Chapter 6
Pedagogical Ontology Modelling for Cell Biology Domain With an Algorithm for Question Generation

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1. INTRODUCTION

Biology is one of the domains which is essential to master and advance scientifically to improve our quality of living. Cells are the constituents of every single thing in this entire universe, and they need to be structured systematically for scientific needs and the purpose of education. Among the several already existing ontologies built for biology, this ontology which is proposed here will be unique because the approach used to build it and its content. Cell biology, in its current form, is like an unstructured domain with random pieces of information present here and there. To organize the content and to build a hierarchy, this work will propose a method of constructing ontologies with cell biology as a domain with a major focus on Cell Organelles. There are many ways to structure the domain knowledge but building an ontology is one of the best methods owing to the sophistication of the product and its usefulness in various ways and different fields.

The modelled ontology can prove to be of great use in the domain of E-Learning with people of all walks of life finding this ontology useful to know about the various parts of the cell and the Cell Organelles. The ontology will be useful for the students, researchers, teachers in educational institutions all over the world. This work will propose to build an ontology which answers the questions about the organization of cells and the parts associated with the organelles. This will be of tremendous use to the students who find it hard to study cytology due to the unorganized nature of the domain. Any cell has various organelles with each of them having several different functions. The proposed ontology will overcome the difficulty of the pandemonium of knowledge in cytology. The cell organelles are studies from various sources, organized in order of their hierarchy, classified as per the domain and modelled into an Ontology.

In this work, Uschold and King's method (Uschold & King, 1995) of Ontology Development is used to model the ontology and to implement it using a tool called Protégé. The domain knowledge is gathered from the already available extensive biology literature, and it is organized into Classes and Objects. The objects then are organized into various hierarchies and developed into theoretical ontologies. The modelled ontology needs to be visualized to make it more useful and user-friendly. The ontology is modelled using XML, and a method of the transfiguration of the Ontology from XML to RDF/OWL is proposed. After modelling, the implementation phase is carried out using a tool called Protégé. The ontology is then evaluated using the metrics available in the Semiotics Approach and the Reuse ratio, Reference ratio are calculated. Finally, a question generation algorithm is proposed focused on this ontology to generate a question related to the entered topic and four distractors.

Motivation: The motivation of this work lies in the scarcity of Biological Ontologies which are specifically modelled for Cell Biology pertaining to Cell Organelles. One

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