I stand in negation of the resolution which states, Resolved: Science leaves no room for free will.

In order to clarify this debate, I offer the following definitions of *science* and *free will*.o

First, as defined by Oxford English Dictionary, *science* is **“The** intellectual and practical **activity encompassing the systematic study of the structure and behaviour of the physical and natural world through observation and experiment.”**[1]

Second, Doctor of Philosophy Kevin Timpe explains *free will* as **“**Minimally, **to say that an agent has free will is to say that the agent has the capacity to choose his or her course of action.** But animals seem to satisfy this criterion, and we typically think that only persons, and not animals, have free will. **Let us** then **understand free will as the capacity unique to persons that allows them to control their actions.”**[2]

Thus I offer three contentions to negate this resolution.

Contention One: Advances in modern physics support the existence of free will on a small scale.

David Harrison from the University of Toronto explains in 2011 why modern physics is a preferable lens for viewing the discussion of free will, stating that

[Einstein, Rosen "Bell's Theorem," http://www.upscale.utoronto.ca/PVB/Harrison/BellsTheorem/BellsTheorem.html

This document was written in February 1999 by David M. Harrison, Department of Physics, University of Toronto 03/17/06.]

**"Classical physics provided a mirror that reflected only the objective structure of the human being who was the observer. There is no room in this scheme for his mental process** which is thus regarded as separate or as a mere 'epiphenomenon' of the objective processes. ... [Through the] mirror [of quantum physics] the observer sees 'himself' both physically and mentally in the larger setting of the universe as a whole. ... More broadly one could say that through the human being, the universe is making a mirror to observe itself." --”

As a result, Tom Hartsfield writes in 2013 that Bell’s inequality, an advancement in the mathematics of modern physics,

[Quantum Mechanics, 4-3-2013, "Quantum Mechanics Supports Free Will," No Publication, http://www.realclearscience.com/articles/2013/04/03/quantum\_mechanics\_supports\_free\_will\_106499.html Tom Hartsfield, 2013]

His famous theorem, Bell's inequality, is an incredibly profound statement. This relatively simple mathematical proof, **when applied to experimental results, gives us a choice: We must either give up determinism or give up the existence of an objective reality explained by science and measurable by humans with instruments.** (You can read the gory details about the experiments [here](http://www.upscale.utoronto.ca/PVB/Harrison/BellsTheorem/BellsTheorem.html).)So **if experiments on quantum phenomena are reliable, then Bell concludes that determinism is false.** Most physicists agree.Essentially,quantum mechanics tells us that there are things which we cannot know about the future, things which are not predetermined but happen with some factor of chance or randomness. Although many things in the world may be predicted, everything is not predetermined, and our actions do not unfold mechanically in a manner predetermined since the very moment of the Big Bang. Free will is preserved.

These experiments are reliable as Koch writes that on the quantum level,

“The deathblow to the Newtonian dream—or nightmare, in my opinion—was the celebrated quantum-mechanical uncertainty principle, formulated by Werner Heisenberg in 1927. In its most common interpretation, it avers that any particle, say, a photon of light or an electron, cannot have both a definite position and a definite momentum at the same time. If you know its speed accurately, its position is correspondingly ill defined, and vice versa. **Heisenberg’s uncertainty principle** is a radical departure from classical physics. It **replaces dogmatic certainty with ambiguity.** Consider an experiment that ends with a 90 percent chance of an electron being here and a 10 percent chance of it being over there. If the experiment were repeated 1,000 times, on about 900 trials, give or take a few, the electron would be here; otherwise, it would be over there. Yet this statistical outcome does not ordain where the electron will be on the next trial. Albert Einstein could never reconcile himself to this random aspect of nature. It is in this context that he famously pronounced, “*Der Alte würfelt nicht*” (the Old Man, that is, God, does not play dice). **The universe has an irreducible, random character.** If **it** is a clockwork, its cogs, springs and levers are not Swiss-made; they **do[es] not follow a predetermined path. Physical determinism has been replaced by the determinism of probabilities. Nothing is certain anymore.”** On a larger level, characterizing the motion of the atmosphere. The solution predicted by his computer program varied widely when he entered starting values that differed by only tiny amounts. This is the hallmark of chaos: **infinitesimally small perturbations in the equations’ starting points lead to radically different outcomes.** In 1972 Lorenz coined the term “butterfly effect” to denote this extreme sensitivity to initial conditions: the beating of a butterfly’s wings creates barely perceptible ripples in the atmosphere that ultimately alter the path of a tornado elsewhere. Remarkably, **such a butterfly effect was found in celestial mechanics, the epitome of the clockwork universe**. Planets majestically ride gravity’s geodesics, propelled by the initial rotation of the cloud that formed the solar system. It came as a mighty surprise, therefore, when computer modeling in the 1990s demonstrated that **Pluto has a chaotic orbit,** with a divergence time of millions of years. Astronomers cannot be certain whether Pluto will be on this side of the sun (relative to Earth’s position) or the other side 10 million years from now! **If this uncertainty holds for a planet with a comparatively simple internal makeup, moving in the vacuum of space under a sole force, gravitation, [it has implications regarding]** what does it portend for **the predictability of a person**, a tiny insect or an itsy-bitsy nerve cell, all of which are swayed by countless factors?

All of this leads Dr. Michio Kaku noting in 2013 that,

Michio Kaku, 2013 "Why Physics Ends the Free Will Debate," Big Think, <http://bigthink.com/videos/why-physics-ends-the-free-will-debate>

“So what does that mean for free will? It means **in some sense we do have some kind of free will.** No one can determine your future events given your past history. There is always the **wildcard. There is always the possibility of uncertainty in whatever we do.** So when I look at myself in a mirror I say to myself what I'm looking at is not really me. It looks like me, but it’s not really me at all. It’s not me today now. It’s me a billionth of a second ago because it takes a billionth of a second for light to go from me to the mirror and back.

This is furthered by the work of,

Michio Kaku, 2013 "Why Physics Ends the Free Will Debate," Big Think, <http://bigthink.com/videos/why-physics-ends-the-free-will-debate>

“Here's the rub: the **Nobel prize winning condensed matter physicist Philip Anderson, [who]** wrote a famous article entitled ‘More is Different’ in 1972  where he **defended the view that the laws and principles he studied as a condensed matter physicist were emergent  and there are plenty of phenomena exhibited by macroscopic systems whose existences cannot be predicted directly from an underlying, microscopic theory.   In other words, the information obtained from the whole can’t be explained by the sum of information from each individual element.**Simply put, **just because matter in the universe-** including all atomic constituents in the human body- **obeys certain physical laws, it really doesn't follow that the choice itself must also be bound by the same laws.** There is a huge gap here which is not explained by this line of reasoning. This is simply bad logic**.**

To summarize the basics of this argument, Stephen Cave writes for the Atlantic in June of 2016 that

Stephen Cave, 6-10-2016, "Free Will Exists and Is Measurable," Atlantic, http://www.theatlantic.com/notes/2016/06/free-will-exists-and-is-measurable/486551/

 “On a different note, Alexander and some other commentators point out that **quantum mechanics demonstrates that the world is not straightforwardly deterministic.** In this, they are right: **quantum indeterminacy implies that physical reality has an irreducibly probabilistic nature.** Other readers have pointed out that **even classical physics does not always allow us to accurately predict what will happen: According to chaos theory, any of an incalculably huge number of tiny differences in initial conditions can lead to radically different outcomes.** (At least, that’s the excuse weather forecasters use for getting it wrong.) This too is a fair point**.”**

All in all, current science suggests that because of the inherent unpredictability of small particles and the huge array of permutations surrounding any single event, science supports the notion of free will.

Contention Two: Current scientific methods for measuring free will are flawed.

The groundbreaking study that lead to many scholars assuming free will does not exist is called the Libet experiment, an experiment in which participants were told to randomly choose when to move their hands. Then, their brain activity was studied, and it was concluded that the subconscious mind predetermines human action, thus eliminating the possibility that free will is a conscious experience. Since this study in the early 1980’s, many scientists have attempted to replicate the results in order to come to the ultimate conclusion that free will is an illusion.

Dr. Mahir S. Ozdemir explains why this method of deciding if free will is flawed for four reasons. First, he writes that,

[Mahir S. Ozdemir, Ph.D., 1-27-2015, "A Scientist’s Defense of Free Will," Creativity Post, http://www.creativitypost.com/science/has\_neuro\_science\_buried\_free\_will]

**“The assumption behind all this empirical evidence against free will is that conscious decision takes place at an instant which can be compared with the neural activity corresponding to it.”**

The problem with this analysis is that there is a fundamental difference between the brain’s action of signalling to organs and the brain’s awareness of this signalling. Just like with infants learning speech, the level of awareness of this learning occupies a spectrum of consciousness rather than a binary switch of aware or unaware.

Second, Dr. Ozdemir continues that

[Mahir S. Ozdemir, Ph.D., 1-27-2015, "A Scientist’s Defense of Free Will," Creativity Post, http://www.creativitypost.com/science/has\_neuro\_science\_buried\_free\_will]

“Another fundamental aspect which is widely overlooked in **these studies** is that they **provide no proof whatsoever that brain activity could happen without conscious decision taking place.”** The evidence against free will comes with the interpretation that it is possible for the brain to take action without somewhere first deciding to take that action. This assumption, which these studies rely on, has never been proven. “**A methodological flaw** that strikes me as odd **is that these experiments always involve a test subject fully aware of the choice they are going to make.”**

Ozdemir argues that this is problematic because it provides an oversimplified picture of the real decision-making processes in the brain as well as involving only procedural memory in the process. This is negative because it again reduces complex brain processes to a point where they are no longer wholly relevant to the examination of a broad topic such as free will.

Finally, Ozdemir notes that the experiments which supposedly render free will a false concept all hinge on the notion that decisions are governed by the laws of nature which make up classical physics. Despite the fact that humans may be unable to break such laws, as evidenced by our inability to fly or accelerate with more force than the product of our mass and acceleration, that does not stop humans from making decisions that defy these laws. The outcome of such a decision does not matter; people can decide to attempt to fly or survive in a vacuum whenever they want, and this represents an exercise of creative free will that is unbounded by the rational laws of physics.

Contention Three: Science has a limited capability to describe the world.

Science, in our Western conception, is very limited. For centuries, humans have practiced science through allegorical mythology, through the practice of alchemy, and by turning to spiritualistic tradition to explain their lived experiences. Our modern understanding of science is also limited by our advances in technology. For example, we cannot test the bounds of space travel without the right equipment, just as we cannot delve into the matters of the human unconscious without more accurate tools. The science of today will not be the science of tomorrow.

Meredith Bryan for CNN in 2010 explains,

Meredith Bryan,, 12-7-2010, "3 mysteries science can't solve," No Publication, http://www.cnn.com/2010/LIVING/12/07/o.science.mysteries.not.solved/

“**It's only in the past 80 years that experts have lined up behind the big bang theory,** which took off after Edwin Hubble's 1929 discovery that the billions of galaxies in the universe are not fixed in place but rather moving away from each other, presumably launched by the explosion of some very hot primordial atom.**”**

indicating that even the most fundamental questions about our existence are yet to be solved with our conception of science.

She furthers that we cannot even identify the exact number of species on this planet due to the unpredicatbility of genetics. Due to this ever-changing process engaging with science, it cannot be stated that science leaves no room for free will as an absolute, definitive statement. At this point, there is no unified theory of everything to describe how electromagnetic, strong, and weak forces interact with each other in the same way that science has yet to reconcile completely with religious experiences and beliefs. Realistically, science still leaves room for infinite possibility.

To affirm the statement that science leaves no room for free will is to state that within our inexact methods of studying the universe, there lies no possibility for the existence of free will; due to the limits of science, such an absolute statement ignores the vast secrets in the world humans have yet to discover.