Chapter 9 Epilogue

There are brief summaries at the end of Chapters 1 and 2, which give some measure of summation of the Dynamic Theory. Here I wish to provide a little further discussion in three areas. First, what is really new in the Dynamic Theory? Secondly, how might it help us teach science and physics? The third topic is where might the theory lead? This does not mean that there are not other new things presented in the preceding chapters. For instance, it is not new to state that the Unit of Action appearing in the derivation of Heisenberg's Uncertainty Principle depends upon the geometry. Anyone who has gone through the derivation considering covariant differentiation has ended up with this conclusion. Indeed, this is necessary in order to get the correct predictions of atomic states. However, when one considered Einstein's vector curvature and the atom or nucleus it was easy to argue that the vector curvature was so small that on the order of the nucleus or the atom the curvature could not influence the unit of action to any meaningful extent. This statement is perfectly true and easily supportable so long as your description of the phenomenon does not involve a gauge function. What is new in the Dynamic Theory is the appearance of a full gauge function. Now we can no longer assume that geometry can be assumed away on the scale of the nucleus. Indeed we have shown that all of the observation laws and experimental data are satisfied if the neutron is a proton in nuclear orbit around and electron.

What is <u>really</u> new?

<u>9.1 Only three basic assumptions.</u>

The Dynamic Theory is based upon only three fundamental assumptions as stated in Chapter 2. When I tried to count the needed fundamental assumptions in all of our current branches of physics I came up with something more than twenty. I am aware that one can generate considerable discussion about whether or not specific one of the twenty plus assumptions were really fundamental or not. However, the criteria I used was whether or not I knew of a method by which it could be derived from another assumption. If the assumption could not be derived, then it must be fundamental.

Though I've been told many times that you can't do it, I see very little logic restraining one from deriving Quantum Mechanics from a continuum theory. For example, if one jiggles a guitar string that is tied down on only one end, there is a continuum of solutions possible. On the other hand, if both the ends of the string are tied down, and this represents an additional restriction, then only certain, and quantified solutions are possible. Why not the same thing in the more broader sense of physics? Table IV shows the necessary restrictive assumptions that must be made in order to start with the

Table I. Restrictive Assumptions to Reach the Branches of Physics.	
Branch of Physics	Restrictive Assumptions
Classical Thermodynamics	i. only a pdv work term
Special Theory of Relativity	Group A assumptions
	i. isolated system, dE=0
	ii. only 3 spatial work terms
	iii. near equilibrium (ρ_{ij}=constant)
	iv. variation of paths
Newtonian Mechanics (4-dimensional)	Group A assumptions, plus
	v. only three spatial work terms
Electromagneto-Gravitic Fields	Group C assumptions
	i. isolated system, dE=0
	ii. gauge field equations
Maxwellian EM Fields	Group C assumptions, plus
	iii. only three spatial work terms
Quantized Gauge Potentials [$e^{(-\lambda/r)}/r$]	Group C assumptions, plus
	iv. ϕ_j independent of path
	v. isentropic states
Strong Nuclear Force	
	i. like particle forces, $\lambda_1=\lambda_2$
Weak Nuclear Force	
	i. unlike particle forces, $\lambda_1\neq\lambda_2$
Atom Physics (Classical)	
	i. 4-D Quantum Mechanics
	ii. $r >> \lambda_{max}$
Perihelion Advance	Group A assumptions, plus
	vi. quantized gauge potentials
Redshifts	
	i. quantized gauge potentials
	ii. geometrical unit of action

fundamental assumptions of the Dynamic Theory to the foundations of various branches of physics and theories.

One example of the ability of the Dynamic Theory to derive the fundamental assumptions of the various branches of physics which is not specifically pointed out in Table IV is that of deriving Einstein's postulate concerning the limiting aspect of the speed of light. We saw, in Chapter 2, that this is a direct result of the Second Law and has, therefore, the same place in the theory as the limiting temperature in thermodynamics.

9.2 Geometry is specified.

Scientists have searched for Lagrangians in their attempts to find a way of unifying the fields of nature. One reason for doing so is because given a variational principle, such as the Principle of Least Action, they can arrive at equations of motion and then field equations. One problem with this approach is that they must make an assumption with respect to the geometry of their space when they employ the Principle of Least Action. This was the same necessity that Newton faced. Newton had no choice of geometries at his disposal. There was only Euclidean geometry to be had. Einstein chose the Riemannian geometry for use in his relativistic theories but rejected the more general Weyl geometry when it was proposed. The Dynamic Theory leaves us no choice. The fundamental laws specify what the geometry must be. To me this is extremely satisfying from the sense that I feel that properly chosen laws should do just that; they should leave no choice as to geometry.

A good many physicists know that one may choose a Lagrangian and use the Principle of Least Action to arrive at equations of motion. Few, if any, know that by doing so they must assume a type of geometry in this process and, thereby, have interjected a restriction into the process. Therefore, the more power to a process that does not allow this unwitting interjection of a restriction.

Another extremely important point with regards to the geometry is that within the Dynamic Theory there are two geometries to be considered. This is as fundamental within the Dynamic Theory as the fact that the concepts of heat and entropy are two different things is fundamental in thermodynamics. The temperature is the integrating factor in thermodynamics and, as such, plays a pivotal role between the heat and the entropy. Within the Dynamic Theory the gauge function was shown to be a geometrical integrating factor between the two geometries.

9.3 The Arrow of Time

The notion of irreversibility is embodied in the laws of thermodynamics, but is not in the Newton and Einstein laws of motion. Yet mankind has been constantly aware of the relentless march of history that Omar Khayyám expressed in his:

The moving finger writes and having writ, moves on; nor all your Piety nor Wit, Shall lure it back to cancel half a Line, Nor all your tears wash out a Word of it.

Many articles and books have been written on the subject of time symmetry, but still questions remain. I first wrote on the Arrow of Time in 1981. The recent book, "The Arrow of Time" by Peter Coveney and Roger Highfield is an excellent one. It sets forth the problem of time symmetry in the mechanical theories in a very clear fashion.

The Dynamic Theory adopts generalizations of the classical laws of thermodynamics as the basis for a new view of all physical phenomena. It was shown in Chapter 2 how the adoption of these laws led to an integrating factor for purely mechanical systems and that this integrating factor was strictly a function of velocity. In Chapter 3 we saw the scope of the entropy increase further, though it still retained the connection to the energy exchange by the integrating factor. Further, we saw that for the isolated systems the Second Law produced an Entropy Principle that the entropy could never decrease, or dS_0. From this we derived equations of motion using the expression for the square of the differential of the entropy. The square masks the fact from the Second Law we obtained dS_0. Further, in Chapter 2 we discussed the fact that we could have obtained our equations of motion as third order equations in time, but chose not to in order to have second order equations.

All of this means that the Arrow of Time is part of the Dynamic Theory from the point of adoption of the Second Law.

9.4 Mass as a coordinate

Hermann Weyl titled his 1918 book "Space-Time-Matter" which somewhat implies that matter is considered on the same footing as space and time. This, of course, is not supported by the contents of the book. In the book he treats space and time as coordinates while he leaves matter in its usual place in mechanics as either being the inertial or gravitating mass. Further, the fact that the Dynamic Theory goes into five-dimensions presents no new factor on that basis alone. Many other researchers have looked into five dimensions in order to try to obtain the necessary degrees of freedom with which to build into their theory the various fields thought to be needed to describe the universe. What is different about the Dynamic Theory is that it treats mass on an equal footing as space and time. This means that it is treated as a coordinate the same as space and time. No other researcher, looking into five-dimensional systems, allowed any physical significance to the fifth dimension. That is to say that they wished to have the added freedom of the five dimensions but did not wish to allow the fifth dimension to play a physical role as space and time were allowed to do.

9.5 Non-singular gauge potential

There are two aspects of the non-singular potential which makes it's appearance something that is really different. The first is the fact that the maximum absolute value of the potential is different for different particles. This is the extraordinary feature, which leads to a description of phenomena usually reserved for the "Weak Force." The second new aspect of the non-singular potential is that when applied to the planetary orbits the potential produces the correct variation of perihelion advance as a function of orbit size by itself. Numerous gravitational potentials were guessed and tried in attempts to obtain an alternative to Einstein's General Theory of Relativity. One of the most severe tests for these candidate potentials is the variation of the predicted advance as a function of the orbit size. None of them could pass this test. The prediction of the perihelion advance within the Dynamic Theory depends upon the orbital parameters in the same fashion as the General Theory of Relativity.

A further utility of having a non-singular potential is that there is no need to renormalize any functions including the gauge potential or any of its derivatives. In Quantum Mechanics renormalization has always created problems and/or discussions. With nothing to renormalize the problems and the need for discussions go away.

9.6 Unification of the Branches of Physics

Numerous researchers have worked on the problem and an untold amount of time has gone into the attempts to find a unified field theory. Still a unified field theory is but a promise of the future. The promises still hold out hope of a theory in the "near" future. These promises remind one of the carrot on the pole. The more the poor horse tries to reach the carrot the more the pole moves the carrot ahead. Nowhere in my reading of books written on physics and unified field theories do I recall reading anything about an attempt to unify the various branches of physics except in my own hand or word processor.

The unification of the various branches of physics is the result of the generalizations of the laws of classical thermodynamics and seeking how to obtain equations of motion from them. Once the Entropy Principle was seen to provide a variational principle from which equations of motion could be obtained the method of unifying the branches of physics became visible.

While it may seem rather anticlimactic to be so brief about a point which has as much significance as this point, there seems to be little that needs to be added to the seven preceding chapters.

9.7 The pedagogical aspect of the Dynamic Theory

The precept that all current branches of physics (i.e. classical thermodynamics, Newtonian mechanics, Special Relativistic mechanics, and Quantum mechanics) plus all the forces in nature (i.e. electromagnetic, gravitational, weak, and strong nuclear) stem from a single, simple set of fundamental laws may now be used to teach each of these branches and forces by the application of a different set of restrictive assumptions. The logic and rigor underlying this ability comes from the Dynamic Theory, which shows that three fundamental laws may be used with restrictive assumptions to derive the fundamentals of the various branches and forces. This not only displays the interrelationships of the different branches and forces, but also sets up the excellent teaching situation where different restrictive assumptions are the only difference between the very dissimilar branches.

Students may be excused for some level of confusion during their advancement through a school system wherein they are confronted with additional fundamental assumptions as they encounter new branches of physics. This confusion may be somewhat enhanced by the necessity of learning increasing skills in mathematics. However, it is the sheer number of fundamental assumptions currently perceived necessary for providing the basis for the existing branches of physics that is the source of the confusion.

The notion that the different forces in nature might somehow be tied together is the impetus behind the unified field theory hunt. Indeed this notion was behind the first formal theory, which attempted to unify the electromagnetic and gravitational fields as far back as 1836. Since then innumerable scientists have conducted investigations into the unification of the forces, or fields, in nature. However, no theory has yet been suggested that has gained undeniable experimental verification. Theoretical physicists are still at work trying to find a theory that will ultimately unify the forces of nature. Such is the belief in the unity of nature.

On the other hand the unification of the branches of physics has not enjoyed the same level of attention. Indeed, relatively speaking, there is very little discussion in the literature of this concept. This concept was the motivation for the development of the Dynamic Theory. The unification of the forces comes as an additional feature.

To based a study of science and physics upon the three fundamental laws and then lead to the various branches of physics by restricting our attention by specific assumptions would seem to be a very logical way to learn about our universe.

9.8 Where to from here?

This might be one of my favorite topics. I seldom get the chance to do much work in this area anymore and certainly have few with which to discuss the topic. One of the things that I disliked about the course of instruction that I received was that the prevailing attitude from virtually all of my professors was that "We now knew where advancement could be made." If this were true then where was there any room for new work? Why should I study a subject for which there was nothing new to be learned? This was a terrible turn-off.

However, I didn't believe them then and don't believe them now.

From the Dynamic Theory's point of view there is a great deal of things to be learned! For example, almost everything in the preceding chapters refers to systems which are isolated and for which the Entropy Principle was employed. What do the non-isolated equations of motion look like? Wouldn't they describe a particle's transition from one stable state to another?

We know that when one has a non-isolated thermodynamic system and are pumping heat energy in or out of the system we must then minimize the free energy to determine what happens. The same logic would apply here. If we wish to seek solutions for non-isolated systems we need to minimize he free energy to obtain the non-isolated equations of motion. This should give us the ability to better describe what happens in these systems.

Notice, though, what this implies. We need to be vary careful when we are considering mechanical systems to classify them as isolated or non-isolated. This is something we never had to worry about before. It is also a way of seeing that there may be a lot more to be learned if we do things differently.

The new things to be learned are not limited to non-isolated systems. Consider the simpler question, can something go faster than the speed of light? From the relativistic point of view one must answer that something going slower than the speed of light now must forever remain slower than the speed of light. Similarly, things faster must remain faster. But is the same conclusion true in the Dynamic Theory? The answer is no. From the five-dimensional point of view the limiting aspect comes from

$$\frac{dq_0}{dt} = \sqrt{1 - \frac{v^2}{c^2} - \frac{g_{44}\dot{\gamma}^2}{a_0^2 c^2}},$$

when time rate of change in entropy goes to zero. Should d/dt_0 and $g_{44}<0$ then v may be allowed to be greater than c. What does this mean?

In nuclear weapons and reactors, mass is converted into energy. However, Einstein's theory, which predicts the energy released in this conversion, says nothing about the rate at which this conversion can or does proceed. On the other hand, the Dynamic Theory not only provides an additional equation of motion that can be solved to find the mass conversion rate as a function of time, but it predicts a limiting rate of mass conversion. The limiting mass conversion rate comes from Eqn. (9.1) when $v=0$ and $g_{44}=1$, then

$$\dot{\gamma}_{\max} = a_0 c.$$

Where does this lead us?