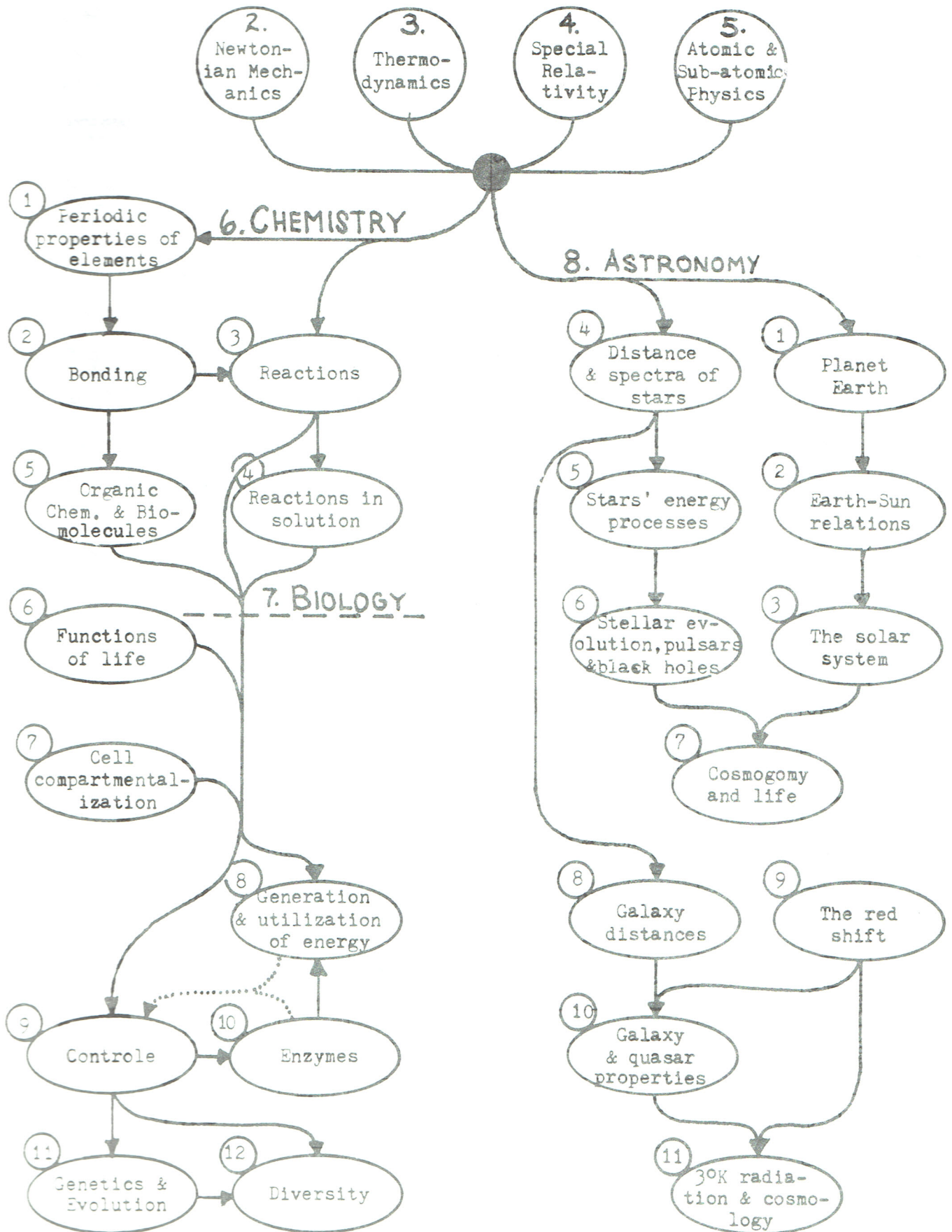


CHEMISTRY, BIOLOGY, AND ASTRONOMY



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verse go on expanding, or will it begin to contract, from the force of gravity, and return to its initial super-dense state only to expand again? Definite answers to these questions cannot yet be provided. Not enough is known about the nature of gravity and the nature of space. However, as the evidence presently stands, it appears that the universe had no beginning and faces no end, but has oscillated and shall continue to oscillate forever as a infinite series of successive expansions and contractions. Of course why should the universe not exist forever? Our concepts of beginning and ending were derived from, and indeed only apply to arrangements and patterns. The changes that permeate the universe, from atoms to man to stars only transform the pieces. In short, energy is conserved.

References to bibliography at end of chapter: 1-14;1-15;1-19;2;7-1;7-4... 7-8;8-34;8-35;11-4;14-5...14-11;16-22.

A Final Overview of Astronomy

We have considered astronomy in a series of steps out from our home planet and solar system, to stars, galaxies, and the cosmological structure of the

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universe itself.

Essays #1,2, and 3 consisted of a few key observations and deductions that established some of our basic beliefs in regard to our solar system. Simple facts, such as our earth rotates, and also revolves about the sun are not so easy to prove. We also calculated the incredible energy output of the sun, and considered how the orbits of planets can be calculated from the laws of newtonian mechanics and its extensions.

Essays #4,5, and 6 were relatively detailed and involved. In those essays we followed a succession of the basic levels and portions of the arguments which provide our knowledge of stellar distances, evolution, classes, and structure.

In our chart, block #7 stands alone, but links up much of the information found and developed in the previous essays. The results of our study of the probability of earth-like planets, and life existing elsewhere in the universe rather contradict the naive assumption that our earth is the only inhabited planet in the universe.

The logical consistency of essays #8,9,10, and 11 begins with the validity of the methods we deduced for determining star distances in essay #4. For we found the distances to a number of galaxies from the distances to their stars. With this determination of distance, we found the relation between a galaxy's distance and its recessional speed from us via our isolation of the source for their red shifts. This and a little thought, led us to the correct scheme for galaxy evolution. Finally, the combined evidence of the energy of quasar galaxies, 3° Kelvin radiation, and the red shift of galaxies lead to our conclusion that the universe is presently in the expansion phase of what probably is an oscillating, repeating cycle.

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Finally, astronomy, like the other sciences, is more than "science", more than observations and their analysis. In the case of astronomy our conception of the mysterious starry sky and the ideas involved often overshadows our knowledge of its subject matter. So mystery and beauty may envelop the subject as much as illustrate it; this is part of the eternal problem of knowing truth. For the individual, it is the problem of isolating biases from valid observations and true facts.

[Faint, mostly illegible text, likely bleed-through from the reverse side of the page. Some legible fragments include:]

- ... Introduction to Planetary Science ...
- ... The Stars: Their Structure and Evolution ...
- ... Light and Spectra ...
- ... Galaxies and Cosmology ...
- ... The Solar System ...
- ... Stellar Evolution ...
- ... Galaxies and the Universe ...
- ... Planetary Science ...
- ... Light and Spectra ...
- ... Galaxies and Cosmology ...
- ... The Solar System ...
- ... Stellar Evolution ...
- ... Galaxies and the Universe ...
- ... Planetary Science ...