Species Perks

The following perks, borrowed from other supplements, appear on a couple of these species templates.

Feathers: These prevent sunburn and help shed water, eliminating up to -2 in penalties for being wet – notably for *Cold* (p. B430).

Sure-Footed: The creature is accustomed to fighting on one specified type of bad surface, and ignores the -2 to attack and -1 to defend for that particular type of bad footing.

New Phobia

Phobia (Humans): This Phobia (see pp. B148-B150) is programmed into certain semi-secret bioroid "wild animal" designs to reduce the risk of their being discovered. These creatures flee from humanoid beings on sight, and may panic if cornered. *-5 points.**

Taboo Trait (Fixed IQ)

Normally, this is found on uplifted animal templates (and is already included in the Domestic Animal meta-trait on p. B263). This feature indicates a species whose brains and minds lack the variability found in humans, with the result that they cannot justify a personal ***GURPS*** IQ score that differs from the racial average by as much as a level. Hence, their IQ *cannot* be bought up from the level defined by the species template, and is only likely to fall below that level in the case of young or brain-damaged specimens. Optionally, in cinematic games, a few members of the species can buy their IQ up by one, to represent amazingly bright animal companions or frighteningly capable individual predators.

In addition, if a creature with this taboo trait has its native language abilities reduced below normal human levels on its racial template, individual members of the species cannot buy them back up and cannot learn any other languages.

Guardian Bear

see *In the Well,* p. 112; 79 points

Highly modified animals, created for use as family guards and pets, guardian bears are found almost solely on Mars. There, a local penchant for biotechnology more than compensates for the worries that might be caused by the presence of omnivorous 1,000-lb. creatures in private houses. Hence, the template below includes Mars-Adapted.

Most guardian bears are trained to act as effective but nonlethal guards; they usually have some level of Wrestling skill, having been taught to grapple and pin in combat. They are also carefully taught to know the dangers of their own strength and weight, and they are affectionate with people they know, especially children.

Despite their sapient-level practical intelligence, guardian bears are not great conversationalists; their working vocabulary is usually as low as 50-100 words. Most have some kind of radio implant, allowing them to receive instructions and to call for support when faced with intruders.

Attribute Modifiers: ST+8 (Size, -10%) [72]; DX+2 [40]; IQ-4 [-80]; HT+3 [30].
Secondary Characteristic Modifiers: SM +1; Will+4 [20]; Per+5 [25]; Basic Move+1 [5].
Advantages: Blunt Claws [3]; Damage Resistance 2 (Flexible, -20%) [8]; Enhanced Move 1/2 (Ground) [10]; Mars-Adapted [9]; Sharp Teeth [1]; Temperature Tolerance 3 [3].
Perks: Fur. [1]
Disadvantages: Bad Grip 3 [-15]; Dead Broke [-25]; Innumerate [-5]; Native Language reduced to Spoken (Broken)/Written (None) [-5]; Semi-Upright [-5]; Social Stigma (Valuable Property) [-10].
Quirks: Affectionate to "Family"; Broad-Minded; Dull. [-3]
Features: Taboo Traits (Fixed IQ; Genetic Defects).
Date: 2088.
Cost: $13,000.

Just the Stats: Guardian Bear

ST: 18	**HP:** 18	**Speed:** 6.25
DX: 12	**Will:** 10	**Move:** 10
IQ: 6	**Per:** 11	**Weight:** 500-1,000 lbs.
HT: 13	**FP:** 13	**SM:** +1

Dodge: 9 **Parry:** 9 (Wrestling) **DR:** 2

Bite (12): 1d+1 cutting. Reach C, 1.
Claw (12): 1d+2 crushing. Reach C, 1.
Grapple (13): Reach C; +1 to hit SM 0 opponents; follow up with a ST 19 takedown and pin.

Traits: Bad Grip 3; Blunt Claws; Broken Native Language Only; Fur; Innumerate; Mars-Adapted; Semi-Upright; Sharp Teeth; Temperature Tolerance 3.
Skills: Wrestling-13.
Cost: $13,000.

Just the Stats: Mars Hawk

ST: 4	**HP:** 4	**Speed:** 6.00
DX: 12	**Will:** 10	**Move:** 18 (Air)
IQ: 6	**Per:** 12	**Weight:** 6-12 lbs.
HT: 12	**FP:** 12	**SM:** -3

Dodge: 9 **Parry:** N/A **DR:** 1

Claw (12): 1d-6 cutting. Reach C.
Peck (12): 1d-6 large piercing. Reach C.

Traits: Acute Vision 3; Broken Native Language Only; Feathers; Flight (Winged); Innumerate; Mars-Adapted; Sharp Beak; Sharp Claws; Temperature Tolerance 1.
Cost: $3,000.

Mars Hawk

see *In the Well,* p. 112; -40 points

As the name implies, the Mars hawk is another purely Mars-oriented creation, with almost-sapient intelligence and a voice box based on that of a parrot, as well as large, carefully engineered wings. Mars hawks serve as companion-pets and occasionally as scouts.

Attribute Modifiers: ST-6 [-60]; DX+2 [40]; IQ-4 [-80]; HT+2 [20].
Secondary Characteristic Modifiers: SM -3; Will+4 [20]; Per+6 [30]; Basic Move-5 (Ground Only, -60%) [-10].
Advantages: Acute Vision 3 [6]; Damage Resistance 1 (Flexible, -20%) [4]; Enhanced Move 1/2 (Air) [10]; Flight (Winged, -25%) [30]; Mars-Adapted [9]; Sharp Beak [1]; Sharp Claws [5]; Temperature Tolerance 1 [1].
Perks: Feathers. [1]

Despite their sapient-level practical intelligence, guardian bears are not great conversationalists; their working vocabulary is usually as low as 50-100 words.

Martian Fauna 1: Domesticates

Various creatures genetically engineered to provide Martian humans with interesting pets or useful farm animals are detailed in ***In the Well,*** pp. 111-114. The following are Fourth Edition treatments of those species which are never worth detailing as characters.

Dracofly

ST: 0-2	**HP:** 1-2	**Speed:** 6.75
DX: 13	**Will:** 5	**Move:** 15 (Air)
IQ: 1	**Per:** 8	**Weight:** up to 1 lb.
HT: 14	**FP:** 14	**SM:** -6 to -2
Dodge: 10	**Parry:** N/A	**DR:** 0

Traits: Domestic Animal; Flight (Winged); Mars-Adapted; No Fine Manipulators.
Skills: Aerobatics-12; Flight-13.
Cost: $100, or more for exotic and bespoke designs.
Notes: Ground Move is 2, with no effective Dodge. IQ is effectively 5 when following specific instructions from an insect director device, thanks more to the intelligence of the device's controlling AI than to anything in the insect's own brain. If a dracofly gets distractingly close to someone's face, the victim suffers -2 to IQ or Per-based rolls or skills, and has to roll vs. Will on the first turn to resist the urge to do nothing but bat the thing away. See ***Transhuman Space,*** p. 171, for details of insect director technology, but note that dracoflies are controlled by infrared signals rather than pheromones, permitting finer control.

Dracofly Swarms: A swarm of dracoflies uses the rules on p. B461. It has a Move of 10 and is dispersed after losing 10 HP, or 15 HP for a swarm that is being directly ordered to attack by a swarm controller. It does no damage, although it can distract opponents as above, but even more effectively; -3 to IQ or Per-based rolls or skills, or -4 in brightly lit areas, and -3 to the first-turn Will roll.

Spybug Variant: See ***In the Well*** for notes on typical spybug tasks. The spybug can be treated as having IQ 6 in its very limited area of expertise while following directions given through an insect director, but this effectiveness may be better reflected in most cases by giving it skill 10 in whatever it was designed to do. A spybug can attack if necessary (roll against DX to hit; in many cases it will be undetected to start with, and will make an All-Out Attack); it can bite for a nominal 1 point of small piercing damage, or use its stinger to deliver one dose of some drug or nanodrug. The stinger will be stopped by any DR, unless it has the Tough Skin limitation. A spybug is LC1, due to the technology's still-secret status and potential insidious applications, and costs $8,000 on the black market.

Genemod Goat

ST: 8-14	**HP:** 8-14	**Speed:** 6.50
DX: 13	**Will:** 12	**Move:** 9
IQ: 3	**Per:** 11	**Weight:** 75-400 lbs.
HT: 13	**FP:** 16	**SM:** 0 to +1
Dodge: 9	**Parry:** N/A	**DR:** 2

Bite (13): 1d-4 to 1d-1 crushing. Reach C or C, 1.
Butt (13): Slam attack (p. B371).

Traits: Domestic Animal; Enhanced Move 1/2 (Ground Move 9); Fur; Hooves; Mars-Adapted; Peripheral Vision; Quadruped; Reduced Consumption 1 (Cast-Iron Stomach); Stubbornness; Temperature Tolerance 6.
Skills: Jumping-16.
Cost: $2,000. Add at least $8,000 for specialized variants such as the spider goat.
Notes: In 0.38 G, the goat can jump over 8' upward from a standing start, or 13' with a good running start; it can also jump 34' horizontally without a running start, or 55' with a good run. Escaped goats replace Domestic Animal with Wild Animal, and usually have Survival (Martian Plains)-12.

Pharm Cow

ST: 22-28	**HP:** 22-28	**Speed:** 5.25
DX: 8	**Will:** 11	**Move:** 7
IQ: 3	**Per:** 10	**Weight:** 1,500-3,000 lbs.
HT: 13	**FP:** 16	**SM:** +2
Dodge: 8	**Parry:** N/A	**DR:** 0

Kick (6): 2d to 3d-1 crushing. Reach C-2.
Trample (8): 2d+2 to 3d+2 crushing on fallen victims.

Traits: Domestic Animal; Hooves; Mars-Adapted; Peripheral Vision; Quadruped; Weak Bite.
Cost: $5,000, or possibly much more for specialized or exotic drug production.
Notes: See ***In the Well*** for background information on these creatures.

All forms that perish other forms supply
(By turns we catch the vital breath, and die),
Like bubbles on the sea of matter borne,
They rise, they break, and to that sea return.

– Alexander Pope, "An Essay on Man"

Disadvantages: Two "Arms" are Short Foot Manipulators [-16]; Dead Broke [-25]; Hidebound [-5]; Innumerate [-5]; Native Language reduced to Spoken (Broken)/Written (None) [-5]; Social Stigma (Valuable Property) [-10].
Quirks: Staid. [-1]
Features: Taboo Traits (Fixed IQ; Genetic Defects).
Date: 2095.
Cost: $3,000.

Octosap

see *Under Pressure,* p. 101; 74 points

A Pacific octopus enhanced to become a worker animal with dog-level intelligence. Its psychological fragility suggests that the genetic engineers didn't try very hard to modify the original brain design, and necessarily limits use of these worker creatures to well-controlled environments.

Attribute Modifiers: ST-1 [-10]; DX+4 [80]; IQ-4 [-80]; HT+2 [20].
Secondary Characteristic Modifiers: Per+6 [30].
Advantages: Ambidexterity [5]; Chameleon 2 [10]; Constriction Attack [15]; Damage Resistance 1 (Can't Wear Armor, -40%; Tough Skin, -40%) [1]; Doesn't Breathe (Gills, Water Only) [0]; Enhanced Move 1/2 (Water) [10]; Extra Arms 6 (Extra-Flexible, +50%) [90]; Extra-Flexible [10]; Injury Tolerance (No Neck) [5]; Obscure 10 (Vision; Accessibility, Only in water, -30%) [14]; Peripheral Vision [15]; Pressure Support 1 [5]; Sharp Beak [1].
Disadvantages: Bad Grip 2 [-10]; Bad Sight (Nearsighted; Mitigator, -60%) [-10]; Cold-Blooded (50°F) [-5]; Colorblindness [-10]; Dead Broke [-25]; Fearfulness 1 [-2]; Hidebound [-5]; Innumerate [-5]; Invertebrate [-20]; Mute (Mitigator, Vulnerable, External loudspeakers with computer connections, -60%) [-10]; No Legs (Aquatic) [0]; Short Lifespan 2 [-20]; Social Stigma (Valuable Property) [-10]; Stress Atavism (Mild; 9) [-15].
Date: 2072.
Cost: $21,000.

Notes and Variations

Octosap II: A second-generation Octosap, with growth rates slowed to permit the development of higher intelligence. Change IQ to -2 [-40], Per to +4 [20], Damage Resistance to 2 (Can't Wear Armor, -40%; Tough Skin, -40%) [2], and Short Lifespan to 1 [-10]. *115 points.* ($35,000; 2081.)

Smartcat

see *In the Well,* p. 111; -106 points

A domestic cat with a voice box and improved intelligence and lifespan. A smartcat's language skills are relatively limited, though – its brain *is* only cat-sized. Despite decades of optimism among cat-lovers, this ultimately places a hard limit on the potential intelligence of any genetically modified, standard-size cat.

Enhanced pets like this are particularly associated with the human colonies on Mars, but they may also be encountered on Earth.

Attribute Modifiers: ST-6 [-60]; DX+4 (No Fine Manipulators, -40%) [48]; IQ-4 [-80]; HT+1 [10].
Secondary Characteristic Modifiers: SM -3; Will+4 [20]; Per+6 [30]; Basic Move+1 [5].
Advantages: Catfall [10]; Combat Reflexes [15]; Enhanced Move 1/2 (Ground) [10]; Night Vision 5 [5]; Sharp Claws [5]; Sharp Teeth [1]; Ultrahearing [5].
Perks: Fur. [1]

Just the Stats: Octosap

ST: 9	**HP:** 9	**Speed:** 6.50
DX: 14	**Will:** 6	**Move:** 9 (Water)
IQ: 6	**Per:** 12	**Weight:** 160 lbs.
HT: 12	**FP:** 12	**SM:** 0
Dodge: 9	**Parry:** 10	**DR:** 1

Grapple (26): Reach C; follow up with bite (below).
Neck Grapple (21): Reach C; follow up with ST 21 strangle. Only works on opponents with necks!
Sharp Beak (14): 1d-3 large piercing. Reach C.

Traits: Bad Grip 2; Bad Sight (Nearsighted; with Mitigator); Chameleon 2; Cold-Blooded (50°F); Colorblindness; Constriction Attack; Extra Arms 6; Extra-Flexible Arms; Fearfulness 1; Gills; Injury Tolerance (No Neck); Innumerate; Invertebrate; No Legs (Aquatic); Mute (with Mitigator); Obscure 10 (Vision; Only in Water); Peripheral Vision; Pressure Support 1; Stress Atavism (Mild; 9).
Cost: $21,000.
Notes: The Octosap II has IQ 8, Will 8, and DR 2. An Octosap which grapples an opponent can employ or release any or all of its arms (tentacles) for other purposes while still performing or maintaining its hold, but each tentacle freed up gives -2 to rolls to grapple and to effective ST for strangling.

Just the Stats: Smartcat

ST: 4	**HP:** 4	**Speed:** 6.25
DX: 14	**Will:** 10	**Move:** 10
IQ: 6	**Per:** 12	**Weight:** 5-15 lbs.
HT: 11	**FP:** 11	**SM:** -3
Dodge: 10	**Parry:** N/A	**DR:** 0

Sharp Claws (14): 1d-6 cutting. Reach C.
Sharp Teeth (14): 1d-6 cutting. Reach C.

Traits: Broken Native Language Only; Catfall; Colorblindness; Combat Reflexes; Distractible; Disturbing Voice; Fur; Night Vision 5; Quadruped; Sleepy (1/2 of the time); Ultrahearing.
Cost: $1,000.
Notes: See the *Notes and Variations* in the main text for variant features.

Martian Fauna 2: Wildlife

Work is ongoing to provide Mars with a functioning ecosystem. The following are Fourth Edition treatments of "wild" creatures from ***In the Well,*** pp. 114-115. Note that native temperature ranges for these creatures are suited to their environment, and so are lower than for humans.

Ice Weasel

ST: 6-8	**HP:** 6-8	**Speed:** 6.00
DX: 12	**Will:** 10	**Move:** 8
IQ: 4	**Per:** 12	**Weight:** 30-70 lbs.
HT: 12	**FP:** 13	**SM:** -1
Dodge: 10	**Parry:** N/A	**DR:** 2

Sharp Teeth (12): 1d-5 to 1d-4 cutting. Reach C.

Traits: Blunt Claws; Combat Reflexes; Fur; Mars-Adapted; Quadruped; Sure-Footed (Ice); Wild Animal.
Skills: Stealth-12.
Notes: See ***In the Well*** for details of the problems that ice weasels sometimes cause when humans (or transhumans) are around.

Mini Bear

ST: 10-11	**HP:** 10-11	**Speed:** 6.25
DX: 13	**Will:** 10	**Move:** 7
IQ: 4	**Per:** 11	**Weight:** 120-180 lbs.
HT: 12	**FP:** 12	**SM:** 0
Dodge: 9	**Parry:** 9	**DR:** 1

Blunt Claws (13): 1d-2 or 1d-1 crushing. Reach C.
Grapple (13): Grab opponent (see p. B370). Reach C.
Sharp Teeth (13): 1d-3 or 1d-2 cutting. Reach C.

Traits: Fur; Mars-Adapted; Reduced Consumption 3 (Cast-Iron Stomach); Semi-Upright; Wild Animal.

Sand Wolf

ST: 10-12	**HP:** 10-12	**Speed:** 6.25
DX: 12	**Will:** 11	**Move:** 7
IQ: 5	**Per:** 12	**Weight:** 150-250 lbs.
HT: 13	**FP:** 13	**SM:** 0
Dodge: 10	**Parry:** N/A	**DR:** 2

Sharp Teeth (13): 1d-3 to 1d-2 cutting. Reach C.

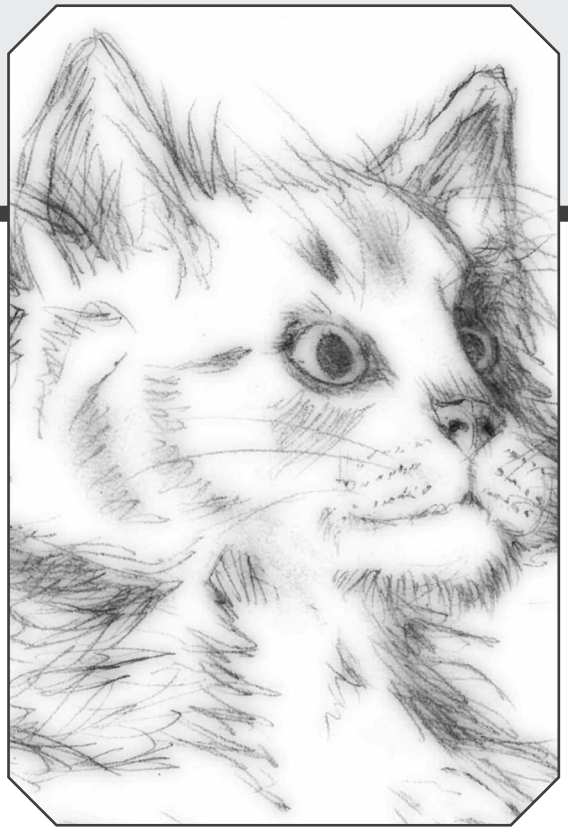
Traits: Blunt Claws; Combat Reflexes; Discriminatory Smell; Fur; Mars-Adapted; Night Vision 2; Quadruped; Sure-Footed (Sand); Temperature Tolerance 1; Wild Animal.
Skills: Brawling-13; Camouflage-12; Tracking-15.
Notes: See ***In the Well*** for details of sand wolves' hunting and burrow-defense methods.

Tika Bird

ST: 1-2	**HP:** 1-2	**Speed:** 6.75
DX: 14	**Will:** 9	**Move:** 12 (Air)
IQ: 3	**Per:** 10	**Weight:** < 1 lb.
HT: 13	**FP:** 13	**SM:** -4
Dodge: 9	**Parry:** N/A	**DR:** 0

Sharp Beak (14): 1d-7 large piercing. Reach C.

Traits: Blunt Claws; Feathers; Flight (Winged); Mars-Adapted; No Fine Manipulators; Wild Animal.
Notes: Ground Move is 2. See ***In the Well*** for the long-term effects of tika bird activity.



Disadvantages: Colorblindness [-10]; Dead Broke [-25]; Disturbing Voice [-10]; Hidebound [-5]; Native Language reduced to Spoken (Broken)/Written (None) [-5]; Quadruped [-35]; Short Legs [-2]; Short Lifespan 2 [-20]; Sleepy (1/2 of the time) [-8]; Social Stigma (Valuable Property) [-10].
Quirks: Distractible. [-1]
Features: Hard to train (treat as IQ 4 for this purpose); Reflective Eyes; Taboo Traits (Fixed IQ; Genetic Defects).
Date: 2092.
Cost: $1,000.

Notes and Variations

Smartcats can easily justify having Acute Senses (especially Hearing) and possibly Discriminatory Hearing, Perfect Balance, or Silence, but these aren't universal for the genotype. An especially well-designed fur pattern and natural grace might reasonably qualify as Attractive. Although smartcats are hard to *train,* they are fully capable of picking up "natural" cat skills such as Acrobatics, Brawling, Climbing, Stealth, and Survival.

First Generation Smartcats: Early smartcats (developed around 2082) were a bit *too* feline in unfortunate ways. Delete Hidebound and add Bully (12) [-10], Callous [-5], and Selfish (12) [-5], making the template cost -121 points; most had at least something out of Absent-Mindedness, Dislike (Water), Dull, Nosy, Uncongenial, and allegedly sometimes Megalomania. Some at least of these animals may have had the same IQ as the smarter smartcats discussed below.

Mars Smartcats: A smartcat created for life on Mars can add Mars-Adapted [9], raising the template value to -97 points and adding $500 to the cost.

Smarter Smartcats: Despite their supposedly very well-defined (and Fixed) intelligence, some later-generation smartcats have an extra level of IQ (+20 points); they may even have some level of literacy. A few of these also have the unfortunate personalities of the first-generation type above. A cat-sized mammal this smart is using its brain near its theoretical limits, which may turn out to have unfortunate consequences for its mental stability or physical health in the long term. These variations show up among smartcats created for Martian owners at least as often as elsewhere, and possibly more often; local biotech operations may be a bit more experiment-prone and careless.

Bioroid "Animals"

The creatures in this section are not members of true biological species. Rather, they are the products of bioroid manufacturing technology, and they cannot reproduce.

Cryptomorphs

These designs, imitations of creatures from modern myth, are the creation of the Society for Applied Teratology (***Toxic Memes,*** pp. 75-76).

Chupacabra

-122 points

The Chupacabra ("goat-sucker") is a creature of modern legends from Latin America. It is usually said to stand 3-4' high, with the posture and leaping ability of a kangaroo, reptilian scaly or leathery gray-green skin, and a row of short spines running from its head to the base of its tail. It is described as a vampiric predator with large fangs and a habit of sucking the blood of livestock it kills.

The Teratologists set to work replicating most of this, but realized that they needed to forget about the aggressive carnivore behavior if they wanted their creature to remain hidden. They could manage the forked tongue, the dog-like snout, and even the sulfuric smell, but regretfully left out the glowing red eyes and kept the screeching alarm call fairly quiet. The fast leaping movement helps their shy creatures to evade attention, and a low-key omnivorous diet, including fruit and small invertebrates, provides just enough calories to keep them going. The fangs aren't as sharp as they look.

The Society released their first Chupacabra into the wild in Mexico in 2097, and they now have a small colony there, along with a few in Brazil. Both groups have been seen just often enough to keep the legend going, although it's hard to say if they have really reinforced what was already an enduring low-level meme much. The bioroid Chupacabras are definitely *not* responsible for any attacks on livestock in the region, but one worry for the Society is that if any sightings happened to coincide with the sort of feral dog attacks or odd accidents that reinforce the meme at other times, they could have a panic or a hunting spree on their hands, possibly leading to the discovery of the trick.

Just the Stats: Chupacabra

ST: 7	**HP:** 7	**Speed:** 6.00
DX: 11	**Will:** 8	**Move:** 9
IQ: 4	**Per:** 11	**Weight:** 45 lbs.
HT: 12	**FP:** 12	**SM:** -1
Dodge: 9	**Parry:** 8	**DR:** 1

Bite (11): 1d-4 crushing. Reach C.
Blunt Claws (11): 1d-3 crushing. Reach C.

Traits: Acute Taste and Smell 1; Bad Grip 3; Bad Smell; Bestial; Bioroid Body; Cold-Blooded (50°F); Monstrous Appearance; Night Vision 3; Peripheral Vision; Reduced Consumption 2 (Cast-Iron Stomach); Phobia (Humans) (9); Scales; Short Spines (Back Only); Super Jump 1.
Cost: $75,000.
Notes: Can jump 52" up or 18' horizontally from a standing start, or up to twice those distances with a nine-yard running start.

Just the Stats: Sasquatch

ST: 14	**HP:** 14	**Speed:** 6.25
DX: 11	**Will:** 8	**Move:** 12
IQ: 6	**Per:** 9	**Weight:** 400 lbs.
HT: 14	**FP:** 14	**SM:** +1
Dodge: 9	**Parry:** 8	**DR:** 1

Sharp Claws (11): 1d-1 cutting. Reach C, 1.

Traits: Acute Taste and Smell 2; Bestial; Bioroid Body; Broken Native Language Only; Fearlessness 1; Fur; Innumerate; Monstrous Appearance; Night Vision 5; Shyness (Crippling); Temperature Tolerance 2.
Cost: $75,000.
Notes: 2098 version changes Shyness to (Mild).

One or two bioengineers in the group *may* doodle designs for a "real" Chupacabra, complete with vampiric diet and even demonic eyes, in their spare time, but the Society has generally managed to keep its members behaving vaguely responsibly. Still, if, say, an eccentric billionaire wanted a "zoo specimen," it wouldn't be hard for them to supply one. Including the legend's vicious blood-thirst would surely be *much* too unwise for anyone.

Attribute Modifiers: ST-3 [-30]; DX+1 [20]; IQ-6 [-120]; HT+2 [20].

Secondary Characteristic Modifiers: SM -1; Will+4 [20]; Per+7 [35]; Basic Speed+0.25 [5].

Advantages: Acute Taste and Smell 1 [2]; Blunt Claws [3]; Damage Resistance 1 (Flexible, -20%) [4]; Enhanced Move 1/2 (Ground) [10]; Night Vision 3 [3]; Peripheral Vision [15]; Reduced Consumption 2 (Cast-Iron Stomach, -50%) [2]; Resistant to Disease (+3) [3]; Short Spines (Back Only, -50%) [1]; Super Jump 1 [10].

Perks: Scales. [1]

Disadvantages: Appearance (Monstrous) [-20]; Bad Grip 3 [-15]; Bad Smell [-10]; Bestial [-10]; Bioroid Body [-4]; Cold-Blooded (50°F) [-5]; Dead Broke [-25]; Hidebound [-5]; Phobia (Humans) (9) [-7]; Short Arms (Two arms) [-10]; Social Stigma (Monster) [-15].

Features: Reflective Eyes; Taboo Trait (Fixed IQ).

Date: 2096.

Cost: $75,000.

Notes

The Social Stigma reflects how humans are currently likely to respond to these creatures. If their harmless diet and habits become known, they may be treated more as Valuable Property, especially if captured.

The Loch Ness Monster Bioroid

The Society for Applied Teratology aren't idiots; the fundamental problems with their Loch Ness Project reflect things that have been discussed by cryptozoologists for well over a century, and were confirmed by initial computer modeling, not actual failed creatures. The basic issues are metabolic; the loch is simply too cold for an aquatic reptile, and too small to hide a large mammal for long or to feed a colony of them. However, other practical problems are just as bad. Loch Ness and the surrounding area are *mostly* protected countryside, but there are villages, tourist facilities, a few small high-tech fish farms, and roads along the loch side – in other words, lots of people and systems that might see any creature that surfaces and record it in digital high resolution. While the Teratologists want their Nessie to be seen *sometimes,* it has to be glimpsed briefly and confusingly; if anyone starts taking the subject too seriously, even small, low-budget investigation teams will probably bring in systems that can search the loch in excruciating detail.

So plans for a warm-blooded, air-breathing creature were quickly scrapped; it would have to surface too often, and would probably end up raiding fish farms for food, while its body heat would show up on the simplest IR sensors. The eventual design was based on modified fish biology (although it has the "classic" plesiosaur shape), with gills at the base of the neck plus an auxiliary air-breathing mechanism to allow metabolic boosts when it can surface safely. (The long neck acts usefully as a snorkel.) Likewise, it is an herbivore, which forced the engineers to give it a slow baseline metabolism – but they designed its digestion to handle high-energy supplements which they supply when they can, giving it a further boost.

It has a very cautious nature, with a tendency to bury itself in the silt of the loch bed if disturbed or just when resting; since "Nessie" was released (from a rented lochside site) in 2096, sightings have been frustratingly rare. The Society classes this as a long-term project, but the project monitors (teams of two or three specialists working in relays, sometimes on site under various covers) are concerned that the creature's health is declining; the metabolic design was always a fine balance and may be failing. They can exert minimal control over it using subsonic signals at ranges of up to a couple of miles; they have trigger signals for "come here," "flee at speed," and "hide as soon as possible." The first overrides its built-in aversion to human contact.

Some of the designers have preserved their notes regarding a possible warm-blooded "Nessie" – essentially a large, long-necked bioroid seal. It may yet be built, but it is unlikely to be released into Loch Ness. There are other, more remote lakes with monster legends after all.

"Nessie" Bioroid

ST: 15	**HP:** 15	**Speed:** 4.75
DX: 9	**Will:** 8	**Move:** 5 (Water)
IQ: 2	**Per:** 11	**Weight:** 500 lbs.
HT: 10	**FP:** 10	**SM:** +1
Dodge: 7	**Parry:** N/A	**DR:** 2

Weak Bite (9): 1d-2 crushing. Reach C-2.

Traits: Bioroid Body; Doesn't Breathe (Gills; see notes below); Ichthyoid; Long Neck (+2 yards Reach for bite); Nictitating Membrane 1; Night Vision 5; Phobia (Humans) (9); Pressure Support 1; Resistant to Disease (+3); Scales; Temperature Tolerance 2; Wild Animal.

Skills: Survival (Fresh-Water Lake)-11.

Notes: The above attributes are under typical circumstances. The creature suffers -3 DX, -1 Move, and -1 Dodge if it has been unable to breathe air for at least 10 minutes in the last hour; and gains +3 DX, +2 Move, and +1 Dodge for 1d hours after consuming dietary supplements. Note also that it will respond instinctively and automatically to specific subsonic signals.

Sasquatch

see *Toxic Memes*, p. 76; -15 points

The Society's greatest success and currently its greatest worry.

Attribute Modifiers: ST+4 (Size, -10%) [36]; DX+1 [20]; IQ-4 [-80]; HT+4 [40].
Secondary Characteristic Modifiers: SM +1; Will+2 [10]; Per+3 [15].
Advantages: Acute Taste and Smell 2 [4]; Damage Resistance 1 (Flexible, -20%) [4]; Enhanced Move 1 (Ground) [20]; Fearlessness 1 [2]; Night Vision 5 [5]; Resistant to Disease (+8) [5]; Sharp Claws [5]; Temperature Tolerance 2 [2].
Perks: Fur. [1]
Disadvantages: Appearance (Monstrous) [-20]; Bestial [-10]; Bioroid Body [-4]; Dead Broke [-25]; Innumerate [-5]; Native Language reduced to Spoken (Broken)/Written (None) [-5]; Shyness (Crippling) [-20]; Social Stigma (Monster) [-15].
Date: 2094.
Cost: $75,000.

Notes and Variations

The Social Stigma reflects how humans will respond to these creatures if they encounter them closely enough to react to them as individuals. If more of the truth about the history and nature of the design becomes known, the Stigma may change to Subjugated, or merely to Valuable Property. Likewise, the creatures' Appearance may come to be rated far less negatively if humans get used to them.

2098 Version: Change Shyness (Crippling) to Shyness (Mild) [-5], increasing the template value to 0 points.

Destrier

59 points

A rare example of a nonhumanoid bioroid design with limited resemblance to any natural creature, the Destrier is intended as a riding and work animal, partly for hobbyists and partly for use in wilderness areas where even advanced vehicles sometimes have difficulty with the terrain. In practice, the market for the design has proved limited, but a few are in use around the world. A version optimized for Mars is being considered, but it is hard for a creature of this size to function efficiently and do heavy work in that planet's current atmosphere.

Just the Stats: Destrier

ST: 28	**HP:** 28	**Speed:** 5.50
DX: 10	**Will:** 10	**Move:** 10
IQ: 6	**Per:** 12	**Weight:** 2,200 lbs.
HT: 12	**FP:** 12	**SM:** +2
Dodge: 8	**Parry:** 8	**DR:** 1

Punch (10): 3d-2 crushing. Reach C, 1.
Weak Bite (10): 3d-8 crushing. Reach C, 1.

Traits: Bad Grip 2; Bioroid Body; Broken Native Language Only; Deep Sleeper; Domestic Animal; Fur; Innumerate; Night Vision 1; Semi-Upright; Temperature Tolerance 3.
Skills: Mount-10.
Cost: $144,000.

Just the Stats: Mars Camel

ST: 20	**HP:** 20	**Speed:** 5.00
DX: 8	**Will:** 12	**Move:** 10
IQ: 4	**Per:** 12	**Weight:** 1,200 lbs.
HT: 12	**FP:** 12	**SM:** +1
Dodge: 8	**Parry:** N/A	**DR:** 2

Slam (8): See p. B371; up to 2d crushing at move 10, then overrun and trample for 1d-1 crushing if opponent falls.
Trample (8): 2d+1 crushing on fallen victims.
Weak Bite (8): 2d-6 crushing. Reach C, 1.

Traits: Bad Temper (15); Bioroid Body; Colorblindness; Deep Sleeper; Domestic Animal; Fur; Hard to Subdue 2; Hooves; Mars-Adapted; Nictitating Membrane 1; Peripheral Vision; Quadruped; Radiation Tolerance 2; Reduced Consumption 3 (Water Only); Stubbornness; Temperature Tolerance 7; Terrain Adaptation (Sand).
Skills: Survival (Martian Desert)-12.
Cost: $52,000

The Destrier is a stocky, muscular creature with a semi-upright posture, although its gait when moving on four limbs is smooth. It can also use its front limbs as slightly clumsy arms, increasing its versatility and usefulness. It can wear a double saddle and carry two adult humans and some luggage. (A double saddle and riding tack cost $200 and weigh 20 lbs.)

Although I possessed the capacity of bestowing animation, yet to prepare a frame for the reception of it, with all its intricacies of fibers, muscles, and veins, still remained a work of inconceivable difficulty and labor.

– Mary Shelley, ***Frankenstein***

Some people assume that their all-too-camel-like psychology (irascible and not very cooperative) represents another aesthetic decision, but the designers swear that it is a useful pattern for a creature that has to survive in a harsh desert environment – and that they managed to tone it down from the original camel personality.

It has a face somewhere between that of a horse and a great ape, with good binocular vision, and thick fur, usually in a shade of brown.

The design incorporates biological elements from a number of herbivores and a few genes from gorillas, with a very efficient purely herbivorous digestive system, allowing it to live off the land without too much time spent grazing. Still, it functions best on a carefully balanced diet, heavy on grain. Its brain is designed to make it smart but not too unpredictable; it rates as borderline sapient on most tests and can manage simple conversations. Although its designers built the Destrier to last as well as they could, the strains on its system imposed by its size and typical workload give it a relatively limited lifespan.

Attribute Modifiers: ST+18 (Size, -20%) [144]; IQ-4 [-80]; HT+2 [20].
Secondary Characteristic Modifiers: SM +2; Will+4 [20]; Per+6 [30].
Advantages: Damage Resistance 1 (Flexible, -20%) [4]; Enhanced Move 1 (Ground) [20]; Night Vision 1 [1]; Temperature Tolerance 3 [3].
Perks: Deep Sleeper; Fur. [2]
Disadvantages: Bad Grip 2 [-10]; Bioroid Body [-4]; Dead Broke [-25]; Domestic Animal [-30]; Innumerate [-5]; Native Language reduced to Spoken (Broken)/Written (None) [-5]; Semi-Upright [-5]; Short Lifespan 2 [-20]; Weak Bite [-2].
Quirks: Attentive. [-1]
Features: Sexless; Taboo Trait (Mental Instability).
Racial Skills: Mount (A) DX [2].
Date: 2089.
Cost: $144,000.

Mars Camel

-62 points

Like the Destrier (pp. 29-30), the Mars camel is a bioroid beast of burden – but one that is specifically designed from the first for the Martian environment, while being closely based on a terrestrial animal. The designers, working for a group of sentimental Martian Saudi Arabians (***In the Well,*** p. 48), were permitted to sacrifice speed and a certain amount of strength to get the appearance right.

Mars camels are designed as riding and baggage *animals;* although they are a little smarter than terrestrial camels, they certainly aren't sapient. Some people assume that their all-too-camel-like psychology (irascible and not very cooperative) represents another aesthetic decision, but the designers swear that it is a useful pattern for a creature that has to survive in a harsh desert environment – and that they managed to tone it down from the original camel personality. This is true; Animal Handling rolls for Mars camels are at only -2.

The main snag with this whole concept, though, is that the bioroid's respiratory system is still based on that of a terrestrial animal, albeit with modifications analogous to an Andraste biomod – so, ideally, Mars camels need to wear air masks when outdoors. However, it's difficult to persuade a camel to wear a mask at all, let alone to keep one fitted properly. Although the creatures can handle high carbon dioxide levels, this pushes their food consumption up, so using Mars camels becomes an especially expensive and inefficient luxury.

Mars camels have carefully engineered hides and fur, making them incredibly resistant to cold; they can typically handle temperatures from about -70°F to 70°F. This is sufficient much of the time, but not enough for really cold Martian nights. Owners usually carry collapsible shelters for their animals, or plan their journeys with an eye on weather forecasts. As Martian temperatures rise, this part of the design may need further adjustment.

Only a few dozen Mars camels currently live on the planet, but they do look good in the right light. Work is underway on a racing variant that sacrifices even more strength in order to restore the real camel's speed.

Attribute Modifiers: ST+10 (No Fine Manipulators, -40%; Size, -10%) [50]; DX-2 [-40]; IQ-6 [-120]; HT+2 [20].
Secondary Characteristic Modifiers: SM +1; Will+8 [40]; Per+8 [40].
Advantages: Damage Resistance 2 (Flexible, -20%) [8]; Enhanced Move 1 (Ground) [20]; Hard to Subdue 2 [4]; Hooves [3]; Mars-Adapted [9]; Nictitating Membrane 1 [1]; Peripheral Vision [15]; Radiation Tolerance 2 [5]; Reduced Consumption 3 (Water Only, -50%) [3]; Temperature Tolerance 7 [7]; Terrain Adaptation (Sand) [5].
Perks: Deep Sleeper; Fur. [2]
Disadvantages: Bad Temper (15) [-5]; Bioroid Body [-4]; Colorblindness [-10]; Dead Broke [-25]; Domestic Animal [-30]; Quadruped [-35]; Short Lifespan 2 [-20]; Stubbornness [-5]; Weak Bite [-2].
Features: Sexless; Taboo Traits (Fixed IQ; Mental Instability).
Racial Skills: Survival (Martian Desert) (A) Per [2].
Date: 2095.
Cost: $52,000.

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We wish to suggest a structure for the salt of deoxyribose nucleic acid (D.N.A.). This structure has novel features which are of considerable biological interest.

– J.D. Watson and F.H.C. Crick,
"A Structure for Deoxyribose Nucleic Acid," ***Nature,*** *April 1953*