

Biotechnology in Traveller

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See Also the Genetics Catalogue

When the Science fiction genre was created back in the early 20th century, most of the current advances were in the fields of physics, aerodynamics, and engineering. These advances were projected into the future in order to create the background for science fictional stories. Even today, in the world of traveller, the term “high tech” applies mostly to these fields. In the last 15 years, a brand new type of science has emerged. This is the science of gene manipulation, and all of it’s consequent sciences such as biotechnology, gene therapy, and molecular biology. The potential ramifications of advancement in this field is both wondrous and terrifying. The experiments in physics were conducted on inanimate machines, there was always a distance between the research and the researcher. We, however, are biological entities, and the new science gives us the potential to manipulate and uncover the truths about ourselves. As with all branches of technology, the game master should rule on how far along the 3rd Imperium and other nations carried biotechnological research. I would expect a minimum of biotech level 10 (BTL10) as an imperial standard unless some major biotechnophobia has gripped humaniti for the last few thousand years. Enthusiastic researchers on key worlds may have gotten as high as BTL15, but progress beyond that level would seriously alter the tenor of the game. What follows are technological advances listed per tech level, along with examples of available products. Costs for each technology are included for a world of that tech level. As with all technology, the cost drops dramatically at higher tech levels, the products also become more compact, more efficient, and have slightly broader uses. For most products, this is left up to the GM, a rule of thumb of halving cost per tech level, increasing efficiency 10-50%, etc. These changes should only occur for 2-3 tech levels, after which further improvements cannot be made (The technology has reached a plateau).

Biotechnological Advances

Tech Level 8: (1990-2000 modern)

Molecular Biology really begins at this tech level. Genes can be identified, and traced through an organism’s development. Genetic Fingerprinting of unique code is possible. It would be possible to identify every gene (i.e. Human genome project), but would involve many decades of research and a budget of many nations. Simple genetic diseases can be

combated by Gene therapy. Individual cells can be cloned, and simple tissues (skin) can be grown in vitro. This allows major surgery (Dif:surg to Imp:surg) success implies that the patient has recovered from critical wounds (even from fire) with little permanent injury. Some growth hormones are crudely understood (such as steroids). Gene Therapy involves extracting some stem cells from the bone marrow, transforming them with new genes, and replacing them inside the patients bones. In this way, substances can be fabricated by the new cells, and injected into the bloodstream. In this way diseases such as phenylketonuria, and diabetes can be combated.

Example Products

BTL8 Steroid Program Cost: 3000cr for 3 month program.

A three month program of BTL8 steroid usage can increase strength by +1. At the end of the activity period, an average roll vs constitution will determine side-effects. Failure indicates that minor side effects have occurred, these could include infertility, impotence, and acne. Catastrophic failure indicates that health has been seriously compromised by unequal development of the circulatory system, there is an immediate permanent -2 con penalty, as the risk of heart attack and stroke increases.

Tech Level 9: (Embryonic transformation/ human cloning)

This tech level assumes that the human genome has been successfully sequenced, along with many other life forms. A better understanding of body development allows for use of several developmental drugs. Selection of offspring for sex, hair color, and a host of other factors is possible, but changes cannot be made after the embryo begins to develop. Gene therapy can now be used on embryos, correcting most genetic diseases permanently.

Immortality: Physical immortality can begin anywhere from BTL9-11 depending on the GM. It is the result of the shutdown of the natural death program (see notes). If modern experts are correct, this will involve a simple gene therapy applied to some cells in all tissues (20-50KCr) or to embryos (10KCr). It extends life by about double (150-200yrs), and death is usually due to cancer. At BTL10, the cure for cancer increases the average lifespan to 300yrs and death will be due to brain disfunction. Finally by BTL16-17, full immortality should be possible, and death will only occur through injury or disease. Ironically, this will have little affect on society, as we are already (at TL8) having fewer and fewer children, and living longer and longer. Physical immortality nearly carries this trend to its extrem.

BTL9 High Hemoglobin Gene Cost: 15,000Cr

This gene can be introduced into the bone marrow via Gene Therapy. It increases the hemoglobin content of the blood by a factor of 10. This alters the blood chemistry to allow the player to go without oxygen for 20 minutes.

BTL9 Toxin Resistance Gene Cost: 10,000Cr each

Introduced both through bone marrow and embryo gene therapies, each of these genes will give partial or complete resistance to a bevy of designer toxic substances. This has civilian uses (allowing transformed players to breathe normally on tainted atmospheres), as well as the obvious military and covert operations uses. For Military use, the toxic can also

be purchased in liquid form (20cr/dose) or gaseous dispersed form (200cr/grenade equivalent). Toxins protected against can be Vomiting-inducing, blood agents, blister agents, or nerve gas. NB: Not all toxic substances can be protected against in this manner, and in many cases, the protection only reduces the effectiveness of the toxin ($\frac{1}{2}$; damage).

Tech level 10:(biotech revolution)

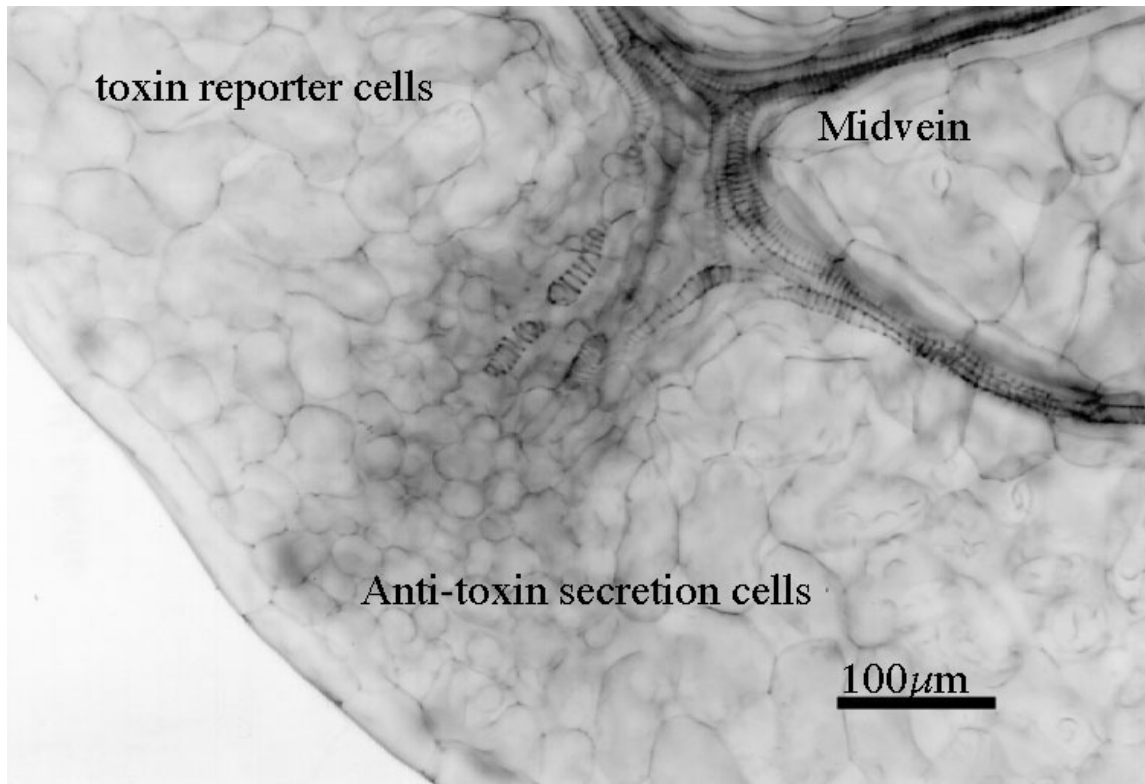
Finally, a good understanding of human development and genetic systems is available. Cancer is finally cured. Most of the body organs can be simply regrown and replaced. This dramatically extends expected lifespan of middle and upper classes (120-150yrs). The principle cause of death is invariably a brain disorder, which of course creates large social problems in dealing with the elderly. This is a threshold breaker which allows for a bevy of new technologies. Recombinant technology allows Gene Therapy on adult hosts, transforming living cells through a viral or parasitic vector.

BTL10 Organ replacement Cost: 15000cr

Private companies will now be able to clone and fabricate tissues and organs of the circulatory and gastrointestinal tract. Formerly fatal wounds can be recovered as long as the PC can get to the hospital in time. There is no chance of rejection, and morphogen treatments insure that no permanent damage (or even scarring) remains. Old scars can be re-worked into normal tissue (cost 100-1000cr), cosmetic surgery is now fully natural (2-5000cr).

BTL10 Steroids Cost: 3000Cr for 1 month treatment

Finally, we understand how muscles work. Each treatment will increase strength by +1, but only 3 treatments can be undertaken safely. The use of BTL8 steroids prohibits this treatment. BTL10 Disease Resistance Genes Cost: 5000cr per gene These operate much like the toxin resistance genes, but they need to be introduced into every cell of the body, not just the bone marrow. Military uses would include strategic use of specially tailored diseases (viral or bacterial) prior to operations.



Tech Level 11:(Dawn of Organic technology)

Other organisms developmental systems are now understood, this allows the Biotechnological industry to break away from medicine, and branch into other aspects of life.

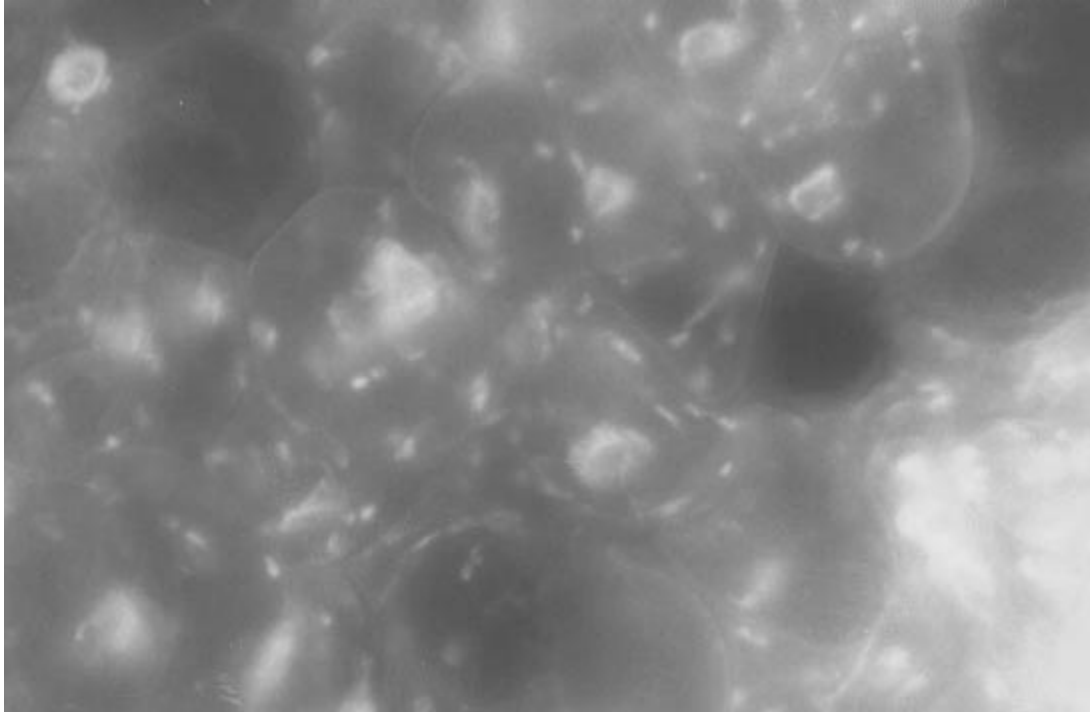
BTL11 Biofilters Cost: 10,000cr / metric ton

These are artificial organs which process and detoxify atmospheres aboard ships and stations. The gaseous-type filters (G-filters) absorb CO₂, poisonous gases, and some viruses, and replace oxygen and water vapor. G-filters can be placed anywhere in a ventilation system, but need a large surface area (20m²/ton). They passively absorb gas through tiny holes in their surface called stomata, while the processing cells are fed by chemical ions which are recharged electrically (requiring 10Kw per ton). Each metric ton will filter the gaseous wastes of 10 average humans when used a ship or station life support system. A second system filters and process liquid and solid biological wastes, it only processes 3 average humans per ton, but needs no surface area. Biofilters can only filter out toxins slowly (10m³ per hour), and cannot deal with concentrated toxin attacks.

BTL11 Epidermal bandages Cost: disposable 50cr/Regenerating 500cr

Small living patches of plant/animal organs which can be applied to damaged tissues. At BTL11, these simply clean and disinfect wounds, as well as blocking bleeding.

Regenerating bandages are fed a sucrose-nutrient solution, and kept in a special carrying case (0.5kg) T112 models digest damaged tissue, and stimulate cell growth amongst healthy tissues. T113 includes rapid regeneration (2x healing rates), and can stiffen up like a splint, but the bone still has to be correctly set.



Tech level 12:(Gene Families)

At BTL12, an understanding of simple neural development has been achieved, but the complex development of the brain is still not approachable. More complex artificial organs can be constructed, their size decreases by a factor of 10 or so. Gene therapies now transform entire gene families into existing humans, but integration with existing genes is still a problem, and a lot of horrible genetic accidents occur in 1 of 10 transformations (Requiring wavers to be signed prior to treatment).

BTL12 Regeneration gene package Cost: 10000cr

This consists of a set of genes which allow rapid recovery from wounds, and offset the effects of shock and trauma. Knockdown value is increased by +1, wounds (if not infected) recover at twice the normal rate. There are side effects however, food and water intake increases by 20%, the effects of dehydration and starvation are doubled, and the higher metabolic rate decreases lifespan by 10-20%.

BTL12 Agility steroids/ gene therapy Cost: 5000cr per 1 month treatment

Only one treatment will be of benefit, but agility is improved by +1. This cannot be attempted if lower tech level steroids have been taken.

BTL12 Suit Bio-respirator Cost: 3500cr

This is a miniaturized version of the G-filter, fitted to a suit backpack. It weighs 25kg, and uses only 1kw electricity. It can supply oxygen as long as electricity is available.

BTL12 Anti-Toxin filter/secretor Cost: 7500cr

This is actually a potted (or hydroponic) plant which constantly scans an environment for toxic substances. It's reporter cells send samples of these chemicals to the rest of the plant,

which then derive an antidote. This antidote is then secreted through the hydathodes at the tips of each leaf. Thus eating the dew of this plant cures most poisonings. The cost of this plant drops to 750Cr at T13, as it becomes easier to clone. Each plant normally lives for 20 years, and is sterile (no seeds- so they can sell you another plant).

Tech level 13:(The age of the organic machine)

It becomes possible to extensively modify the basic human form, but very few of these changes are inherited. Gross modification of the human form at the genetic level is attempted, but mostly results in monstrosities, causing fear among populations. As a result, very few worlds have evolved beyond tech level 13 in terms of biology.

BTL13 Hypodermic homeostasis root Cost:5000cr

This is a small emergency aid device, which is quickly unpacked and clamped on the skin like an epidermal bandage. It's roots dig painlessly into the skin and seek out the circulatory and lymph systems. Secretions from the plant body then make an attempt to restore homeostasis to the patient, quickly stabilizing traumatic wounds without a doctor.

BTL13 Body replacement Cost:40000cr

The only organs not easily replaceable are the brain and spine. Even these organs can be removed from one body, and placed inside another. The second body can be salvaged from another human, or can be fabricated (takes 6-12 months) from organs generated by cloning. Some companies will synthesize and keep fabricated organs alive for an extremely high price.

BTL13 Organic Machines Cost: 10x mechanical equivalent

Simple mechanical devices can be replaced by living facimilies. These can include metal parts attached to muscles, bone, chitin, and sinew covered by skin. These machines eat a variety of substrates, from oxygen/sugar-nutrient, light, or electrolytic ions. These do not become more efficient than their mechanical counterparts until tech level 15. However, damage to an organic machine can be regenerated medically, making them ultimately more versatile than mechanics.

Tech level 14:(Heritable genetic alterations)

Improvements to previous tech levels are made, along with improved chances of altering human forms. Cosmetic gene therapy can alter appearance and abilities heritably, but horrible side effects in second and third generation children still occur with alarming frequency. Organic machines become increasingly more complex.

T14 Living Suit Cost:4500cr

This is a self-sealing suit which acts like a second skin, wrapping around the body (which must be naked). It provides oxygen intravenously, and removes and processes wastes, requiring 4kw electricity to do so. A fully organic variant can survive on sunlight, but need to deploy 40m² wings, and supplies sugars as well. This will enable a human to survive in the continuously habitable zone of a star (or closer).

BTL14 Organic Wings Cost:5500cr

This is a simple one-person flying machine which can be strapped to the back of a person. It uses feathers and hollow bones, along with an ultralight metal frame.

Tech level 15:(On the verge of the sentient organic machine)

Tech Level 15 is a breakthrough level. The mysteries of the human brain have begun to reveal themselves, Gene family transformation is now fully heritable, with no side effects. It is possible to alter the race of a person, but not the personality or memories. Many people experimenting with this new technology have created major races of agricultural animals literally from scratch. Bio-organic machines made in secret now use brain matter as living computers (Though far inferior to silicon computers). It is also possible to integrate existing human brains into organic machines. The next advances in organic technology would have produced living cybernetic starships, with volunteer human brains incorporated directly into the architecture. This research was forestalled, ironically, because of the ethic problems of having sentient machines and starships

BTL15 Organic Automated facility Cost: 1-2Mcr

Still experimental at the height of the imperium, this is a large (11 ton) organic machine which consumes 200kw electricity, as well as a host of nutrient chemicals. A body is placed inside the mouth of the machine, which takes it into a sealed internal chamber. Inside the entire body is dissected, each organ is taken apart, while the spine-brain system is kept alive. New tissues or organs are fabricated, and then woven back into a body around the old brain-spine. This process takes anywhere from 2 days to 3 months, depending on the level of damage. In some miraculous cases, a severed head has been rebuilt into a body, after being kept in stasis (with a hypo-root patch) for 3 days... but this is far from the rule with this machine. Later models will allow the patient to communicate with the outside world (as the new body is being grown) through interface workstations, or even cybernetic robots.

Notes: I have deliberately avoided existing traveller medical technology because it is so vaguely defined, and appears at inappropriate tech levels (e.g anagathics). Somewhere around tech level 10, we should be able to figure out how to keep our bodies young and fit artificially. By tech level 16 the human becomes effectively immortal, replacing and regenerating all tissues externally, and perhaps by tech level 17 internally. What most people don't realize is that immortality is the default state of all biological systems, and that death is a deliberate genetic program. There are some things which biology cannot do... biological changes are slow, and low energy and rely on complex interactions. Shape-shifting, high-energy weapons, and changing mass are impossible biologically, no matter what tech level. Altering the shape of existing tissue is nearly impossible, it is much easier to chop organs away, grow new ones of the desired shape, and knit them back into place. I have assumed that the many races of "alien" animals and humaniti have been fabricated from terran primates by the ancients. This means that Terra (earth) should be the only world in the imperium with a geological record of evolution. Work of this kind is at least

tech level 16, probably early in the ancients development, what kind of biological breakthroughs they achieved at tech level 22 (their assumed peak) I dare not speculate.