

CHAPTER 3 "The Reformed Concept of Matter"

ANALYSIS

1. Chapter Position in the Overall Argument

This chapter completes the physics groundwork Smuts has been laying in Chapters 2-3. Having reformed Space-Time in Chapter 2, he now applies the same structural principle to Matter itself, arguing that structure is "much more conspicuous and important" in matter than even in the Space-Time continuum.

The chapter serves as the crucial bridge between the physical universe and life. Its explicit purpose is "to pave the way for a reform of the concept of matter, to break down the old concept of matter as something inert, passive, barren, dead, as something with absolute contours and nothing beyond, as something final and presenting an impassable barrier to the kingdoms of life and mind beyond."

The structural logic is sequential: Chapter 1 diagnosed the problem (rigid concepts); Chapter 2 reformed Space-Time; Chapter 3 reforms Matter; subsequent chapters will address Life, Mind, and finally Holism itself. This chapter's thesis—that matter is active, structural, and creative—provides the material foundation upon which life and mind can be shown to emerge as higher phases of the same fundamental process.

2. Key Concepts Introduced or Developed

A. Structure as Fundamental to Matter

The central thesis: "The physical and chemical constitution of matter is almost entirely a matter of structure." Smuts traces this through multiple levels: atoms combining into molecules, molecules into substances, all "according to structural schemes dependent on the placing and spacing of the different units in various chemical combinations."

B. Atomic Structure (Rutherford-Bohr Model)

Atoms are "electrical constellations somewhat like our gravitational solar system; the centre of the system being a minute very massive nucleus positively electrified, round which revolve equally minute electrons." In a revealing footnote, Smuts acknowledges this model has been "largely superseded by the new quantum mechanics associated mostly with the names of Schrödinger, Heisenberg, and Dirac" but notes crucially that "the feature of structure is, however, as markedly emphasised in the new theories as in the prior Rutherford-Bohr symbolism."

C. Matter as Concentrated Energy

One of the chapter's most radical claims: "Matter itself is nothing but concentrated structural energy, energy stereotyped into structure." Mass becomes a function of velocity: "matter is but a form of energy, concentrated by its exceeding velocity, and structured to appear massive or substantial."

D. The Quantum

Planck's quantum (1900) reveals nature's fundamental discreteness: "Nature stores or expends her energy, not continuously, but in fixed quantities or quanta—in spurts, and not in a continuous jet." This discreteness is foundational for individuality.

E. Radioactivity and Transmutation

Radioactivity (Becquerel, 1896) showed the atom "was not indivisible and could break up spontaneously." This destroys the fixity of elemental types: "The fixity of the types of matter has followed the fixity of the types of life to the limbo of the obsolete."

F. The Periodic Table as Taxonomy

Smuts draws an explicit parallel: "The Periodic Table of Chemistry has a distinct resemblance to the Systems of Botany and Zoology; the concepts of families, genera and species could be applied to both." This suggests a common logic of organization across matter and life.

G. States of Matter

All states (gas, liquid, solid, colloid) explained by internal charge equilibrium. Inert gases (Helium, Argon) have complete equilibrium; liquids have incomplete equilibrium producing surface tension; solids have greater disequilibrium producing crystal lattices. The colloid state—particles dispersed through another medium—is "specially important because the protoplasm of all organic cells is organised in this state."

H. Colloid Surface Properties

Colloid surfaces exhibit "selective adsorption," catalytic activity, and enzyme-like specificity. Smuts quotes Dr. E. F. Armstrong: "the conception of an orientated active structure at the surface of a colloid aggregate might endow it with selective power of so fine a nature as almost to merit the description of intelligence."

I. Matter as Active

Against the traditional view of inert matter: "Matter like life is intensely active; the difference is not between deadness and activity, but between two different kinds of activity."

J. Matter as Creative

A daring extension: "The structure of matter indicates that matter is also in a sense creative—creative, that is to say, not of its own stuff, but of the forms, arrangements and patterns which constitute all its value in the physical sphere."

K. Discreteness/Discontinuity

The quantum reveals fundamental discontinuity in nature: "The flow of nature is interrupted by halts and pauses in all directions." This connects to organic individuality: "It is this discreteness or individual element that specially distinguishes organic nature."

L. The Matter-Life Mutation

Rather than an impassable gulf, the transition from matter to life is reconceived as "a leap forward, not as between species, but as between kingdoms... the greatest mutation of all undoubtedly in the whole range of science, but essentially nothing more than a mutation."

3. Dialectical Context

Views Opposed

- **Traditional Materialism:** The concept of matter as "inert, passive, barren, dead"—as absolute substance with "absolute contours and nothing beyond."
- **Newtonian Inertia:** "Its inertia, which is apparently its most distinctive quality and has been consecrated by Newton in his First Law, has received its death-blow at the hands of Einstein."
- **Sharp Matter-Life Dualism:** The "apparently impassable gaps" and "impassable gulf" between matter and life.
- **Conservation as Anti-Creativity:** "The principles of the conservation of matter and energy have effectively barred any such idea" of material creativity.
- **Mechanistic Reductionism:** "The more rigid mechanistic conceptions of science" that deny novelty and creativeness.

Thinkers Engaged Supportively

Einstein (reformed mass/inertia), Rutherford and Bohr (atomic structure), Planck (quantum), Becquerel, Thomson, Röntgen (revolutionary discoveries), Schrödinger, Heisenberg, Dirac (new quantum mechanics), Darwin (Organic Descent parallel), De Vries (mutations), Dr. E. F. Armstrong (colloid selectivity), James Jeans (discontinuity), Professor Millikan (cosmic rays).

Synthesis Achieved

Matter and life are shown to be "different phases in the evolution of an essential unity." Through shared features—activity, plasticity, structural creativity, discreteness—they form "the faint lineaments of a family resemblance." The partition wall between physical and organic domains falls.

4. Main Arguments and Their Structure

Argument 1: Structure is the Essence of Matter

Premise 1: Chemistry discovered that properties depend on structural arrangement, not just composition (isomers, allotropes).

Premise 2: "So important is structure to matter that without it one may safely say that organic chemistry becomes unintelligible."

Premise 3: The New Physics traced structure "back into the innermost recesses of the atom."

Conclusion: "There is thus structure through and through, not only in matter or the energies which in their extreme concentration and velocity assume the massive form of matter, but also in the field which surrounds this matter."

Argument 2: Matter is Intensely Active

Premise 1: Atomic structure reveals electrons revolving at immense velocities, quanta being emitted, continuous dynamic activity.

Premise 2: Einstein's relativity shows mass/inertia is a function of velocity, not an absolute property.

Premise 3: "Matter itself is nothing but concentrated structural energy, energy stereotyped into structure."

Conclusion: "So far from matter being pure inertia or passivity, it is in reality a mass of seething, palpitating energies and activities."

Argument 3: Material Types Are Fluid

Premise 1: Radioactivity demonstrates spontaneous transmutation of elements.

Premise 2: The Periodic Table shows elements in systematic relationships like biological taxonomy.

Premise 3: Both radioactive decay and organic evolution proceed by discrete steps.

Conclusion: "Radioactivity has done a somewhat similar work for matter as Darwin's theory of Organic Descent did for life two generations ago."

Argument 4: Matter is Creative of Value

Premise 1: All values of matter "arise purely from these structures and forms."

Premise 2: If matter were structureless and diffuse, "the entropy of the universe would be absolute, and its value... would be nil."

Premise 3: Creation of structure is creation of value.

Conclusion: "In a very real sense the idea of value applies as truly and effectively in the domain of the physical as in that of the biological or the psychological."

Argument 5: Discreteness Connects Matter to Life

The quantum represents fundamental discreteness in energy; atoms in material composition; genes in biological inheritance. "Here we find its real basis laid in the ultimate energy unit, in the quantum."

Argument 6: The Colloid State Bridges Matter and Life

Protoplasm is organized in the colloid state; colloid surfaces exhibit selective, quasi-intelligent properties; colloids manufacture life's mechanisms. "In its colloid state we thus see matter reaching up to the very threshold of life."

Argument 7: The Gap is a Mutation, Not a Gulf

Six points from the Summary narrowing the gap:

1. Activity shared (not deadness vs. activity)
2. Radioactivity parallels Organic Descent
3. Periodic Table parallels biological taxonomy
4. Structural creativity shared
5. Discreteness shared (quantum → individuality)
6. Colloid state manufactures life's mechanisms

"Instead of the old impassable gulf between matter and life, between the chemical compound and the cell, we have found on closer scrutiny only a mutation—the greatest mutation of all undoubtedly in the whole range of science, but essentially nothing more than a mutation."

5. Evidence and Examples Used

Revolutionary Physical Discoveries

- Radioactivity (Becquerel, 1896)
- X-rays (Röntgen, 1895)
- Electron isolation (J. J. Thomson, 1897)
- The quantum (Planck, 1900)
- Rutherford-Bohr atomic model
- Rutherford's nitrogen bombardment experiments (artificial transmutation)

Chemical Evidence

- **Carbon allotropes:** coal, graphite, diamond—same atoms, different structures, entirely different properties
- **Isomers:** Same composition, different properties, proving structure is decisive
- **Periodic Table:** 92 elements, atomic numbers 1 (Hydrogen) to 92 (Uranium)
- **Radioactive decay chains:** Uranium → Thorium → Radium → Lead
- **Mass defect:** Four protons in helium nucleus show less mass than four free hydrogen atoms

Prescient Observation on Nuclear Energy

"Should this energy ever become economically available, the greatest potential source of energy in the universe will be opened up for the benefit or destruction of mankind." (Written 1926—19 years before Hiroshima)

6. Key Quotations for Reference

On Structure as Fundamental

"The physical and chemical constitution of matter is almost entirely a matter of structure." (p. 31)

"So important is structure to matter that without it one may safely say that organic chemistry becomes unintelligible." (p. 34)

"There is thus structure through and through, not only in matter or the energies which in their extreme concentration and velocity assume the massive form of matter, but also in the field which surrounds this matter." (p. 41)

On Matter as Active

"Matter like life is intensely active; the difference is not between deadness and activity, but between two different kinds of activity." (p. 32)

"So far from matter being pure inertia or passivity, it is in reality a mass of seething, palpitating energies and activities. Its very dead-weight simply means the push of inner activities." (p. 48)

"Matter itself is nothing but concentrated structural energy, energy stereotyped into structure." (p. 48)

"The very nature of the physical universe is activity or Action. The Law of the Quantum rules all." (p. 48)

On the Fall of the Old Concept

"With the dissolution of the old traditional concept of matter the dead-weight of its utter passivity disappears from men's minds, and one of the greatest partition walls in knowledge falls down." (p. 48)

On Matter as Creative

"But for its dynamic structural creative character matter could not have been the mother of the universe." (p. 32)

"The structure of matter indicates that matter is also in a sense creative—creative, that is to say, not of its own stuff, but of the forms, arrangements and patterns which constitute all its value in the physical sphere." (p. 52)

"The 'values' of matter or the physical universe arise purely from these structures and forms." (p. 53)

On Interpreting Matter from Within

"We have to interpret matter from the inside, from a point of view which is that of matter and not remote from and indifferent to it. And from that intimate angle matter is seen to create its structures and patterns and values very much as life or mind does on another much higher plane." (p. 52)

On Colloid State

"In its colloid state we thus see matter reaching up to the very threshold of life." (p. 32)

"The colloid surface is apparently a special field of force or influence in which other chemical or physical reactions besides selective adsorption are facilitated." (p. 43)

"The conception of an orientated active structure at the surface of a colloid aggregate might endow it with selective power of so fine a nature as almost to merit the description of intelligence." (Armstrong, quoted p. 44)

On Matter-Life Continuity

"For the fields of matter and life overlap, intermingle, and interpenetrate each other, the fruitful contacts are established, and the enriched and broadened concepts of matter and life appear as what they are—different phases in the evolution of an essential unity." (pp. 48-49)

"Instead of the old impassable gulf between matter and life, between the chemical compound and the cell, we have found on closer scrutiny only a mutation—the greatest mutation of all undoubtedly in the whole range of science, but essentially nothing more than a mutation." (p. 55)

"They present the faint lineaments of a family resemblance, and as science advances and our philosophy looks more deeply, the resemblance will become clearer and more unmistakable." (p. 55)

7. Tier 1 Concept Development

HOLISM

This chapter advances holism by showing that wholeness is fundamental even at the material level. Properties arise from structural organization, not mere aggregation:

- *Isomers prove the whole determines properties:* Same parts (atoms) in different arrangements yield entirely different substances
- *Chemical formulas are "mere abstract notational shorthand":* Only the whole structure explains behavior
- *"Structure through and through":* Wholeness extends from nucleus through atom through field

The error of analysis is explicitly named: treating matter from "the outside" as "indifferent external spectators" misses its nature. True understanding requires identifying "with the point of view of matter, so to speak."

THE WHOLE

Multiple levels of whole are identified:

- *Atom as organized whole:* "An electrical constellation somewhat like our gravitational solar system"
- *Compound molecules as systems of systems:* "suns with their attendant planets again revolve round a greater central sun"
- *Crystal unit bodies:* "A unit body or minute structure... which always acts as a unit"

Properties emerge from the whole's organization: "In every case the external properties of the element are simply the expression of its internal structure and its condition of stable or unstable equilibrium in respect of its inner elements."

FIELDS

Field concepts continue from Chapter 2:

- *Gravitational field:* "The movements of the substance as a whole and of its parts relatively to each other create the gravitational field or curved Space-Time system"
- *Colloid surface as field:* "The colloid surface is apparently a special field of force or influence"
- *Chlorophyll surfaces as fields:* "Its colloidal surfaces are 'fields' in which the energy of sunlight can synthesise"
- *Overlapping fields:* "The fields of matter and life thus overlap and intermingle"

CREATIVE EVOLUTION

Material creativity is explicitly argued:

- *Matter creates forms:* "Matter is also in a sense creative—creative, that is to say, not of its own stuff, but of the forms, arrangements and patterns"
- *Radioactivity as material evolution:* "Radioactivity has done a somewhat similar work for matter as Darwin's theory of Organic Descent did for life"
- *Ongoing creation:* "The whole romance of the Aniline dyes is a tribute to the still active 'creativity' of matter"

- *Historical evolution of elements:* "A similar evolution of material structures and elemental types may have gone on during the practically infinite period of past time"

MIND (Proto-Mind)

The chapter hints at proto-mental properties in matter:

- *Selective power:* Colloids show "a peculiar and almost mysterious selective action for other substances"
- *Intelligence attribution:* Armstrong quoted on selective power "of so fine a nature as almost to merit the description of intelligence"
- *Epistemological point:* Understanding matter requires adopting its internal perspective—"We have humbly to get into that closed cage"

This prepares for the later argument that mind emerges from matter not as alien addition but as intensification of capacities already present in nascent form.

8. Contemporary Relevance for Validation

Quantum Field Theory

Smuts's reduction of matter to "a form of energy, concentrated by its exceeding velocity, and structured to appear massive or substantial" anticipates quantum field theory where particles are excitations of underlying fields. His insistence that structure remains fundamental even as specific models (Rutherford-Bohr) are superseded proved prescient.

Nuclear Physics

Smuts's comment on nuclear energy—"Should this energy ever become economically available, the greatest potential source of energy in the universe will be opened up for the benefit or destruction of mankind"—written in 1926, constitutes a remarkable anticipation of developments culminating in 1945 and after.

Emergence and Complexity Science

The thesis that structure creates value and that properties emerge from arrangements not reducible to components anticipates emergence theory in complexity science. Contemporary researchers studying self-organization, phase transitions, and emergent phenomena echo Smuts's structural approach.

Structural Biology

The discovery of DNA structure (1953) and ongoing work in protein folding confirm that structure determines function at life's molecular basis—precisely Smuts's argument about isomers and molecular architecture extended to biological macromolecules.

Origins of Life Research

Current research on protocells, autocatalysis, surface chemistry, and the role of membranes in life's origin echoes Smuts's emphasis on the colloid state as bridging matter and life. His focus on surfaces as "fields" of selective activity anticipates membrane biophysics.

Process Philosophy

Smuts's conception of matter as inherently active rather than inert substrate aligns with Whitehead's process philosophy developed contemporaneously. Both reject substance metaphysics in favor of activity as fundamental.

Philosophy of Science

The chapter's methodological discussion of atomic structure as hypothesis—"accepted as scientific realities... not directly observed, but deduced from observations"—anticipates debates about scientific realism. Smuts's position that "the sensible order is the governing factor to which the conceptual order has to conform" while acknowledging the conceptual order as legitimate scientific knowledge represents sophisticated structural realism.

Information Theory

The connection between structure and value—that diffuse, structureless matter would have "nil" value—anticipates information-theoretic approaches where order and organization carry significance. Structure as the locus of value connects to contemporary discussions of information, negentropy, and complexity.

Summary: Chapter 3's Contribution to Holism Rising

Chapter 3 completes Smuts's physical groundwork by demonstrating that structure—not inert substance—is the fundamental reality of matter. This chapter is crucial for the *Holism Rising* project because:

- **It grounds holism in physics:** Smuts shows that wholeness and structure are not just biological or mental phenomena but fundamental to physical reality itself.
- **It bridges matter and life:** The colloid state, surface fields, and proto-selective properties create conceptual continuity between inorganic and organic domains.
- **It anticipates contemporary science:** Quantum field theory, emergence science, structural biology, and origins-of-life research all echo Smuts's structural approach.
- **It provides the key quotation on creativity:** "But for its dynamic structural creative character matter could not have been the mother of the universe."
- **It presciently addresses nuclear energy:** The 1926 prediction about nuclear power "for the benefit or destruction of mankind" demonstrates Smuts's grasp of physics' implications.

The chapter's central insight—that the transition from matter to life is "the greatest mutation of all... but essentially nothing more than a mutation"—provides the conceptual foundation for understanding life as emergence rather than rupture.