

Charles Darwin, Samuel Wilberforce and How We See the Color of Ants

"We are not afraid to entrust the American people with unpleasant facts, foreign ideas, alien philosophies, and competitive values. For a nation that is afraid to let its people judge the truth and falsehood in an open market is a nation that is afraid of its people."

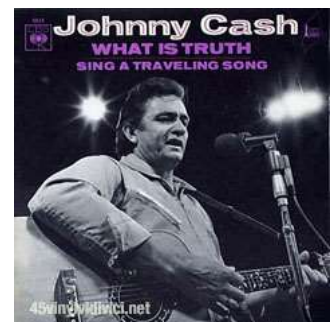
From "Remarks on the 20th Anniversary of the Voice of America,"
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Likewise, in our personal struggle to keep what is good, bring in what is better, remove the bad, and keep out the worst, we should not be afraid to entrust students, including science students, with unpleasant facts, foreign ideas, alien philosophies, and competitive values in their own personal **search for truth**. After all, while I believe that truth exists, and that the truth will set you free (John 8:32), I also believe that none of us (including me) has a monopoly on the truth. Pilate asked (John 18:38) “*What is truth?*” More recently, Johnny Cash asked *What is Truth* and sang
(<https://www.youtube.com/watch?v=qO5z2xUNUpU>)



*You better help the voice of youth find
"What is truth"
And the lonely voice of youth cries
"What is truth?"*



In *A Few Good Men* Tom Cruise said “*I want the truth.*”
<https://www.youtube.com/watch?v=9FnO3igOkOk> We should all ask, in everything we study and do, *What is truth?*



In the last lecture I talked about **eyes**, both human and animal, and the conditions and compromises that are necessary for seeing in **water and/or air**, seeing during **daytime and/or during the night**, and seeing for **predators and their prey**. Looking at the eye, **William Paley** concluded that the Creator must be good. Paley (1802) wrote, “*The proof of the divine goodness rests upon two propositions; each, as we contend, capable of being made out by observations drawn from the appearances of nature. The first is, ‘that, in a vast plurality of instances in which contrivance is perceived, **the design of the contrivance is beneficial.**’ The second, ‘that the Deity has superadded pleasure to animal sensations, **beyond what was necessary for any other purpose**, or when the purpose, so far as it was necessary,’ might have been effected by the operation of pain.*”

Nature is not simple and there are difficult questions for everyone to ask and answer. Paley saw nature in terms of evidence of the goodness of God. However others, such as Augustin Pyramus de Candolle (1820) saw nature as war-like:

“*All the plants of a given country, all those of a given place, are **at war one with another.** The first which establish themselves by chance in a particular spot, tend, by the mere occupancy of space, to exclude other species—**the greater choke the smaller**, the longest livers replace those which last for a shorter period, the more prolific gradually make themselves masters of the ground, which species multiplying more slowly would otherwise fill.*”



De Candolle's thinking became known in artistic circles. The poet, **Alfred, Lord Tennyson** (1849) wrote in *In Memoriam A.H.H.*, a poem about hope after great loss that took seventeen years to write: <http://www.online-literature.com/tennyson/718/>

*Are God and Nature then at strife,
That Nature lends such evil dreams?
So careful of the type she seems,
So careless of the single life;*

*Who trusted God was love indeed
And love Creation's final law
Tho' Nature, red in tooth and claw
With ravine, shriek'd against his creed*



And the theme *red in tooth and claw* was taken up by Sting in *I was Brought to My Senses* (<https://www.youtube.com/watch?v=QrLF4HymAs4>)



De Candolle's thinking was considered by scientists such as the geologist **Charles Lyell** (1832), the botanist **William Jackson Hooker** (1834) and the polymath **Herbert Spencer** (1852). Spencer wrote

“On contemplating its general circumstances, we perceive that any race of organisms is subject to two sets of conflicting influences. On the one hand by natural death, by enemies, by lack of food, by atmospheric changes, &c., it is constantly being destroyed. On the other hand, partly by the strength, swiftness, and sagacity of its members, and partly by their fertility, it is constantly being maintained.” Spencer then uses



physical analogy. *“These conflicting sets of influences may be conveniently generalized as—the **forces destructive** of race, and the **forces preservative** of race. Whilst any race continues to exist, the forces destructive of it and the forces preservative of it must perpetually tend towards **equilibrium**. If the forces destructive of it decrease, the race must gradually become more numerous, until, either from lack of food or from increase of enemies, the destroying forces again balance the preserving forces. If, reversely, the forces destructive of it increase, then the race must diminish, until, either from its food becoming relatively more abundant, or from its enemies dying of hunger, the destroying forces sink to the level of the preserving forces. Should the destroying forces be of a kind that cannot be thus met (as great change of climate), the race, by becoming extinct, is removed out of the category. Hence this is necessarily the law of maintenance of all races; seeing that when they cease to conform to it they cease to be.”*

Charles Darwin also saw nature in terms of war and warfare. In 1858, in a manuscript not intended for publication, Charles Darwin began: *“De Candolle, in an eloquent passage, has declared that **all nature is at war**, one organism with another, or with external nature. **Seeing** the contented face of nature, this may at first well be doubted; but **reflection** will inevitably prove it to be true.”*



Charles Darwin went on to say that the war exists, in part, because each species has the ability to produce an exponentially increasing number of offspring: *“Nature may be compared to a surface on which rest ten thousand sharp wedges touching each other and driven inwards by incessant blows. Fully to realize these views much **reflection** is requisite. **Malthus on man** should be studied; and all such cases as the mice in La Plata, or of the cattle and horses when first turned out*

in South America, of the birds by our calculation, &c., should be well considered. Reflect on the enormous multiplying power inherent and annually in action in all animals; reflect on the countless seeds scattered by a hundred ingenious contrivances, year after year, over the whole face of the land;”

Even though species have the potential to increase exponentially, the number of individuals in that species tends to stay constant because there is a struggle for the limited amount of food: *“and yet we have every reason to suppose that the average percentage of each of the inhabitants of a country usually remains constant. Finally, let it be borne in mind that this average number of individuals (the external conditions remaining the same) in each country is kept up by recurrent struggles against other species or against external nature (as on borders of the Arctic regions, where the cold checks life), and that ordinarily each individual of every species holds its place, either by its own struggle and capacity of acquiring nourishment in some period of its life, from the egg upwards; or by the struggle of its parents (in short-lived organisms, when the main check occurs at longer intervals) with other individuals of the same or different species.”*

Darwin goes on to say that if conditions change and a certain variation in an individual gives it an advantage in the struggle for existence under the new conditions, and, if the adaptive trait is inherited, then the offspring that inherit the advantageous variation would have an advantage in the struggle for existence: *“Now, can it be doubted, from the struggle each individual has to obtain subsistence, that any minute variation in structure, habits, or instincts, adapting that individual better to the new conditions, would tell upon its vigour and health? In the struggle it would have a better chance of surviving; and those of its offspring which inherited the variation, be it ever so slight, would also have a better chance.”*

How much of a difference in the advantage of a variation would determine the life or death of an individual? According to Darwin, *“Yearly more are bred than can survive; the smallest grain in the balance, in the long run, must tell on which death shall fall, and which shall survive.”*

The greater the advantage, the shorter the time it should take for the individuals that inherited the advantageous variation to replace the individuals that do not have the advantageous variation. If a variation had such a small selective advantage, how long would it take to produce a new species that had the advantageous variation and for the old species that did not have the advantageous variation to die out? According to Darwin, *“Let the work of selection on the one hand, and death on the other, go on for a thousand generations, who will pretend to affirm that it would produce no effect, when we remember what, in a few years, [Robert] Bakewell effected in cattle, and Western in [Ancon] sheep, by this identical principle of selection?”*

In 1859, Darwin put his theory more succinctly in *On the Origin of Species*, *“If during the long course of ages and under varying conditions of life, organic beings vary at all in the several parts of their organisation, and I think this cannot be disputed; if there be, owing to the high geometrical powers of increase of each species, at some age, season, or year, a severe struggle for life, and this certainly cannot be disputed; then, considering the infinite complexity of the relations of all organic beings to each other and to their conditions of existence, causing an infinite diversity in structure, constitution, and habits, to be advantageous to them, I think it would be a most extraordinary fact if no variation ever had occurred useful to each being's own welfare, in the same way as so many variations have occurred useful to man. But, if variations useful to any organic*



being do occur, assuredly individuals thus characterised will have the best chance of being preserved in the struggle for life; and from the strong principle of inheritance they will tend to produce offspring similarly characterised. This principle of preservation, I have called, for the sake of brevity, Natural Selection.”

We will discuss Darwinian evolutionary theory when we discuss the coloration of the pepper moth later this semester. For now, we will set the way-back machine to Oxford, England on the thirtieth of June in the year 1860 when there was a meeting of the British Association for the Advancement of Science (BAAS). This was the first meeting of the BAAS since the November 24, 1859 publication of Charles’ Darwin’s *On the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life*.



Legend has it that at this meeting, the young **Thomas Henry Huxley** debated the seasoned Bishop of Oxford, **Samuel Wilberforce** who had been elected to the **Royal Society of London** on December 18, 1845 and was vice president of the **British Association for Advancement of Science**, although the legend leaves out his scientific credentials. (The photograph of Samuel Wilberforce was taken by Charles Lutwidge Dodgson better known as Lewis Carroll).



Accounts of the meeting were given in the *Athenaeum*, but there was no mention of a debate. The first mention of the debate was given by **Francis Darwin** (1887) when he put the following description in volume II (pp. 321-323) of *The Life and Letters of Charles Darwin, including an Autobiographical Chapter*:



"The excitement was tremendous. The Lecture-room, in which it had been arranged that the discussion should be held, proved far too small for the audience, and the meeting adjourned to the Library of the Museum, which was crammed to suffocation long before the champions entered the lists. The numbers were estimated at from 700 to 1000. Had it been term-time, or had the general public been admitted, it would have been impossible to have accommodated the rush to hear the oratory of the bold Bishop. Professor Henslow, the President of Section D, occupied the chair, and wisely announced in limine that none who had not valid arguments to bring forward on one side or the other, would be allowed to address the meeting: a caution that proved necessary, for no fewer than four combatants had their utterances burked by him, because of their indulgence in vague declamation.

"The Bishop was up to time, and spoke for full half-an-hour with inimitable spirit, emptiness and unfairness. It was evident from his handling of the subject that he had been 'crammed' up to the throat, and that he knew nothing at first hand; in fact, he used no argument not to be found in his 'Quarterly' article. He ridiculed Darwin badly, and Huxley savagely, but all in such dulcet tones, so persuasive a manner, and in such well-turned periods, that I who had been inclined to blame the President for allowing a discussion that could serve no scientific purpose, now forgave him from the bottom of my heart. Unfortunately the Bishop, hurried along on the current of his own eloquence, so far forgot

himself as to push his attempted advantage to the verge of personality in a telling passage in which he turned round and addressed Huxley: I forget the precise words, and quote from Lyell. 'The Bishop asked whether Huxley was related by this grandfather's or grandmother's side to an ape.' Huxley replied to the scientific argument of his opponent with force and eloquence, and to the personal allusion with a self-restraint, that gave dignity to his crushing rejoinder."*

The legend of the Oxford Debate was also presented by **Leonard Huxley**, (1900) a writer, the son of T. H. Huxley, and the father of Julian Huxley, Andrew Fielding Huxley and Aldous Huxley in *The Life and Letters of Thomas Henry Huxley* Volume 1 (pp. 192-204). Here is an excerpt:



"[The famous Oxford Meeting of 1860 was of no small importance in Huxley's career. It was not merely that he helped to save a great cause from being stifled under misrepresentation and ridicule—that he helped to extort for it a fair hearing; it was now that he first made himself known in popular estimation as a dangerous adversary in debate—a personal force in the world of science which could not be neglected. From this moment he entered the front fighting line in the most exposed quarter of the field....

Then there were calls for the Bishop, but he rose and said he understood his friend Professor Beale had something to say first. Beale, who was an excellent histologist, spoke to the effect that the new theory ought to meet with fair discussion, but added, with great modesty, that he himself had not sufficient knowledge to discuss the subject adequately. Then the Bishop spoke the speech that you know, and the question about his mother being an ape, or his grandmother.

From the scientific point of view, the speech was of small value. It was evident from his mode of handling the subject that he had been "crammed up to the throat," and knew nothing at first hand; he used no argument beyond those to be found in his "Quarterly" article, which appeared a few days later, and is now admitted to have been inspired by Owen. "He ridiculed Darwin badly and Huxley savagely; but," confesses one of his strongest opponents, "all in such dulcet tones, so persuasive a manner, and in such well turned periods, that I who had been inclined to blame the President for allowing a discussion that could serve no scientific purpose, now forgave him from the bottom of my heart."

The Bishop spoke thus "for full half an hour with inimitable spirit, emptiness and unfairness." "In a light, scoffing tone, florid and fluent, he assured us there was nothing in the idea of evolution; rock-pigeons were what rock-pigeons had always been. Then, turning to his antagonist with a smiling insolence, he begged to know, was it through his grandfather or his grandmother that he claimed his descent from a monkey?" ("Reminiscences of a Grandmother," "Macmillan's Magazine," October 1898. Professor Farrar thinks this version of what the Bishop said is slightly inaccurate. His impression is that the words actually used seemed at the moment flippant and unscientific rather than insolent, vulgar, or personal. The Bishop, he writes, "had been talking of the perpetuity of species of Birds; and then, denying a fortiori the derivation of the species Man from Ape, he rhetorically invoked the aid of FEELING, and said, 'If any one were to be willing to trace his descent through an ape as his GRANDFATHER, would he be willing to trace his descent similarly on the side of his GRANDMOTHER?' His false humour was an attempt to arouse the antipathy about degrading WOMAN to the quadrumana. Your father's reply showed there was vulgarity as well as folly in the Bishop's words; and the impression distinctly was, that the Bishop's party, as they left the

room, felt abashed, and recognised the Bishop had forgotten to behave like a perfect gentleman.")

This was the fatal mistake of his speech. Huxley instantly grasped the tactical advantage which the descent to personalities gave him. He turned to Sir Benjamin Brodie, who was sitting beside him, and emphatically striking his hand upon his knee, exclaimed,] "The Lord hath delivered him into mine hands." [The bearing of the exclamation did not dawn upon Sir Benjamin until after Huxley had completed his "forcible and eloquent" answer to the scientific part of the Bishop's argument, and proceeded to make his famous retort. (The "Athenaeum" reports him as saying that Darwin's theory was an explanation of phenomena in Natural History, as the undulatory theory was of the phenomena of light. No one objected to that theory because an undulation of light had never been arrested and measured. Darwin's theory was an explanation of facts, and his book was full of new facts, all bearing on his theory. Without asserting that every part of that theory had been confirmed, he maintained that it was the best explanation of the origin of species which had yet been offered. With regard to the psychological distinction between men and animals, man himself was once a monad—a mere atom, and nobody could say at what moment in the history of his development he became consciously intelligent. The question was not so much one of a transmutation or transition of species, as of the production of forms which became permanent.

Thus the short-legged sheep of America was not produced gradually, but originated in the birth of an original parent of the whole stock, which had been kept up by a rigid system of artificial selection.)

Leonard Huxley ended his account by saying *The importance of the Oxford meeting lay in the open resistance that was made to authority, at a moment when even a drawn battle was hardly less effectual than acknowledged victory. Instead of being crushed under ridicule, the new theories secured a hearing, all the wider, indeed, for the startling nature of their defence.]*”

Leonard Huxley’s account of the so-called Oxford debate between Wilberforce and Huxley became standard reading for many as a result of its inclusion in *The Norton Anthology of English Literature* as an example of Victorian literature. A similar account presented by William Irvine (1955, 1963) in his book, *Apes, Angels, & Victorians* was endorsed by Julian Huxley, and the tradition continues in Ruth Moore’s (1955) *Charles Darwin: A Great Life in Brief* and Ian Hesketh’s (2009), *Of Apes and Ancestors: Evolution, Christianity, and the Oxford Debate*.

This is the standard story about Samuel Wilberforce. As Randy Moore and Mark Decker (2009) wrote, in *More than Darwin: The People and Places of the Evolution-Creationism Controversy*, “The ‘Huxley—Wilberforce debate’ has become legendary, aided by the lack of a transcript of the proceedings...

Whether these statements were actually said, and who ‘won’ the debate is unclear....Although the ‘debate’ accomplished little for either science or religion, the event was significant because it was a public refusal by the scientific community to allow the Church to dictate matters of science.”



FIGURE 1.20. Vanity Fair magazine caricatures of Bishop Wilberforce (left), Thomas Henry Huxley (middle), and Charles Darwin (right). Wilberforce attacked Darwin’s ideas at an 1860 British Association meeting, and Huxley—“Darwin’s bulldog”—defended Darwin at this debate.

1.20, reprinted from Drawings by Ape from Vanity Fair (left) July 24, 1869, (center) January 28, 1871, (right) Sept. 30, 1871

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Unfortunately, it is the only story that most scientists know; which reminds me of a few lines from *Waiting for Godot* by Samuel Beckett:

ESTRAGON:

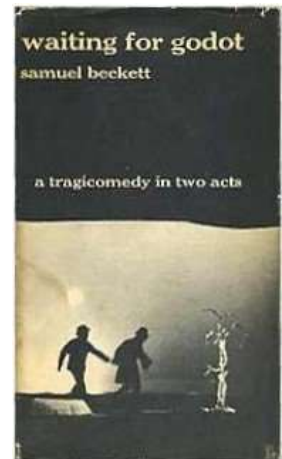
Who believes him?

VLADIMIR:

Everybody. It's the only version they know.

ESTRAGON:

People are bloody ignorant apes.



Aside: As a graduate student in the 1980s, studying how plant cells respond to light, I could see how the truly great natural laws, derived from physics, chemistry and biology applied at every level to the world around us and I saw a logic and beauty in this design and it inspired in me a sense of wonder and gratitude and love for its creator.

Because of my love of science and how useful it was for understanding the world I lived in, I wrote a book entitled, *Plant Cell Biology: From Astronomy to Zoology* for Princeton University Press. As the title suggests, I include all disciplines to emphasize the unity of nature and the intricacy of the design at all levels, as I describe and explain cells and how they make life possible. The book had several working titles, including *Molecular Theology of the Cell*.

In the 400 pages of text and 140 pages of references, I put in a section entitled, The Mechanistic Viewpoint and God. I wrote, “*In general, there seems to be a war between science and religion, but this does not need to occur. In studying mechanisms, one must deconstruct the whole into its parts and determine the relationships between the parts as well as the relationships between the parts and the whole. Each community has words to describe ‘the whole’.* Throughout

civilization, Homo sapiens have strived to live up to our specific epithet by struggling to understand the relationship between the parts and the whole in terms of understanding, among other things, our place in the universe, our relation to other people, our relationship to other species, and our relationship to the environment. Science and religion have been our guides throughout this struggle to understand. Science and religion may be two sides of the same coin of understanding, each with a measure of truth, and each complementing the other....It is often thought that a mechanistic viewpoint excludes God. ...In this book, I will not base any mechanisms on the existence of God, and at the same time, I will not conclude that the discovery of a mechanism precludes the existence of a God.”

While it was not OK to include God in a science book, it seemed like it was OK to dismiss God in a science book. In *DNA: The Secret of Life*, James Watson (2009) wrote: *Does life have some magical, mystical essence, or is it, like any chemical reaction carried out in a science class, the product of normal physical and chemical processes? Is there something divine at the heart of a cell that brings it to life? The double helix answered that question with a definitive No.*” I did not think the question of whether there was something divine at the heart of a cell was definitively solved.

My editor, Emily Wilkinson retired and Sam Elworthy, who became editor at Princeton University Press, told me that **God had no place in a science textbook**. I explained to him why it was important for *scientific completeness* in explaining the relationships between the parts and the whole. He wanted it out, and I said no and we cancelled the contract for that book and another one that I wrote on Light Microscopy that begins with, *And God said, Let there be light: and there was light*.

I had worked hard for almost 20 years on those books, and it wasn't for the money since the royalties had already been promised to the Profiles-in-Courage Award given by the JFK Library and to Habitat for Humanity. But I knew it was the right decision. A year or two later I got a call from Elsevier asking me whether they should publish a certain book. I raved about the book, saying that it was among the top three books written since the field of plant physiology was initiated 150 years ago, and definitely would be worth publishing...but it would not be a money maker because the perspective of the book was not fashionable enough and too few teachers would put in the work necessary to teach the material—even though the book was original, scholarly and important. Good they said, since that is the kind of book they wanted to publish! They liked my way of looking at science. And they asked, “by the way do you have any books you’d like us to publish!” I said yes, and they published them.

I was surprised at the difference in perspectives between the nonprofit academic publisher, who should be my peeps, and the capitalist publisher. I started to wonder if we in academia are giving you the whole story. Now let's discuss Samuel Wilberforce's **Review of Origin of Species**.

Samuel Wilberforce began his review by saying, “*Any contribution to our Natural History literature from the pen of Mr. C. Darwin is certain to command attention. His scientific attainments, his insight and carefulness as an observer, blended with no scanty measure of imaginative sagacity, and his clear and lively style, make all his writings unusually attractive.*”

The essay is full of Mr. Darwin's characteristic excellences. It is a most readable book; full of facts in natural history, old and new, of his collecting and of his observing; and all of these are told in his own perspicuous language, and all

thrown into *picturesque* combinations, and all sparkle with the *colours* of fancy and the *lights* of imagination. It assumes, too, the grave proportions of a sustained argument upon *a matter of the deepest interest, not to naturalists only, or even to men of science exclusively, but to every one who is interested in the history of man and of the relations of nature around him to the history and plan of creation.* (pp. 52-53).

With Mr. Darwin's 'argument' we may say in the outset that we shall have much and grave fault to find. But this does not make us the less disposed to admire the singular excellences of his work; and we will seek in limine to give our readers a few examples of these. Here, for instance, is a beautiful illustration of the wonderful interdependence of nature—of the golden chain of unsuspected relations which bind together all the mighty web which stretches from end to end of this full and most diversified earth. Who, as he listened to the musical hum of the great humble-bees¹, or marked their ponderous flight from flower to flower, and watched the unpacking of their trunks for their work of suction, would have supposed that the multiplication or diminution of their race, or the fruitfulness and sterility of the red clover, depend as directly on the vigilance of our cats as do those of our well-guarded game-preserves on the watching of our keepers? Yet this Mr. Darwin has discovered to be literally the case:—

¹ Humble bees, who were named after their hum, became known as bumble bees in Beatrix Potter's (1910) book *The Tale of Mrs. Tittlemouse*, in which she wrote, "Suddenly round a corner, she met Babbitty Bumble--"Zizz, Bizz, Bizz!" said the bumblebee."

From experiments which I have lately tried, I have found that the visits of bees are necessary for the fertilisation of some kinds of clover; but humble-bees alone visit the red clover (*Trifolium pratense*), as other "bees cannot reach the nectar. Hence I have very little doubt, that if the whole genus of humble-bees became extinct or very rare in England, the heartsease and red clover would become very rare or wholly disappear. The number of humble-bees in any district depends in a great degree on the number of field-mice, which destroy their combs and nests; and Mr. H. Newman, who has long attended to the habits of humble-bees, believes that "more than two-thirds of them are thus destroyed all over England." Now the number of mice is largely dependent, as every one knows, on the number of cats; and Mr. Newman says, "near villages and small towns I have found the nests of humble-bees more numerous than elsewhere, which I attribute to the number of cats that destroy the mice." Hence, it is quite credible that the presence of a feline animal in large numbers in a district might determine, through the intervention, first of mice, and then of bees, the frequency of certain flowers in that district. (pp. 73-74).



*Again, how beautiful are the experiments recorded by him concerning that wonderful relation of the ants to the aphides, which would almost warrant us in giving to the aphids the name of *Vacca formicaria*:—*

One of the strongest instances of an animal apparently performing an action for the sole good of another with which I am acquainted is that of aphides voluntarily yielding their sweet excretion to ants. That they do so voluntarily the following facts will show. I removed all the ants from a group of about a dozen aphides on a dock plant, and prevented their attendance during several hours. After this interval, I felt sure that the aphides would want to excrete. I watched them for



some time through a lens, but not one of them excreted. I then tickled and stroked them with a hair in the same manner, as well as I could, as the ants do with their antennae, but not one excreted. Afterwards I allowed an ant to visit them, and it immediately seemed, by its eager way of running about, to be well aware what a rich flock it had discovered. It then began to play with, its antennae on the abdomen first of one aphid and then of another, and each aphid, as soon as it felt the antennae, immediately lifted up its abdomen and excreted a limpid drop of sweet juice, which was eagerly devoured by the ant. Even the quite young aphides behaved in this manner, showing that the action was instinctive, and not the result of experience. (pp. 210-211).

*Or take the following admirable specimen of the union of which we have spoken, of the employment of the observations of others with what he has observed himself, in that which is almost the most marvelous of facts—the **slave-making instinct** of certain ants. We say nothing at present of the place assigned to these facts in Mr. Darwin's argument, but are merely referring to the collection, observation, and statement of the facts themselves:*

Slave-making Instinct.—This remarkable instinct was first discovered in the *Formica (Polyerges) rufescens* by Pierre Huber, a better observer even than his celebrated father. This ant is absolutely dependent on its **slaves**; without their aid the species would certainly become extinct in a single year. The males and fertile females do no work.



The workers or sterile females, though most energetic and courageous in capturing slaves, do no other work. They are incapable of making their own nests or of feeding their own larvae.

When the old nest is found inconvenient, and they have to migrate, it is the slaves which determine the migration, and actually carry their masters in their jaws. So utterly helpless are the masters, that when



Huber shut up thirty of them without a **slave**, but with plenty of the food, which they like best, and with their larvae and pupæ to stimulate them to work, they did nothing; they could not even feed themselves, and many perished of hunger. Huber then introduced a



single slave (*F. fusca*), and she instantly set to work, fed and saved the survivors, made some cells and tended the larvae, and put all to rights. What can be more extraordinary than these well-ascertained facts? If we had not known of any other slave-making ant, it would have been, hopeless to have speculated **how so wonderful an instinct could have been perfected**. Another species (*Formica sanguinea*) was likewise first discovered by P. Huber to be a **slave-making ant**. This species is found in the southern parts of England, and its habits have been attended to by Mr. F. Smith, of the British Museum, to whom I am much indebted for information on this and other subjects,— Although fully trusting to the

statements of Huber and Mr. Smith, **I tried to approach the subject in a sceptical frame of mind, as any one may well be excused for doubting the truth of so extraordinary and odious an instinct as that of making slaves.** Hence I give the observations which I have myself made in some little detail. I opened fourteen nests of *F. sanguinea*, and found a few slaves in each. Males and fertile females of the slave-species (*F. fusca*) are found only in their own proper communities, and have never been observed in the nests of *F. sanguinea*. **The slaves are black,** and not above half the size of their **red masters**, so that **the contrast in their appearance is very great.** When the nest is slightly disturbed, the slaves occasionally come out, and, like their masters, are much agitated, and defend the nest. When the nest is much disturbed, and the larvae and pupae are exposed, the slaves work energetically with their masters in carrying them away to a place of safety. Hence it is clear that the slaves feel quite at home. During the months of June and July, in three successive years, I have watched for many hours several nests in Surrey and Sussex, and never saw a slave either leave or enter a nest. As, during these months, the slaves are very few in number, I thought that they might behave differently when more numerous, but Mr. Smith informs me that he has watched nests at various hours during May, June, and August both in Surrey and Hampshire, and has never seen the slaves, though present in large numbers in August, either leave or enter the nest. Hence he considers them as **strictly household slaves.** The masters, on the other hand, may be constantly seen bringing in materials for the nest and food of all kinds. During the present year, however, in the month of July, I came across a community with an unusually large stock of slaves, and I observed a few slaves mingled with their masters leaving the nest, and marching along the same road to a large Scotch fir-tree, twenty-five yards distant,



which they ascended together, probably in search of aphides or cocci. According to Huber, who had ample opportunities for observation, in Switzerland the slaves habitually work with their masters in making the nest, and they alone open and close the doors in the morning and evening; and, as Huber expressly states, their principal office is to search for aphides. This difference in the usual habits of the masters and slaves in the two countries probably depends merely on the slaves being captured in greater numbers in Switzerland than in England.

One day I fortunately witnessed a migration of *F. sanguinea* from one nest to another, and it was a most interesting spectacle to behold the masters carefully carrying (instead of being carried by, as in the case of *F. rufescens*) their slaves in their jaws.



Another day my attention was struck by about a score of the slave-makers haunting the same spot, and evidently not in search of food: they approached, and were vigorously repulsed by an independent community of the slave species (*F. fusca*), sometimes as many as three of these ants clinging to the legs of the slave-making *F. sanguinea*. The latter ruthlessly killed their small opponents, and carried their dead bodies as food to their nest, twenty-nine yards distant, but they were prevented from getting any pupæ to rear as slaves. I then dug up a small parcel of pupæ of *F. fusca* from another nest, and put them down on a bare spot near the place of combat; they were eagerly seized and carried off by the tyrants, who perhaps fancied that, after all, they had been victorious in their late combat....

Now I was curious to ascertain whether *F. sanguinea* could distinguish the pupæ of *F. fusca*, which they habitually make into slaves, from those of the little and furious *F. flava*, which they rarely capture, and it was evident that they did at once distinguish them, for we have seen that they eagerly and instantly seized the pupæ of *F. fusca*, whereas they were much terrified when they came across the pupæ or even the earth from the nest of *F. flava*, and quickly ran away; but in about a quarter of an hour, shortly after all the little yellow ants had crawled away, they took heart and carried off the pupæ.



One evening I visited another community of *F. sanguinea*, and found a number of these ants entering their nest, carrying the dead bodies of *F. fusca* (showing that it was not a migration) and numerous pupæ. I traced the returning file burthened with booty, for about forty yards, to a very thick clump of heath, whence I saw the last individual of *F. sanguinea* emerge, carrying a pupa; but I was not able to find the desolated nest in the thick heath. The nest, however, must have been close at hand, for two or three individuals of *F. fusca* were rushing about in the greatest agitation, and one was perched motionless with its own pupa in its mouth on the top of a spray of heath over its ravaged home. (pp. 219-223).

We can perhaps best convey to our readers a clear view of Mr. Darwin's chain of reasoning, and of our objections to it, if we set before them, first, the conclusion to which he seeks to bring them; next, the leading propositions which he must establish in order to make good his final inference; and then the mode by which he endeavours to support his proposition. Here is "the theory which really pervades the whole volume." (p. 57).

Analogy would lead me one step further, namely, to the belief that all animals and plants have descended from some one prototype. But analogy may be a deceitful guide. Nevertheless all living things have much in common, in their chemical composition, their germinal vesicles, their cellular structure, and their laws of growth and reproduction.... Therefore I should infer from analogy that probably all the organic beings which have ever lived on this earth have descended from some one primordial form, into which life was first breathed [by the Creator]. (p. 484).

*But we are too loyal pupils of inductive philosophy to start back from any conclusion by reason of its strangeness. Newton's patient philosophy taught him to find in the falling apple the law which governs the silent movements of the stars in their courses; and if Mr. Darwin can with the same correctness of reasoning demonstrate to us our fungular descent, we shall dismiss our pride, and avow, with the characteristic humility of philosophy, our unsuspected cousinship with the mushrooms.... Now, the main propositions by which Mr. Darwin's conclusion is attained are these:- 1. That observed and admitted variations spring up in the course of descents from a common progenitor. 2. That many of these variations tend to an improvement of the parent stock. 3. That, by a continued selection of these improved specimens as the progenitors of future stock, **its improvement may be unlimitedly increased**. 4. And, lastly, that there is in nature a power continually and universally working out this selection, and so fixing and augmenting these improvements. (pp. 57-58).*

What do you think is the strength of each of these propositions? Wilberforce concedes that “*The facts are all gathered from a true observation of nature, and from a patiently obtained comprehension of their undoubted and unquestionable relative significance. That such a struggle for life then actually exists, and that it*

tends continually to lead the strong to exterminate the weak, we readily admit...But before we can go a step further, and argue from its operation in favour of a perpetual improvement in natural types, we must be shown first that this law of competition has in nature to deal with such favourable variations in the individuals of any species, as truly to exalt those individuals above the highest type of perfection to which their least imperfect predecessors attained...and then, next, we must be shown that there is actively at work in nature, co-ordinate with the law of competition and with the existence of such favourable variations, a power of accumulating such favourable variation through successive descents. (pp. 61-62).

Wilberforce admits that variation exists in a species and so does selection for superior traits. He wonders however, is there proof that nature has the power to fix this variation into a new and improved species? That is, why don't we see old species turn into new and improved species?

Wilberforce points out that in the past 4000 years of history, domestic pigeons, which are a race eminently subject to **variation** and have been **selected** to produce any given feather, beak or head, all have identical major structures (e.g. **skeletal**) and all **interbreed**. Moreover, there is reversion of hybrids to the parental type. Consequently there is more of a tendency for **variations to vanish** and for the hybrids to return or relapse to the parental type than for variations to **become fixed** and form new species. Consequently, Wilberforce considers all domestic pigeons one species. Are they **one diverse species with well-marked varieties** as Wilberforce suggests or are they **each incipient species** as Darwin asserts?



Wilberforce points out that the same is true of the hog, horse, ass, sheep, goat, cow, dog, cat and chicken: when breeding is relaxed they tend back to the **original type** without a **SPECIFIC change**. In fact ever since the wandering Ulysses returned to Ithaca with his dog, **there has not been a SPECIFIC change in dogs** (e.g. no major difference in the skeletal structure or in the ability to breed). Consequently, according to Wilberforce, dogs are **one diverse species with well-**

marked varieties. That is, there is an archetypical or Platonic dog with many varied representations.



Cats were embalmed in Egypt 4000 years ago and, while there is a lot of variation, there appears to be no SPECIFIC change in cats in the past 4000 years and all cats are of **one diverse species with well-marked varieties.** That is, there is an archetypical or platonic cat with many varied representations.



Darwin argues that **nature is a more powerful and continuous selector, working over vast expanses of time,** and can do more than man in selecting varieties...that is ...can cause *specific* or *species-inducing* changes...(p. 67).

Wilberforce argues that man can only **select one part at the expense of another...**this is a LAW! The **bulldog gains in strength but loses in swiftness...** the **greyhound gains in swiftness but loses in strength...** Man's variations do

not IMPROVE the character of an animal because something is lost and something is gained. **Nature tends to kill the monster and stabilize the type.** There is no evidence for accumulating and fixing **specific** variations. (p. 68).

Wilberforce asks, if new species were occurring **shouldn't we see at least one?** He also wonders why the closest microscopic observation has never detected the faintest tendency in the highest of the Algae to improve into the very lowest Zoophyte. (pp. 69-70).

Wilberforce concludes that there is **no** evidence for **speciation going on.** What about evidence from the fossil record?

Why then is not every geological formation and every stratum full of such intermediate links? Geology assuredly does not reveal any such finely graduated organic chain; and this, perhaps, is the most obvious and gravest objection which can be urged against my theory. The explanation lies, as I believe, in the extreme imperfection of the geological record. (p. 280).

Now Wilberforce asks, *“On what then is the new theory based? We say it with unfeigned regret, in dealing with such a man as Mr. Darwin, on the merest hypothesis, supported by the most unbounded assumptions. These are strong words, but we will give a few instances to prove their truth:--”* (p. 81).

All physiologists admit that the swim-bladder is homologous or " ideally similar " in position and structure with the lungs of the higher vertebrate animals ; hence there **seems to me to be no great difficulty in believing** that natural selection has actually converted a swim-bladder into a lung, or organ used exclusively for respiration. (p. 191).

I can indeed hardly doubt that all vertebrate animals having true lungs have descended by ordinary generation from the ancient prototype, of which we know nothing, furnished with a floating apparatus or swim-bladder. (p. 191).

I see no difficulty in supposing that such links formerly existed, and that each had been formed by the same steps as in the case of the less perfectly gliding squirrels, and that each grade of structure was useful to its possessor. Nor **can I see any insuperable difficulty in further believing** it possible that the membrane-connected fingers and forearm of the galeopithecus might be greatly lengthened by natural selection, and this, as far as the organs of flight are concerned, would convert it into a bat. (p. 181).

Wilberforce protests against the frequent occurrence of statements such as “*I can conceive*” ... “*It is not incredible*” ... “*I do not doubt*” ... “*It is conceivable*” Wilberforce adds, “*In the name of all true philosophy we protest against such a mode of dealing with nature, as utterly dishonourable to all natural science, as reducing it from its present lofty level of being one of the noblest trainers of man’s intellect and instructors of his mind, to being a mere idle play of the fancy, without the basis of fact or the discipline of observation.*” (pp. 83-84). Is Wilberforce being fair here? Why and/or why not?

Why might someone have a hard time believing what Darwin asks us to believe? Darwin answers,

...the chief cause of our natural unwillingness to admit that one species has given birth to other and distinct species is that we are always slow in admitting any great change of which we do not see the intermediate steps. (p. 481).

But what is **belief** and what is **analysis**? What is **faith** and what is **reason**?

Wilberforce answers, '*Analysis*,' says Professor Sedgwick, 'consists in making experiments and observations, and in drawing general conclusions from them by induction, and admitting of no objections against the conclusions but such as are taken from experiments or other certain truths; for hypotheses are not to be regarded in experimental philosophy.' [*A Discourse on the Studies of the University*,' by A. Sedgwick, p. 102.

Wilberforce also rejects Darwin's use of time. According to Wilberforce, *The other solvent which Mr. Darwin most freely and, we think, unphilosophically employs to get rid of difficulties, is his use of time. This he shortens or prolongs at will by the mere wave of his magician's rod. Thus the duration of whole epochs, during which certain forms of animal life prevailed, is gathered up into a point, whilst an unlimited expanse of years, impressing his mind with a sense of eternity, is suddenly interposed between that and the next series, though geology proclaims the transition to have been one of gentle and, it may be, swift accomplishment. All this too is made the more startling because it is used to meet the objections drawn from facts. 'We see none of your works,' says the observer of nature; 'we see no beginnings of the portentous change; we see plainly beings of another order in creation, but we find amongst them no tendencies to these altered organisms.'* True says the great magician, with a calmness no difficulty derived from the obstinacy of facts can disturb; 'true, but remember the effect of time. Throw in a few hundreds of millions of years more or less, and why should not all these changes be possible, and, if possible, why may I not assume them to be real?' (pp. 84-85).

Now I think we come to the crux of the matter. Wilberforce writes, "*There are no parts of Mr. Darwin's ingenious book in which he gives the reins more completely to his fancy than where he deals with **the improvement of instinct by***

his principle of natural selection. We need but instance his assumption, without a fact on which to build it, that the marvelous skill of the honey-bee in constructing its cells is thus obtained, and the slave-making habits of the Formica Polyerges thus formed. There seems to be no limit here to the exuberance of his fancy, and we cannot but think that we detect one of those hints by which Mr. Darwin indicates the application of his system from the lower animals to man himself, when he dwells so pointedly upon the fact that it is always the black ant which is enslaved by his other coloured and more fortunate brethren. 'The slaves are black!' We believe that, if we had Mr. Darwin in the witness-box, and could subject him to a moderate cross-examination, we should find that he believed that the tendency of the lighter-coloured races of mankind to prosecute the negro slave-trade was really a remains, in their more favoured condition, of the 'extraordinary and odious instinct ' which had possessed them before they had been ' improved by natural selection ' from Formica Polyerges into Homo." (pp. 88-89).

Samuel Wilberforce, who obtained a first class in mathematics at Oxford, was a member of the Royal Society of London, and was vice president of the BAAS then states, “*Our readers will not have failed to notice that we have objected to the views with which we have been dealing solely on scientific grounds. We have done so from our fixed conviction that it is thus that the truth or falsehood of such arguments should be tried. We have no sympathy with those who object to any facts or alleged facts in nature, or to any inference logically deduced from them, because they believe them to contradict what it appears to them is taught by Revelation. We think that all such objections savour of a timidity which is really inconsistent with a firm and well-instructed faith:—*

'Let us for a moment,' profoundly remarks Professor Sedgwick, 'suppose that there are some religious difficulties in the conclusions of geology. How, then, are we to solve them? Not by making a world after a pattern of our own—not by shifting and shuffling the solid strata of the earth, and then dealing them out in such a way as to play the game of an ignorant or dishonest hypothesis—not by shutting our eyes to facts, or denying the evidence of our senses—but by patient investigation, carried on in the sincere love of truth, and by learning to reject every consequence not warranted by physical evidence' [Wilberforce's note: 'A Discourse on the Studies of the University, p. 149.

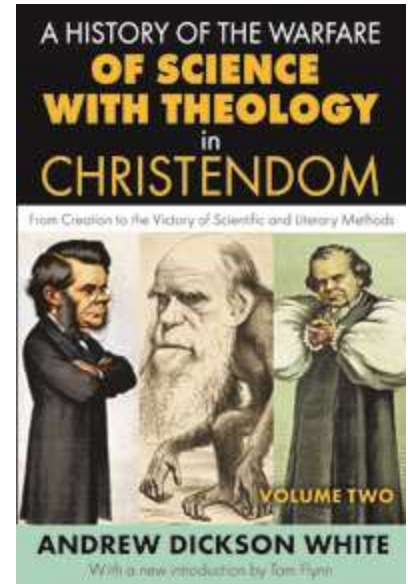
*He who is as sure as he is of his own existence that the **God of Truth is at once the God of Nature and the God of Revelation**, cannot believe it to be possible that His voice in either, rightly understood, can differ, or deceive His creatures. To oppose facts in the natural world because they seem to oppose Revelation, or to humour them so as to compel them to speak its voice, is, he knows, but another form of the ever-ready feeble-minded dishonesty of lying for **God, and trying by fraud or falsehood to do the work of the God of truth**. It is with another and a nobler spirit that the true believer walks amongst the works of nature. The words graven on the everlasting rocks are the words of God, and they are graven by His hand. No more can they contradict His Word written in His book, than could the words of the old [256/257] covenant graven by His hand on the stony tables contradict the writings of His hand in the volume of the new dispensation. There may be to man difficulty in reconciling all the utterances of the two voices. But what of that? He has learned already that **here he knows only in part, and that the day of reconciling all apparent contradictions between what must agree is nigh at hand**. He rests his mind in perfect quietness on this*

assurance, and rejoices in the gift of light without a misgiving as to what it may discover:—” (pp. 92-93).

Andrew Dickson White (1896), the first president of Cornell University and a historian, wrote about Wilberforce's review of Darwin's *Origin of Species* and the Oxford debate in his *History of the Warfare of Science with Theology in Christendom* (pp. 70-86):

“Darwin's Origin of Species had come into the theological world like a plough into an ant-hill. Everywhere those thus rudely awakened from their old comfort and repose had swarmed forth angry and confused. Reviews, sermons, books light and heavy, came flying at the new thinker from all sides.

*The keynote was struck at once in the Quarterly Review by Wilberforce, Bishop of Oxford. He declared that Darwin was guilty of "a tendency to limit God's glory in creation"; that "the principle of natural selection is absolutely incompatible with the word of God"; that it "contradicts the revealed relations of creation to its Creator"; that it is "inconsistent with the fulness of his glory"; that it is "a dishonouring view of Nature"; and that there is "a simpler explanation of the presence of these strange forms among the works of God": that explanation being—"the fall of Adam." Nor did the bishop's efforts end here; at **the meeting of the British Association for the Advancement of Science** he again disported himself in the tide of popular applause. Referring to the ideas of Darwin, who was absent on account of illness, he congratulated himself in a public speech that he was not descended from a monkey. The reply came from Huxley, who said in substance: "If I had to choose, I would prefer to be a descendant of a humble monkey*



rather than of a man who employs his knowledge and eloquence in misrepresenting those who are wearing out their lives in the search for truth."

This shot reverberated through England, and indeed through other countries.

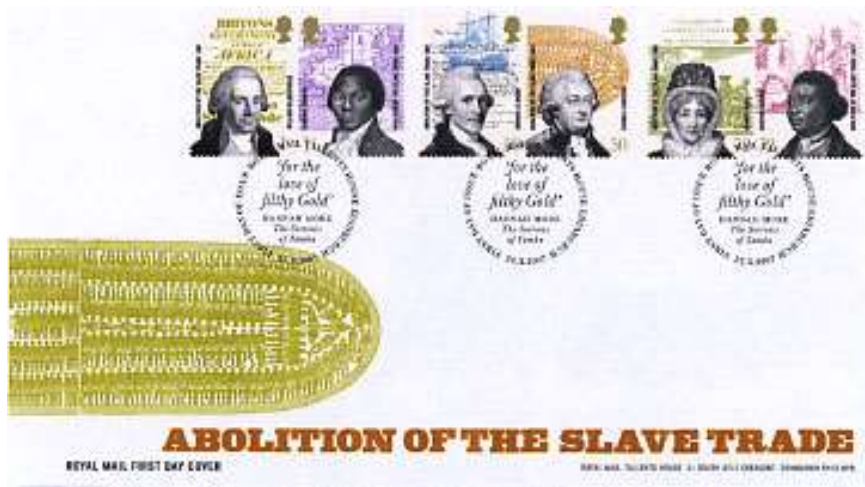
Whatever additional factors may be added to natural selection—and Darwin himself fully admitted that there might be others—the theory of an evolution process in the formation of the universe and of animated nature is established, and the old theory of direct creation is gone forever. In place of it science has given us conceptions far more noble, and opened the way to an argument for design infinitely more beautiful than any ever developed by theology."

A. D. White, Francis Darwin and Leonard Huxley never mentioned Wilberforce's scientific criticisms. **Were A. D. White, Francis Darwin, and Leonard Huxley promoting the questioning of authority as long as no one questioned their view of scientific authority?** I personally wonder if the way the scientific establishment chose to argue or not argue the merits of the case between Wilberforce and Huxley set up the model for the **unquestioning authority of scientism**, the use of *ad hominem* remarks to the "deniers" and "contrarians," and the eventual marginalization of the unfit.

Why was Samuel Wilberforce so concerned about the slave-making instinct of ants and that this instinct may be inherited by humans? Samuel Wilberforce's father was **William Wilberforce**. William was influenced by his friend named **John Newton** (1788), the author of *Thoughts upon the African Slave Trade* and the hymn **Amazing Grace**. The autobiographical hymn is about Newton, who was a slave trader and realized that he was lost. He got William Wilberforce to become an abolitionist and Wilberforce spent the rest of his life to end the slave trade



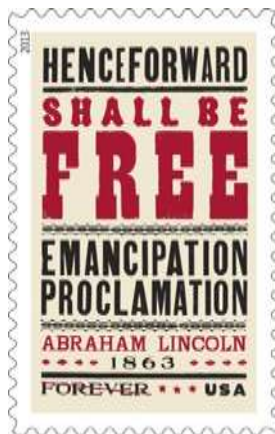
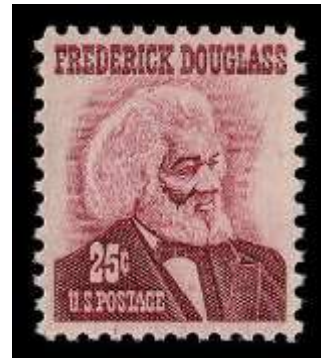
in the British Empire. <http://www.amazinggracemovie.com/> William Wilberforce was known in the nineteenth century. He was mentioned by Harriet Beecher Stowe in *Uncle Tom's Cabin* published in 1852 and by Abraham Lincoln during a debate in 1858.



Do any of you know the name of William Wilberforce? If not, I bet you know the names of other freedom fighters such as Abraham Lincoln, Martin Luther King, Cesar Chavez, Mahatmas Gandhi, Frederick Douglass, Elizabeth Cady Stanton,



Susan B. Anthony, and Nelson Mandela. William Wilberforce belongs with this group.



Samuel Wilberforce (1868) wrote a book about his father's life entitled, *Life of William Wilberforce*. He ended the book like so: "A number of those who had been indebted to his kindness met after his funeral, 'with feelings almost as disconsolate as those of the bereaved apostles, to lament his loss.' 'Great part of our coloured population, who form here an important body,' writes a dignified clergyman from the West Indies, 'went into mourning at the news of his death.' The same honour was paid his by this class of persons at New York, where also an eulogium (since printed) was pronounced upon him by a person publicly selected for the task, and their brethren throughout the United States were called upon to pay the marks of external respect to the memory of their benefactor. For departed kings there are appointed honours, and the wealthy have their gorgeous obsequies:

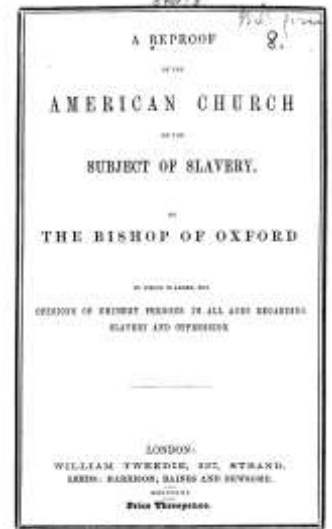
it was his nobler portion to clothe a people with spontaneous mourning, and go down to the grave amid the benedictions of the poor.”

“It is impossible to conclude this history without noting the truth of the inspired words: ‘Godliness has the promise of the life that now is well as that which is yet to come.’ If ever any man drew the lot of a happy life, he did so who has been described. Yet his Christian faith was from first to last the talisman of his happiness. Without it the buoyancy of his youthful spirits led to a frivolous and unsatisfying waste of life. With it came lofty conceptions—an energy which triumphed over sickness and languor, over the coldness of friends and the violence of enemies—a calmness not to be provoked—a perseverance which repulse could not baffle. To these virtues was owing the happiness of his active days. Through the power of the same sustaining principle, his affection towards his fellow-creatures was not dulled by the intercourse with the world, nor his sweetness of temper impaired by the irritability of age. A firm trust in God, an undeviating submission to His will, an overflowing thankfulness—these maintained in him to the last that cheerfulness which this world could neither give nor take away. They poured even upon his earthly pilgrimage the anticipated radiance of that brighter region, to which the servants of God are admitted, For ‘the path of the just is like the shining light, which shineth more and more unto the perfect day.’”



After his father William Wilberforce brought a successful end to the slave trade and slavery in the British Empire, Samuel Wilberforce (1844,1853) fought to end slavery in America. *“Of the twenty-six states, thirteen are slave states; admitting, that is, within their own borders, the institution of Slavery as a part of*

their institutions; and of these, five—Maryland, Virginia, Kentucky, Missouri, and in part, Tennessee—are slave-selling, whilst those south of them are slave-buying statesAccordingly, the master-evil of the South is, that the slaves are not treated as having souls.... ‘Let no man from henceforth,’ said the Christian Council of London, in 1102, ‘presume to carry on that wicked traffic, by which men in England have been hitherto sold like brute animals.’ This must be the Church’s rule on the banks of the Mississippi, as it was on those of the Thames.”



Wilberforce University, named after William Wilberforce, was the first predominantly African-American Private University in the United States. It was founded in 1856 by members of the Methodist Episcopalian Church.



In May, 1860, just a month before the meeting of the BAAS at Oxford, Samuel Wilberforce gave speeches on behalf of the Oxford and Cambridge Mission to Central Africa. He said, “*The Gospel must be brought from without from those who had now the **lamp of truth**, and who had it in order that they might **enlighten** others as well as themselves. The grounds which should induce us to make some great and hearty efforts to carry God’s truth among His people were, that they need it greatly, that they are ready to receive it, that we are specially called to impart it from close connection with them, and because **as the children of slave traders we had to cut off the entail of curses by reversing the inheritance of wrong which the slave trade had inflicted upon Africa.***”

I think that Samuel Wilberforce like Thomas Jefferson believed, **“We hold these truths to be self-evident, that all men are created equal, that they are endowed by their Creator with certain unalienable Rights, that among these are Life, Liberty and the pursuit of Happiness.** I think that Wilberforce would have accepted Darwinian Theory if the **evidence** from the **fossil record** was strong enough and if someone could show that a **new and improved species was differentiated from a pre-existing and less improved species.** That is **macroevolution** (which he rejected) as opposed to **microevolution** (which he accepted). But in the absence of that data, he would not accept the theory because the theory could serve as a **natural law justification** for a **slave-making instinct in humans** at a time when England was looking for **new colonies** to replace the lost American colonies. Science is often used to provide a natural law for justifying political, social and economic policy. For example, **John Draper** (1861) wrote in *History of the Intellectual Development of Europe* that the “*Social advancement is as completely under the control of natural law as is bodily growth.*” The page



below is from Draper's book on *Human Physiology*, the same John Draper who was the keynote speaker in June 1860 at the BAAS meeting in Oxford.

THERE are great differences in the aspect of men.

The portrait of Newton is from the frontispiece of his immortal *Principia*.



Sir Isaac Newton.

“Does he eat, and drink, and sleep, like other people?” ask- Differences in form, color, and dispositions of men.



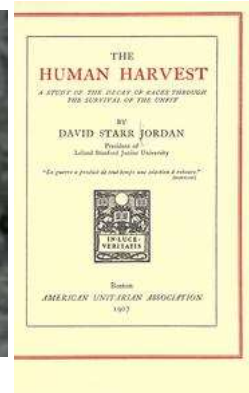
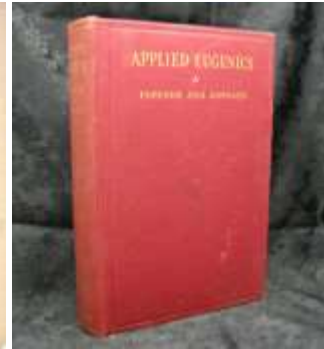
Australian.

ed the Marquis de l'Hôpital, himself a great contemporary French math-

What a contrast between the astronomer, of whom the human race may be justly proud, and the Australian savage whose portrait Dr. Prichard has furnished! This man lives in a hollow tree, which he has in part excavated by fire, and obtains a precarious support from shell-fish, or bruised ants and grass. He can make a hook of a piece of oyster,

Many scientists, including **David Starr Jordan**, a Cornell graduate and first president of Stanford University, Paul Popenoe, Luther Burbank, Charles Davenport, William Castle and others began looking at human beings as

predominantly a product of their genes and built up the **progressive science of eugenics**, the science of the improvement of the human race by better breeding. As Charles B. Davenport (1911) wrote, “*The*



eugenical standpoint is that of the agriculturalist who, while recognizing the value of culture, believes that permanent advance is to be made only by securing the best ‘blood.’ Man is an organism—an animal; and the laws of improvement of corn and of race horses hold for him also. Unless people accept this simple truth and let it influence marriage selection human progress will cease.”

William E. Castle (1921) wrote in *Genetics and Eugenics*: “No one can deny that our country’s population is increasing fast enough, the only danger is that the biologically poorest elements in the population may increase faster than any other. The declining birth rate is not itself serious, but the differential character of its decline is serious. The most intellectual and cultured elements in the population breed slowest. Professor Cattell says that a Harvard graduate has on the average three-fourths of a son and a Vassar graduate one-half of a daughter. If this continues college graduates may look forward to the early extinction of their line as an element of the American population.”

See the movie, *The Black Stork*, made in 1917 about Doctor **Harry J. Haiselden** and his quest to use his scientific and medical knowledge for human progress. <https://www.youtube.com/watch?v=9m6OCT8YmfU> *Tomorrow’s Children* is another movie made in 1934 with the same theme. <https://www.youtube.com/watch?v=yXQNU4IeO6Y>

Viktor Frankl (1962), a survivor of Auschwitz, wrote in the *Doctor and the Soul*, “Three factors characterize human existence as such: man’s spirituality, his freedom, his responsibility.” Is it likely that these three factors arose by natural selection and that these three factors will be enhanced through a breeding program?

William Jennings Bryan (1925) began to question the value of the Darwinian war-like philosophy. At the Scopes Trial, he said, “*Let us, then, hear the conclusion of the whole matter. Science is a magnificent material force, but it is not a teacher of morals. It can perfect machinery, but it adds no moral restraints to protect society from the misuse of the machine. It can also build gigantic intellectual ships, but it constructs no moral rudders or the control of storm-tossed human vessels. It not only fails to supply the spiritual element needed, but some of its unproven hypotheses rob the ship of its compass and thus endanger its cargo.*



In war, science has proven itself an evil genius; it has made war more terrible than it ever was before. Man used to be content to slaughter his fellowmen on a single plain - the earth's surface. Science has taught him to go down into the water and shoot up from below and to go up into the clouds and shoot down from above, thus making the battlefield three times as bloody as it was before. But science does not teach brotherly love. Science has made war so hellish that civilization was about to commit suicide; and now we are told that newly discovered instruments of destruction will make the cruelty of the late war seem trivial in comparison with the cruelties of wars that may come in the future. If civilization is to be saved from the wreckage threatened by intelligence not consecrated by love, it must be saved by the moral code of the meek and lowly Nazarene. His teachings, and His teachings alone, can solve the problems that vex the heart and perplex the world.”

We hear all the time “*Science says*,” but science does not say anything, scientists do. And scientists must make their case as much as anyone else. In seeing the gradual change from science as a method of inquiry to scientism, where the authority of science becomes unquestioned, G. K. Chesterton (1932) wrote in, *On the Intellect of Yesterday* “Or take another test from another type of inquiry. When all the drawing-rooms began to buzz



suddenly with the name of Einstein, some of us were enabled to guess that they must once have buzzed quite as abruptly with the name of Darwin. Some of us are inclined to guess that Darwinism became a fashion long before anybody really thought it was a fact. Doubtless any number of society ladies went about saying that Professor Darwin was really too wonderful, just as they afterwards went about saying that Professor Einstein was really too wonderful. But, when all is said, there is no comparison between the two cases. Any number of people did really attack the study of biology, in order to agree or disagree with Darwin. Hardly one person in a thousand thought of attacking the higher mathematics in order to agree with Einstein. People did talk about Darwinism as well as about Darwin. Most of those who talk about Einstein talk about Einstein. They know nothing but the name and the notion that something very important has happened in connexion with the name. The talk about Darwin may have been popular science, but it was science, and it was popular. The talk about Einstein may rather be called **popular nescience**. He has not made astronomy really popular, as the other made biology really popular. And I believe that the reason is a certain increased laziness of the intellect; that fewer people are ready for a long, sustained logical demonstration, quite apart from whether we think that the demonstration really demonstrates. In my boyhood there were any number of funny little atheists running about ready and eager to prove what they had learned from the work of

Darwin. So there were any number of fanatical little Free-Traders eager to prove what they had learned from the speeches of Cobden. I do not find men now so eager to prove things; but, at the most, to assure me that they have been proved.

One way of putting it is that this is a psychological age, which is the opposite of an intellectual age. It is not a question of persuading men, but of suggesting how they are persuaded. It is an age of Suggestion; that is, of appeal to the irrational part of man. Men discussed whether Free Trade was false or true; they do not so much discuss whether Empire Free Trade is false or true, as whether it is booming or slumping; whether it is based on an understanding of Mass Psychology, or whether its opponents or supporters have what Americans call Personality. It is all great fun, and there is doubtless a truth in it, as in other things. But, whatever else it is, it is not a mark of stronger mentality, and any old Scotch Calvinist farmer, who could follow his minister's desolate and appalling sermon to Seventeenthly and Lastly, had an immeasurably better brain."