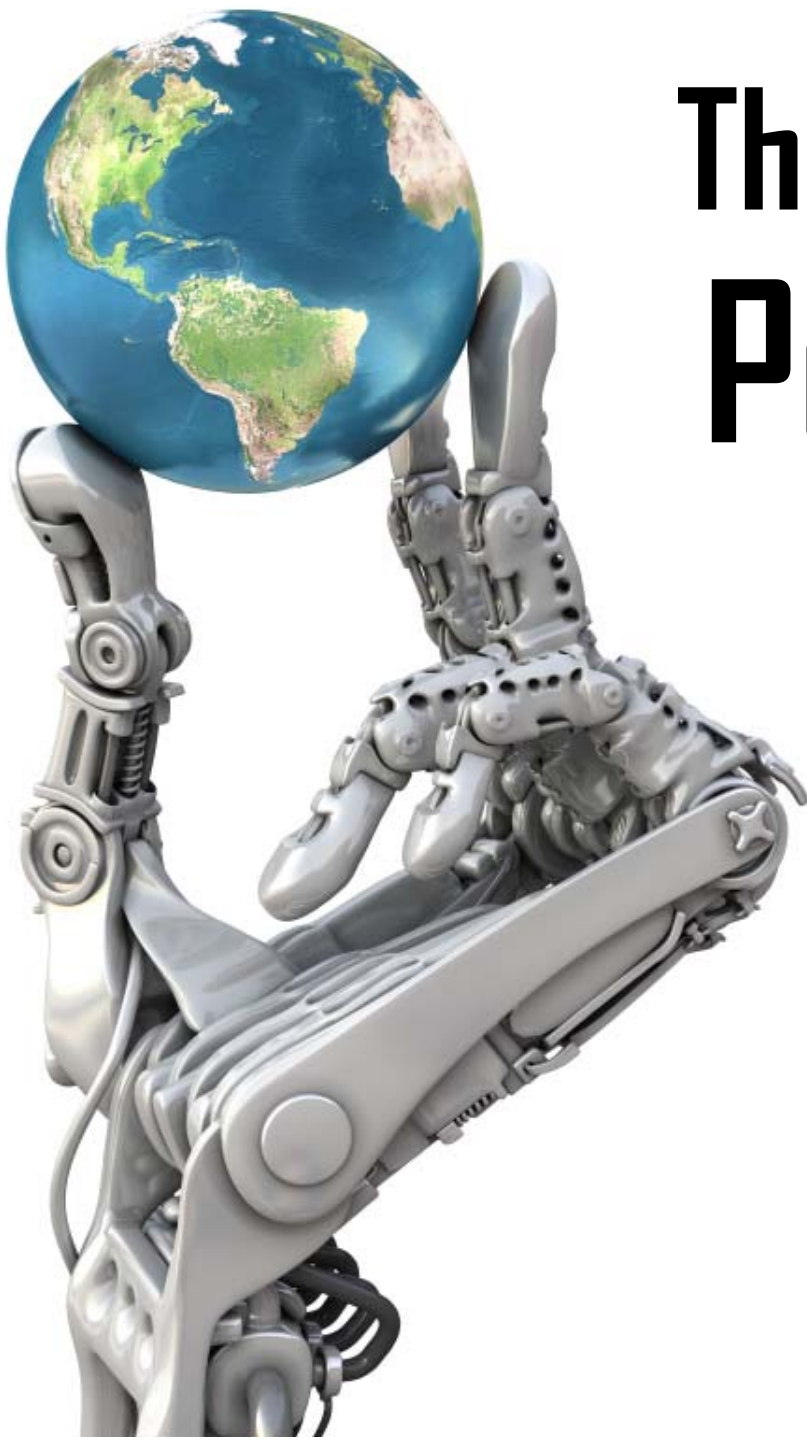




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The Science of Possibility

Every once in a while, a scientific breakthrough comes along that changes the world in a way no one could have imagined. Recently, there have been so many amazing breakthroughs, it's almost impossible to keep track of the amazing trajectory of our insights and knowledge. What are historians likely to say about the science of 2008? In this week's publication, we preview three amazing breakthroughs that may change the world forever. . .



Possibility:

Ability to grow human tissues and organs in a lab

ETA:
2017 AD

For many of us, the term “stem cells” has become so politically charged that the science has been overlooked. Stem cells have the unique capacity to take on the characteristics of the cells that surround them. The applications of a mature stem-cell infrastructure are magnificent. Stem cells could be conditioned to repair damaged organs, restore movement and sensation to those suffering from paralysis, and even reverse the aging process. Unfortunately, right now, these applications are theoretical because research has been sparse and poorly funded. Stem cells bring with them a host of ethical problems. Most notably, stem-cell research is most commonly conducted with aborted fetuses. Many opposed to abortion fear that if and when stem cells are capable of performing these life-saving feats, there will be increased pressure to find fetuses for research, and, thus, increased pressure to abort fetuses. The result has been a very confusing and complicated research environment for scientists.

In 2007, two amazing breakthroughs reset the stem-cell debate and quieted many opposed to the research. The first breakthrough involved cloning. Last year, researchers cloned a monkey—the closest genetic match to a human. The researchers then took the resulting embryo to make stem cells. Until then, this transformative feat had only been achieved with small mice embryos, despite years of effort with other animals. The research team revealed the key to its success was eliminating the use of ultraviolet lights and dyes, which can damage the delicate cells. Previously, such tools were the cornerstone of stem-cell research. With this new knowledge, scientists now believe it is possible to clone an embryo from a human being and use the resulting cells to repair damaged tissues and organs in that same person. Of course, this creates as many ethical problems as it solves, which is why the second development is so important...

Towards the end of 2007, a research team at Kyoto University successfully converted skin cells into stem cells. The resulting stem cells are more limited than those obtained from human embryos, but some scientists believe these limitations can be overcome with more research. The most important limitation of stem cells derived from skin cells is their tendency to become cancerous. However, the research team claimed in an interview in November that this problem had been solved by using one less growth gene. If this claim proves true, the ethical issues disappear, and many believe funding for the research will skyrocket.

A microscopic view of numerous red blood cells, which are biconcave discs, floating in a dark red fluid. The cells are illuminated from the side, creating a sense of depth and highlighting their texture.

Possibility: Infinite supply of transferable blood

ETA:
2014 AD

Unless you are a hospital administrator, you may not be aware of how many people die for lack of quality blood-transfusion supplies. Anytime there is a crisis requiring a lot of blood transfusions (a 23-car pileup, for instance), hospitals can have their supplies depleted more quickly than they can replace them. To complicate things further, every patient requires a specific type of blood. If a patient is given the wrong blood type, sugars in the red blood cell cause the immune system to malfunction and attack the body. The traditional response has been public awareness. Local hospitals and health organizations hold blood drives, in hopes of banking as much blood as possible. Unfortunately, volunteers are unpredictable and may not supply the types of blood needed by the hospital at that particular time. It's a troubling situation but not a desperate one...

Nature provides us a clue as to how we may solve this problem: Type O blood. People with Type O are considered "universal donors", meaning anybody can receive their blood without complications. This works because Type O blood is devoid of the sugars that cause incompatible immune systems to misfire. In a perfect world, all blood would be Type O, allowing every person to donate blood to every other person, thus alleviating blood shortages. Over the last 2 years, we have moved closer to this perfect scenario. In the Spring of 2007, a professor in Denmark detailed a method for stripping bloods of their unique sugars and filtering any blood type to Type O.

Fortunately, this technology is moving from theoretical to practical at record speed. Start-ups such as ZymeQuest are currently developing products that use this technology to make blood-transforming machines that can be used by hospitals during blood shortages.

Beyond the initial application of changing blood to be universally transferrable, the professor's achievement proves that it is possible to alter the properties of blood without damaging it. In the future, blood banks may be able to use similar technology to collect blood from people who were previously considered unviable due to infections and drug use and filter the blood so that it is safe for transfusions.

Possibility: Discovering other planets friendly to human life

ETA:
2025 AD

Millions of science fans have followed the Mars Rover missions with intense interest, though Mars is actually quite boring from a scientific standpoint. We know that Mars is devoid of intelligent life now. We can further surmise that Mars has been devoid of any life for millions of years. Finally, we may soon conclude that Mars never had life on it, except for a few small bacterium and some uninspiring plant life, which may have actually careened off of an asteroid from our own planet. So, why are we spending so much time and money exploring Mars? There are legitimate scientific reasons; they just aren't that exciting. The real reason we study Mars is because it's close and relatively easy to explore.

Today, astrobiologists have their eyes fixed on the horizon—about 20 million light years away, to be exact. Stephane Udry recently located two planets that have very similar properties to Earth. They have very similar climates, similar solar cycles, and are made of similar materials. None of this is proof that life exists on these planets, but both planets are more promising and more exciting than Mars. To top it all off, 20 light years is considered relatively close in cosmic terms. It is conceivable that we may, one day, be able to explore these planets in the same way we are exploring Mars today.

There are a lot of reasons why we would want to study planets similar to ours beyond blind curiosity. For instance, by studying the climate patterns of similar planets without human life, we can better understand the human effect on climate. We may also come to better understand the limits of human life by finding life in other parts of the galaxy--even if it is very small and simple (i.e., bacteria). In the distant future, one of these planets may even serve as our final destination, if Earth was to be threatened by asteroids, radiation, or some other unforeseeable cosmic turbulence. It always helps to have a Plan B.

Beyond the obvious applications of finding planets similar to Earth, Udry's discovery is likely to usher in a whole new era of planetary discoveries, since he pioneered several innovative imaging techniques for locating and understanding distant planets.