

## Science for the Odia Public

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### ABSTRACT

Writings on science subjects, directed at the public have been a regular feature of modern Odia literature which began taking shape during the 1850's. This article attempts to document such writings between 1850 and 1950 and to present an overview of their number, content and authors. A search through the available printed material, mostly periodicals, of this time interval yielded 765 articles which were contributed by about 100 different authors. The articles showed wide variance with respect to their length, content and style. The writings were distributed among various periodicals (672 articles), collected works (35), and two works of reference (58). The combined length of the 765 articles is about 6,00,000 words and these were supplemented with numerous illustrations and several tables. An illustrative list of 80 selected articles is given with this article along with brief summaries of their contents with a view to helping the readers appreciate their diversity. Tables giving the distribution of the articles according to the time period of publication and according to their length are included. Tabulation of authors and the number of articles written by each has been made to identify the more prolific authors.

**KEYWORDS:** Odia Literature, Science Writing, Science Magazine, Science Books, Terminology,

### Historical Background

The geographical-political entity known as Odisha today finds mention in history under various names since the 6th century BCE (Common Era, History of Orissa)). These names include Odra and Udra as well as others like Kalinga, Utkal, Koshal, Trikalinga. The earliest 'written' reference to Kalinga dates back to 261 BCE in the form of

the Ashokan edicts describing the Emperor's conquest of the region through a bloody war (Dora, 2008; Rajguru, 1985). Subsequent references are found in the edicts of Emperor Kharavela (1st century BCE) and in Pliny's *Natural History* (1st century CE). Geographers Ibn Khurdadvi and Hadud Al Alan (9th-10th c. CE) have described Odisha as 'Ursin' or 'Ursifin' and the great traveller Al Beruni (11th c. CE) as 'Urdabisau' in his book *India* (Dora, 2008; Rajguru, 1985).

The Sanskrit name 'Odra', probably from which the name 'Odisha' is derived, has come into regular use since the 2nd c. BCE. The first clear mention of the name Odisha came in the 14th c. CE and has found popular use since the times of King Kapilendra Deb during early 15th c. CE (Panigrahi, 1981).

During this time many different dynasties ruled over this entity and its geographical area varied greatly with the conquests made and defeats suffered by the rulers. The vast kingdom of Kalinga reflected the greatest extent of Odisha while it shrunk to a coastal tract of much smaller area when the British subjugation started in 1804. During most of the British rule the Odisha (then named Orissa) region was split into three major parts, which remained separately under the Madras, Central and Bengal Presidencies/provinces. In addition there were 26 princely states with independent administration spread over the entire region (Orissa at a Glance).

A separate Bihar-Orissa province was created in 1912 CE by splitting the Bengal Presidency and its administrative head quarters remained at Patna. It was only in 1936 that a separate language-based province named Orissa was formed that consolidated most of the Odia speaking areas, other than the princely states, into one administrative unit with its capital at Cuttack. The princely states were merged into the state after independence and

the resultant geographical area remained more or less unchanged during the states' reorganisation in 1957 to emerge as the Odisha we know today (Dora, 2008).

### **Language, Literature and Culture**

Rudimentary characteristics of Odia language and script date back to the 3rd c. BCE (Mohanty, 2006). It is generally believed that the language has evolved from Sanskrit and Prakrit through *Magadhi* Prakrit and *Magadhi Apabhramsha* to reach its developed form, which is reflected in the inscriptions since 1051 CE (Common Era). Odia literature followed a similar time frame of development and a significant body of oral literature grew over this period, which was transmitted over the generations through the word of mouth (Mohanty, 2006; Mansinha, 1967).

The *Buddhist Charya Gitikas* written around the 9th c. CE are considered to be the earliest examples of written Odia literature, although in its rudimentary form (Mohanty, 2006; Mansinha, 1967). These and other works upto 1400 CE are grouped as Proto-Odia literature which laid the foundation for future development. This literary development reached a well-defined stage by the 15th c. CE. During a part of this period, especially between the 7th and 12th c. CE, Sanskrit was a favoured language among the learned people of Odisha. In addition to the copper plate edicts and literary works in Sanskrit, several works on astronomy were produced by a pundit named Satananda in the 11th c. CE\*.

Odia literature progressed steadily between 1400 and 1900 CE, the time interval identified as the Early and Middle Odia periods. These periods were marked by

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\* Some examples of such Sanskrit literature are *Anargha Raghava Natakam* by Murari Mishra and the famous *Gita Govinda* by Jayadev. Works by Satananda included *Vaswati*, *Satananda Ratnamala* and *Satananda Sangraha*.

numerous rich creations like the epics, kavyas, ornate poetry and verse (Mishra, 2012; Mohapatra and Pradhan, 2009). Prose writings were few during this time but significant contributions exist in this form and this form of writing was to play a major role in future as discussed later in this article.

The progress in the field of literature was a part of an overall socio-cultural development, which saw advances being made in areas like art and architecture, trade and other professional activities as well. The progress of this cultural development picked up pace around the 9th c. CE and reached its peak during the 15th c. CE (Mohanty, 2006).

### **Technology at the Cultural High Point**

During this period various professional activities that kept the people engaged were based on locally developed technologies (Mishra, 2012; Kulke *et al.*, 2013). Two such activities that reached a high degree of sophistication were temple building and maritime trade. Incidental to these two activities was iron smelting which produced rust-resistant iron fittings required for use in the seafaring ships and temples.

Designing and building of large temples involved many skills like identifying appropriate types of stone, transportation of massive blocks of such stone, hoisting these to great heights and balancing them through counterpoising (Mishra, 2012; Kulke *et al.*, 2013). All these required knowledge refined over the centuries through experimentation and practice. Similarly, building sailing ships and navigating these across the high seas required deep technical knowledge in many fields.

The sun temple at Konark built during the 13th c. CE bears witness to many types of skills and technical knowledge of the period. The massive temple, only ruins of

which now stand, presents the finest sculptures and carvings in stone. Besides the usual temple building skills, the layout of the temple reflects a knowledge of astronomy and the large stone sculptures of animals like elephants and horses are hewn with anatomical precision (Mishra, 1919; Mishra, 1919; Dey, 2012).

On the premises of the Konark temple lie a pile of massive iron beams some of which are larger than the Iron Pillar of Delhi. These were used in the main temple, which collapsed some 300 years after construction and are still free of rust and show little corrosion even after being exposed to the sea breeze for over 700 years. It is believed that these beams were produced locally in small segments and welded together either by pouring molten iron over them or by hammering when hot (Acharya, 2011).

### **Eclipse and Re-emergence**

Soon after reaching its cultural high point Odisha went into a, what can be termed as, a cultural eclipse. The cause for this was its passing into the hands of the Afghan and Moghul rulers and then coming under the Marathas. This period, from 1568 CE to about 1805 CE, proved quite disruptive for Odisha and was marked by much destruction and terror (Acharya, 2011). While the activities like temple building stopped because of lack of patronage from the rulers, literature managed to survive and even flourish with the help of native patrons<sup>17</sup>.

Starting in early 20th c. CE major political and social changes were experienced in Odisha. Increased activities of Christian missionaries in adjoining Bengal and the start of British occupation of Odisha in 1803 were two major factors for this. Among the changes that were soon felt across the Odisha region were increasing contact with western ideas, establishment of institutions imparting education with western content, setting up of printing

presses and availability of printed books. Attempts were also made to develop dictionaries and codify the grammatical rules at this time (Dash, 1983; Nayak, 2013).

Independent of the political development a change was also coming over Odia literature both in its form and content. Early and medieval Odia literature consisted mostly of various forms of poetical writings that required a mastery over the language to understand and appreciate. There were some notable pieces of writings in prose, but these were rather small in number (Mohanty 2008). The older Odia literary works used deities, myths, nature, kings and wars as their themes. Spiritual and religious sentiments as well as devotion to the deities and the rulers were the underlying sentiments for many of these works.

The new Odia literature during the first part of the 20th c., in contrast, used prose as its medium of expression (Mishra, 1978). Prose provided freedom for expressing intricate ideas in logical and analytical ways. Essays and short compositions became powerful vehicles for ideas and issues. Almost anyone could now express their ideas in writing as the emphasis shifted to the content rather than style. Newer areas of human knowledge entered the literary scene and students of these newer academic divisions started writing about their work for the public, both to inform and to seek popular support.

### **Modern Odia Literature and Science Writing**

All these changes paved the way for the emergence of Odia literature in its 'Modern' form during the second half of the 20th c. CE. This is the point where science became a subject for literature. Initially established writers wrote about science and scientists (Senapati, 1866; Giri, 2007) (see Annexure). But in time students of science joined, and even overtook, them in this endeavour. As a result not only modern Odia literature became broader and

richer, science writing efforts grew into a recognised branch of literature.

Publication of printed periodicals in Odia started in 1849 and three separate monthlies appeared in the next 12 years. These were brought out by the Christian Missionaries and were rather short-lived. No copies of the first and the third have survived but the second one, *Prabodh Chandrika*, published between 1856 and 1858 featured science articles right from its first issue.

The first regular periodical, *Utkal Dipika*, started publication in 1866 as a weekly 'newspaper' and it carried short write-ups related to science on its pages. Publication of other such periodicals followed from different parts of Odisha and three of these, *Utkal Dipika*, *Baleswar Sambad Bahika* (1868) and *Sambalpur Hiteishini* (1889), remained in publication for a considerable period of time. In addition to short pieces of newsy write-ups these carried occasional long articles on science and related issues.

The first monthly literary magazine in Odia, *Utkal Darpa* (Giri, 2007), appeared in 1873 and started featuring long articles on science from the beginning. Unfortunately, the magazine did not survive for long and only a few issues of the first volume are now available. Several other magazines with similar literary objective and short life appeared before the end of the century and many interesting science articles appeared in these. A list of some of these articles is given in Annexure.

Interestingly, an Odia magazine, *Bigyan Darpan*, fully devoted to science appeared in 1880. It was published from Calcutta (Kolkata) and continued for three years. Unfortunately, no copies of it are to be found now. However, reviews of and extracts from some issues are found in other periodicals which give an idea about its contents. A magazine on health and medical subjects, *Utkal Chikitsaka*, was published in 1894 by a medical practitioner

Ramakrushna Sahu who was a regular writer on health matters.

Magazine publishing in Odia language can be said to have come of age in 1897 with the launching of *Utkal Sahitya*. It offered rich content covering a wide range of topics and remained in continuous publication till 1941. The opening editorial of *Utkal Sahitya* stated that it will try its best *to present the best from the older literature and also the advanced concepts and thoughts of the modern era*. It included science specifically as an area where articles would be the most welcome. In keeping with its objectives a biography of Benjamin Franklin was featured in its first issue. In time it carried science articles on a regular basis and often explored the philosophical and social aspects of science through special articles.

Several other magazines both for the general readers and specifically for children appeared between 1906 and 1950 and provided space for science articles regularly. *Baruni*, a two-monthly magazine published in 1925 carried some well-illustrated science articles, but it ceased publication after only five issues.

### **Science Articles in Odia Periodicals — An Overview**

The earliest science articles found in Odia literature of the modern period date back to 1856. The two articles in the magazine *Prabodha Chandrika* were on the subjects of respiration and blood circulation and were of moderate length (~450 words) (Mohanty, 1984; Srujanika, 2010). These were followed by a book of biographies, Fakir Mohan Senapati's *Jeeban Charita*, which presented sketches of life and work of several scientists like Copernicus, Galileo, Herschel, Newton and Linnaeus (Senapati, 1866). The biographies of 1000 to 2000 words were, however, translations from Bengali version of the original writings in English. Hence these were important,



more from a literary point of view, using the still-evolving Odia prose as a vehicle for modern topics words for which did not even exist in the language.

Most of the other science writings found over the next 40 years were short pieces suitable for newspapers. These were reports relating to health and disease issues, celestial events like the eclipses, reviews of science books and magazines and other developments that the editors found interesting (Annexure). Some examples of the last were: several reports on the proposal to establish a 'science association' (*Bigyan Sabha*) by Dr. Mahendralal Sarkar, reports on the establishment of a science institution in Bangalore by the Tatas, report on Kashmir Maharaja's initiative to have science books translated into Sanskrit, King of Siam inviting foreign astronomers to observe an eclipse as the state's guests, what Darwin says..., and boy blinded from viewing eclipse with naked eye (Annexure).

Some of the short reports in the newspapers gave scientific explanations of some happenings. For example, there was a report of some young brides falling into the wells while drawing water. In addition to mentioning that the wells did not have adequate safety walls, etc., the report explains that the young brides usually wore a lot of ornaments on the upper body which shifted their 'centre of gravity' upward and made them prone to toppling over while bending down to draw water. Another article published in 1882 explains, in a story form, how oil can prevent boiling over of *dal* while being cooked by lowering the 'surface tension' (Article 12, Annexure).

The newspapers also carried some longer articles; some as purely informative, while others provided background for discussion. Some of the latter were: 'Medical sciences' (1869) presents a historical development of human maladies and their treatments; 'Science education' (1871)

discusses how science has empowered the western world through new discoveries and hence the importance of our learning science; 'Seeing star and moon during the day' (1879) explains the circumstances under which planet Venus might be visible before sunset or after sunrise as a 'star' and decries the unnecessary fear of seeing it; 'Science and its benefits' (1880) and 'Lack of scientific discussions' (1881) elaborates on the value of scientific discoveries and comments on our habit of not being inquisitive which hinders scientific progress; 'Is this the comet of *Mahabharat*?' (1882); 'Eclipse musing' (1896) explains the eclipses and questions the rituals like fasting observed by our people; 'Food habits and human life' (1898) explores how food affects our life.

The newspapers also provided a forum for the readers to seek information and raise issues. An interesting example of this was the query by a reader in 1882 whether the forthcoming transit of Venus would be visible from Orissa. This was answered in the negative by an astrologer who did the computation using Samanta Chandrasekhar's ephemerides.

It should also be noted that many articles were simply sensational and had no verifiable basis. Some of these related to the curing of dreaded diseases like leprosy, small pox and cholera or conditions like snake and dog bites. A report was published even on the method of bringing the dead back to life. Reports of imaginary diseases and phenomena also found their way into the news pages.

### **Post 1897 Scenario**

*Utkal Sahitya* (1897) and other magazines that followed it in the twentieth century continued the earlier trend of publishing both informative and philosophical writings. While most were entertaining and stimulating, some of the latter initiated strong debates among the readers. Mohini

Mohan Senapati's article titled, 'Aspirations and Objectives of the Present Era' (1905) discussed the origins of religion to anthropomorphism and the reluctance of man to renounce it. He explored the reasons as to why the dependence on religion was not suitable for the present era and why man should follow the path of nature and science. The article stirred up a debate between the rationalists and traditionalists in the pages of the magazine. Other articles like 'Faith in the Realm of Science', 'Science and Literature', 'Science and Religion' which tried to explore complementary and contrasting features of science and other subjects.

There were also long articles serialised over months, or even years. Krushna Prasad Choudhury's series on 'Self-reliance' presented examples from around the world about individuals who had made a mark through perseverance. Three of these articles (1909) dealt with scientists and their endeavours which led to successful industries. Biraj Mohan Senapati started writing on the plant sciences in 1922 and continued with a long series on agriculture and cropping practices. Ratnakar Pati's series on the theory of evolution was a comprehensive treatment of the subject and continued from 1924 to 1930. Starting in 1934 Banshidhar Samantaray wrote many articles on different aspects of botany and on general science and a long series on genetics.

In contrast to such long serials all magazines carried sections on science titbits and short articles in children's section. The titbits were generally pieces of interesting information or reports on new findings and phenomena. However, these also carried many unsubstantiated sensational reports.

Although most areas of science were covered by the articles, there was a preponderance of writings on the celestial events and bodies. This group was followed by articles on plant sciences and health-related subjects.

### Writers of Odia Science Articles

The early writers of science articles in Odia were the established litterateurs of the period. The earliest identifiable author was Fakir Mohan Senapati, one of the founders of modern Odia literature, who wrote a series of biographies of scientists in the book *Jeeban Charita* (1866). Most of the writings that followed were anonymous, a practice that was common in the field of Odia literature. Many anonymous articles were found in most magazines even at later stages. But these were mostly shorter pieces which were contributed mostly by the editorial staff.

Madusudan Rao, another founder of modern Odia literature, wrote several science articles for *Utkal Darpan* in 1873. Fakir Mohan wrote other articles like the Sun, the Universe and Comet for *Baleswar Sambad Bahika* between 1875 and 1881. After *Utkal Darpan* ceased publication, most of Madhusudan's science writings were published in his books and the major articles were part of *Prabandha Mala* (1880/1886/1898). Other articles written most likely during the 1880's and 1890's formed part of the books *Balabodha*, *Shishubodha*, *Sahitya Kushuma* and *Sahitya Prasanga*.

Science writers active from the late 1890's till about 1910 were Jalandhar Deb, Shyam Sundar Nanda, Sachidananda Deb, Mrutyunjaya Rath, Tarini Charan Rath, Mohini Mohan Senapati, Nilakantha Das, Krushna Prasad Choudhury, Sashibhushan Ray and Gopal Chandra Praharaj who were all well known essayists. They were all better known for their contributions to other areas of Odia literature and served well to introduce science writing into Odia literature. Jalandhar Deb and Sachchidanand Deb were from the ruling family of Bamanda State which had a strong literary tradition. Sachchidanand had a strong interest in science and had set up astronomical and

meteorological observatories. Under their rule the state had adapted many modern technologies, including the setting up of a printing press.

During the first decade of the twentieth century teachers like Madhusudan Dash and Jagannath Tripathy took up science writing. The latter wrote in an entertaining manner on many different topics and was active till the 1930's. In 1909 he discussed the problem of scientific terminology (*paribhasha*) in Odia language. Shyam Sundar Sathia, an avid photographer, wrote a long and comprehensive series of articles on photography. Gangadhar Meher, a well-known poet whose work is noted for sensitive reflection of nature, contributed a poem on the life process of plants (*Tarubara*, 1899) and another on the moon and stars (1914). Meher wrote numerous poems on the raising of various crops which were popular among the village folk.

By the second decade of the twentieth century Odia persons with higher education in science and other fields started teaching in the Ravenshaw College, Cuttack, and took up other jobs in the Government. Several of them tried writing on science for Odia magazines. In 1913 Pranakrushna Parija, a noted Botanist who went on to be the first Vice-Chancellor of the Utkal University, started writing on a wide range of subjects. Although he wrote on botany topics later, his first writings were related to astronomy. He also wrote articles like 'Science in Everyday Life' and 'Eugenics'. He was joined by college teachers and professionals like Sachchidananda Ray, later Principal of Ravenshaw College; Chintamani Acharya, later Vice-Chancellor of Utkal University; Nilakantha Das and Godabarisha Mishra, both educationists at the Satyabadi School and socio-political workers; and Banabihari Pattnaik, doctor and medical professor.

Other college teachers and professionals who wrote during the 1920's to early 1940's were Gurucharan

Mohanty (Chemistry), Agani Das (Teacher), Shyamachandra Tripathy (Physics), Isac Santra (Medicine), Prasanna Kumar Das, Biraj Mohan Senapati (Agriculture) and Ratnakar Pati (Philosophy), Haribandhu Mohanty (Physics), Basant Kumar Nanda (Doctor), Radhacharan Panda (Doctor), Jagat Mohan Sen (Teacher), Banshidhar Samantaray (Botany) and Basant Kumar Behura (Zoology).

During 1946-47 two new writers joined the field, Gokulananda Mohapatra (Chemistry) and Gadadhar Mishra (Botany), who proved to be very prolific and remained active into the twenty first century. They were also involved in organisational activities relating to science writing and in the preparation of glossaries of scientific and technical terminology.

### **Odia Science Articles up to 1950 — A Statistical View**

Examination of the science articles in Odia published up to 1950 (Table 1) shows that about 100 persons contributed these. Interestingly, about half (53) of the 100 authors published only one article each and 30 authors published 2 to 5 articles each. Thus, of the 361 articles with identifiable authors 226 were written by the remaining 17 authors. Seven authors contributed ten or more articles each

Table 1 — Distribution of articles according to their length

| Length (Words) | No. of Articles |
|----------------|-----------------|
| <= 100         | 112             |
| 101 – 200      | 70              |
| 201 – 300      | 45              |
| 301 – 500      | 98              |
| 501 – 1000     | 159             |
| 1001 – 2000    | 162             |
| 2001 – 3000    | 47              |
| > 3000         | 9               |

accounting for a total of 129 articles. Bansidhar Samantaray had the highest number of articles (39 over 20 years) and was followed by Gokulananda Mohapatra (26 in five years). The latter, however, continued his writing over the next fifty years with an astounding productivity.

Several persons, although credited with only a small number of articles, have contributed significantly in their editorial capacities of various magazines. Some of them were Nilamani Bidyaratna (*Utkal Madhupa*), Agani Das (*Panchamruta*), Chintamani Acharya (*Panchamruta, Jhankar*), and Balakrushna Kar (*Jahnamamu, Sahakar*).

### **Science Books in Odia**

One of the first Odia books to be printed was a dictionary, or more accurately, a book of Odia words with their English equivalents. Published in 1811, this book, *A Vocabulary: Odia and English for the use of Students* by Mohunpersaud Takoor, presented the words under different subject headings. Interestingly, several of the subjects covered were science-related. It also contained sections on plants and materia medica which gave the scientific names of a number of plants. This trend of listing the botanical names in Odia dictionaries continued through the 1930's.

The Odia books published during 1811 to 1830 were mostly religious books and a few text books of general reader type. The first science text book *Padarthabidya Sara* (Essence of Physical Sciences) by Amos Sutton appeared in 1830 and was in the form of questions and answers. A few other similar books, written or translated from English/Bengali mostly by the missionaries and their Odia speaking associates, were published through the 1870's for use in the schools. Fakir Mohan Senapati's *Jeeban Charita* (Life Stories) was published in 1866 also to be used as a general reader in schools. This book was a part translation of Eshwara Chandra Vidyasagar's Bengali adaptation

(1849) of Chambers' Biography. Interestingly, almost all the biographies that appeared in the Odia version were of scientists, including Copernicus, Galileo, Herschel, Newton and Linnaeus.

Science-related books published during the next 80 years or so, till the late 1940's, were either text books or books on health/medical matters and agriculture/animal husbandry. These were designed to be used as supplementary reading by the students or as reference by the general public and field workers. The text books included titles on physical science, animal and plant science, health and hygiene and agriculture. Some of the notable general books were *Tika Deba Bisayaka Bidhana* (John Short, 1867, Vaccination Procedures), *Sishupalana O Sishusiksha* (Ramakrushna Sahu, 1885, Childcare and Child Education), *Swasthya Sadhana* (Shyamasundar Pattnaik, 1894, Health Resources), *Oushadha Bhandar* (Gopabandhu Nayak, 1916, Medicine Store), *Krushaka Bandhu* (Madanmohan Pradhan, 1920, Farmers' Friend), *Basanta* (Banabihari Pattnaik, 1929, Small Pox), *Uvida Bigyan* (Aram Patra, 1935, Plant Science), *Malaria* (Gopalchandra Pattnaik, 1941, Malaria). The books on health-related subjects by Banabihari Pattnaik and Gopalchandra Pattnaik, both doctors, were written in a very readable style while keeping the information content high. Nilamani Bidyaratna, the editor of *Sambalpur Hiteishini*, *Utkal Madhupa* and later of *Utkal Dipika*, wrote several books on the treatments for cholera, small pox, fever, cattle diseases, and snake bites, between 1895 and 1915 using folk medicines and traditional practices.

There were a few books which were written purely as 'popular science' during this period. These were *Prakruti* (Sachidananda Deb, 1911, Nature), *Brusti Bigyan* (Sachchidananda Deb, 1915, Meteorology), *Samanta Chandrasekhar* (Chandrasekhar Mishra, 1932, Biography of Samanta Chandrasekhar), *E Jugara Asura* (Prasad, 1947,



Demon of this Era), *Bigyan Bismaya* (Gokulananda Mohapatra, 1949, Wonders of Science), *Bigyan Krutittwa* (Gokulananda Mohapatra, 1949, Achievements of Science), *Pilanka Kahinki* (2 vol., Godabarisha Mishra, c.1950, Children's Questions).

Prakruti was a *khanda-kavya* (short verse) describing the evolution of the physical and the living Universe, while *Brusti Bigyan* was meant to provide a background for the data gathered at the author's own meteorological observatory. *Samanta Chandrasekhar* was the first original biography of a scientist, that too one from Orissa itself. Samanta Chandrasekhar or Pathani Samanta (1835-1904) was a naked-eye astronomer noted for his ephemeral observations and calculations of high accuracy and the author of *Siddhanta Darpan* (1899). The biography was even more notable as it described Samanta's work in much detail and also explained his Sanskrit compositions in easily understandable Odia.

*E Jugara Asura* describes the nuclear bomb and the devastation caused by it in form of a story. Godabarisha Mishra, a noted educationist and socio-political activist, wrote two science fiction books, the first in Odia, around 1950 based on some English ones. These were *Ghatantara* (A Change of Body, inspired by 'Dr Jekyll and Mr Hyde') and *Nirbasita* (The Banished). He also wrote two small volumes composed of questions and answers relating to science for children under the title *Pilanka Kahinki*. Gokulananda Mohapatra's two books of this period were compilations of his articles published in various magazines on various aspects of contemporary science and set the trend for science writing in the 1950's.

### Works of Reference

Compilation of an encyclopedia in Odia was not attempted seriously till the 1930's. The first such compilation was

done by Lala Madhab Lal and the result was his *Bibidha Sangraha* (Miscellaneous Collections). This was followed by similar works by Bhagirathi Mohapatra (*Ratnakosha ba Bruhat Bibidha Sangraha*, 1935), Lala Nagendra Kumar Roy (*Bibidha Ratna Sangraha*) and Akshaya Kumar Chakrabarti (*Bibidha Sara Sangraha*). These were intended to be books of general knowledge and included interesting information relating to science.

Publication of *Purnachandra Odia Bhashakosa* also started during the 1930's. This was a comprehensive lexicon (7 volumes, ~9500 royal quarto pages, 1931-1940) compiled by Gopal Chandra Praharaj and contained many short explanations of important terms as well as several encyclopedic articles running into many pages. Many such write-ups relating to science are found in the *Bhashakosha* including a 16-page article on *Nakshatra* (asterisms). It also contained short descriptions of about 1300 plants including their scientific names and medicinal usage.

Balakrushna Kar, already involved with the publication of magazines like *Sahakar* and children's magazine *Jahnamamu*, conceived the idea of a multi-volume encyclopedia keeping children in mind. Accordingly, he planned to make each volume self-sufficient and to be based on a single subject. Of the eight volumes proposed, three were to be on science subjects like the living world, the Universe, and wonders of science. The first volume on the living world came out in 1941 and was followed by the volume on world history (1943). Unfortunately, the publication could not continue as planned and the work remained incomplete after the publication of the volume on the Universe in 1957. However, the volumes published were well received for their simple language, lucid presentation and numerous illustrations many of which were in colour.

### **Science Popularisation Organisations**

Science writing activity reached a regular phase by 1920 and a need was felt for interaction among the writers as well as between the writers and the public. An organisation named Orissa Science Association was formed in November 1921 in Cuttack. The membership was by subscription and was solicited by open advertisement. The first secretary of the association was Biraj Mohan Senapati, an agricultural scientist and a prolific writer on farming.

The activities of the association included 'Demonstration lectures every Saturday evening in the Town Hall' as was advertised in the press. A news report on one of the meetings mentions a discussion on the use of green manure in paddy cultivation. Another meeting held a demonstration on soap making and offered guidance to anyone interested in taking it up as a cottage industry. The programme for its annual function was to be held at the Ravenshaw College. The meeting there would be followed by demonstrations of scientific instruments in the botany, physics and chemistry laboratories and by lectures with magic lantern slides. The Association probably did not continue for long as no news of its activities is found later.

By the late 1940's science writing in Odia had reached a degree of maturity and the number of writers had grown significantly. The writers of that time were mostly college professors and professionals who came in close contact with each other. Some of the more active writers started planning for an organised forum for their activity. An association by the name Utkal Bigyan Parishad was proposed in 1948, but it never came into formal existence. A second attempt by some professors of the Ravenshaw College and the Cuttack Medical College resulted in the formation of Bigyan Prachar Samiti in Cuttack on the 7th of August 1949. The group met regularly to read and discuss their articles and held symposia on various subjects

the proceedings of which were published in book form. The publication activities of the Samiti gathered momentum during the 1950's and later. The Samiti is still active today after sixty-five years of its formation.

### **Technical Terms in Odia**

Writings on science topics started appearing when prose writing in Odia was still very young. Thus the science writers had to face the compositional problems as faced in general writings. In addition, they had to search for the appropriate terms to convey science concepts which were entirely new and foreign to the language. While many English scientific terms were adapted as such or with slight modifications, newer ones were also coined. The process was, however, highly dependent on the background of the individual writers and there was little scope for standardisation.

Attempts were made in the 1920's to include glossaries of the new/adapted terms used in the articles. But this was followed in very few cases. The problem was not severe as long as the number of writers was small and most subjects were dealt by single authors. Confusing situations arose as the number of science writers grew and newer writers had difficulty in keeping track of all other writings. Increased interaction among the writers and the introduction of Odia language science text books during the 1940's helped in the process of standardisation.

### **Conclusions**

This article attempts to present an overview of the development of Odia culture and literature leading to the spreading of scientific facts and thoughts among the people of Odisha. It provides a brief background on the emergence of modern Odia literature and its progress through printed

periodicals. It then looks at the science articles and books published up to 1950.

An analysis of the 765 articles found in various periodicals and contributed by about 100 authors has been attempted. These covered a wide range with respect to length, content and style. The writings were distributed among various periodicals (672 articles), collected works (35), and two works of reference, *Bhashakosha* and *Ratnakosha* (58). It is of interest to note that the 765 articles run into about 6,00,000 words and have numerous illustrations and several tables.

In addition to the articles, 52 science books and three works of reference with significant science content were also published during this period.

An annotated list of 80 selected articles is given along with some statistics on the articles. It may be noted that the collection of the articles is incomplete as it has not been possible to locate many periodicals/issues some of which are probably lost for ever.

### **Acknowledgement**

The data on the Odia science articles and books are taken from the digital compilation by *Srujanika*, Bhubaneswar (ref. 24). The help of the *Srujanika* team members towards the preparation of this article is gratefully acknowledged.

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**Annexure**

## Selected Science Articles in Odiya Published between 1850 and 1950

| Sl. No. | Title/Author  | Year/Periodical               | Subject matter (word count)   |
|---------|---|-------------------------------|---|
| 1.      | Blood Circulation<br>( <i>Rakta Chaliba Bisaya</i> )                          | 1856<br>Prabodh Chandrika     | Blood circulation through veins and arteries, blood purification, function of the heart (451)   |
| 2.      | Science Association in Calcutta<br>( <i>Kalikatare Gotie Bigyanasabha</i> )   | 1869<br>Utkal Dipika          | News preparations for the establishment Science Association by Dr. Mahendralal Sarkar (326)   |
| 3.      | Lightning Conductor<br>( <i>Bidyut Parichalaka Loharagaja</i> )               | 1869<br>Utkal Dipika          | Nature of lightning and electricity, functioning and utility of a lightning conductor (135)   |
| 4.      | Light and Ether<br>( <i>Alokara Upadana Ithar</i> )                           | 1869<br>Utkal Dipika          | Tindal's ideas about transmission of light through vibration of all pervasive, elastic ether, colour and wavelength. (101)  |
| 5.      | Science Education<br>( <i>Bigyana Shastra Shiksha</i> )                       | 1871<br>Utkal Dipika          | Value of science in day to day life, benefits of scientific awareness in improving living conditions. (562)   |
| 6.      | The Moon and Stars<br>( <i>Chandra O Tara</i> )<br>Madhusudan Rao             | 1873<br>Utkal Darpan          | Conversation among the stars on the changing appearance of the moon and a comet (763)   |
| 7.      | Life on other Planets?<br>( <i>Grahamane Pranimananka Abasabhumi Ki Na?</i> ) | 1873<br>Utkal Darpan          | Are there living beings on other planets? Can life there be detected through a powerful telescope? Considers the requirements for life and if these exist on the other terrestrial planets (1114) |
| 8.      | Sun ( <i>Surjya</i> ) Fakir Mohan Senapati                                    | 1875<br>Baleswar Sambadbahika | Sun as the centre of solar system, it's shape, size, distance from the earth, energy, and motion (289)  |

| Sl. No. | Title/Author  | Year/Periodical                  | Subject matter (word count)  |
|---------|---|----------------------------------|--|
| 9.      | Science and its Benefits ( <i>Bigyana O Sethira Upakarita</i> )       | 1880<br>Baleswar<br>Sambadbahika | Summary of a public lecture on the nature of science, prevalence of scientific thought in India in the past and some modern inventions benefiting the society (1109)                                   |
| 10.     | Comet ( <i>Dhumaketu</i> ) Fakir Mohan Senapati                       | 1881<br>Baleswar<br>Sambadbahika | Comments on the visible comet, its distance from sun, size of the head and tail, origin of comet, periodicity (577)  |
| 11.     | Cooking by Solar energy ( <i>Surjyarashmi Dhari Randhana Karjya</i> ) | 1881-82<br>Mayurbhanj            | News of cooking by solar energy since the fossil fuels are getting exhausted (24)  |
| 12.     | Astonishing Property of Oil ( <i>Tailara Ki Ashcharjya Guna</i> )     | 1882<br>Purusottam<br>Patrika    | A story about how a bit of oil can prevent boiling over of dal being cooked because of its surface tension altering property. Suggests that oil can also calm the waves in a large body of water (338) |
| 13.     | Venus Transit ( <i>Shukra Sanchara Uttara</i> )                       | 1882<br>Purusottam<br>Patrika    | The upcoming transit of venus will not be visible from Orissa (114)  |
| 14.     | 'Bigyan Darpan' ( <i>Patrika Prapti - Bigyana Darpana</i> )           | 1882<br>Baleswar<br>Sambadbahika | Review of the 4th issue of the science magazine in Oriya. 'Carries articles on Science of Aryans, Charles Darwin' (87)   |
| 15.     | Mosquito ( <i>Mashakajati</i> )                                       | 1884<br>Utkal Dipika             | Types of mosquitoes, their breeding habits and life cycle (78)   |
| 16.     | Planet Venus ( <i>Shukra Graha</i> )                                  | 1884<br>Taraka                   | Seen as evening and morning stars, its distance from sun, diurnal and annual periods, atmosphere, no satellites (221)  |



| Sl. No. | Title/Author  | Year/Periodical                 | Subject matter (word count)  |
|---------|---|---------------------------------|--|
| 17.     | Asteroid Palas<br>( <i>Palasa Graha Punja</i> )   | 1884<br>Taraka                  | Hundreds of mini planets between Mars and Jupiter, Palas being the largest. Origin of the asteroids (116)  |
| 18.     | Observation and Experiment<br>( <i>Paridarshana O Pariksha</i> )                                  | 1885<br>Pradeepa                | Function of science is to find the causes of natural phenomena, observation and experimentation are its tools, explained with examples like evaporation and condensation of water (823)                        |
| 19.     | The Infinite Universe<br>( <i>Brahmandara Asimatwa</i> )  | 1888<br>Odia O<br>Nabasambada   | Just as a town is a small part of the earth, the solar system is a tiny speck in the Universe. Extremely large distances between the stars and the vastness of the Universe are hard to comprehend (467)       |
| 20.     | The Earth<br>( <i>Pruthibi</i> )  | 1890<br>Sambalpur<br>Hiteishini | Facts and phenomena relating to earth as a planet, its origin, shape, size, motion etc. With illustrations (1500)  |
| 21.     | Science<br>( <i>Bigyana</i> )   | 1893<br>Asha                    | Nature of science, its divisions, facts about cloud, lightning, thunder, rain, storm, cyclone, air etc (513)   |
| 22.     | Musings on the Eclipses<br>( <i>Grahana Bichara</i> )<br>Sambalpur<br>Hiteishini<br>Jalandhar Deb | 1896                            | Discusses the causes, features and locational circumstances of lunar and solar eclipses. Questions the practice of fasting and observing other rituals even by the educated persons during the eclipses (1400) |

| Sl. No. | Title/Author   | Year/Periodical                 | Subject matter (word count)   |
|---------|--|---------------------------------|---|
| 23.     | Star ( <i>Tara</i> )   | 1897<br>Sambalpur<br>Hiteishini | Nature of a star, number of stars seen with the naked eye as well as through a telescope, cataloguing of stars by Hoselster, Gelami, William and John Herschel and others. Stars are much larger suns (869) |
| 24.     | Benjamin Franklin ( <i>Benjamin Franklin</i> )<br>Shyamasundar Nanda                       | 1897<br>Utkal Sahitya           | Life sketch of Benjamin Franklin emphasising his early struggles (526)  |
| 25.     | Bodies of Water ( <i>Jalarashi</i> )<br>Madhusudan Rao                                     | 1898<br>Prabandhamala           | Water covers a much larger part of earth's surface, supports diverse plant and animal life, helps man with industry and transportation, inland and ocean water, water cycle, composition of water (491)     |
| 26.     | Photography ( <i>Alokachitra Ba Photography</i> )<br>Shyamasundar Sathia                   | 1902-03<br>Utkal Sahitya        | Nine-part serial on all aspects of photography both in theory and practice. Discusses light and camera (9514)   |
| 27.     | Degeneration and extinction ( <i>Jibamanankara Apagamana O Lopa</i> )<br>Tarinicharan Rath | 1905<br>Utkal Sahitya           | Changes in the physical form of organisms through evolution and adaptation, loss of capability because of disuse and parasitism, extinction more common among larger animals (1241)                         |
| 28.     | Light ( <i>Aloka</i> )   | 1906<br>Mukura                  | Light, its propagation and properties, X-rays, radioactive rays, radium and its miraculous properties (1982)  |
| 29.     | Plants and Light ( <i>Aloka Sahita Uvidara Samparka</i> )<br>Mrutyunjaya Rath              | 1907<br>Prabandha<br>Patha      | Effects of light on the growth, colour and response of plants. Mechanism of folding up of mimosa leaves (781)   |

| Sl. No. | Title/Author  | Year/Periodical       | Subject matter (word count)  |
|---------|---|-----------------------|--|
| 30.     | Chemical Principles<br>( <i>Rasayan Tattwa</i> )<br>Satyakumar Ray                          | 1908<br>Mukura        | Discusses atom, elements, chemical transformation, phlogiston theory, works of Ray, Boyle and Pristley on combustion and oxygen, chemical composition of air, water, vermilion (1140)  |
| 31.     | Chats between Grandfather and Grandson<br>( <i>Aja Nati Rahasya</i> )<br>Jagannath Tripathy | 1908-09<br>Mukura     | A multipart series dealing with various scientific questions and explanations presented as lively chats. The topics include: vaporisation and condensation of water, clouds, rain, fog, dew; steam engine and trains; Newton, gravitation and earths revolution, hail stone, rock and soil; pebbles, diamond and glass; lightning, electricity, telegraph (3953) |
| 32.     | Surprising Function of Dust<br>( <i>Dhulira Ashcharjya Karjya</i> )                         | 1909<br>Prabhata      | An early science article in the first children's magazine. Dust present everywhere upto very high in the atmosphere, responsible for diffuse light, colourations of the sky, redness of the rising and setting sun. With diagram (633)   |
| 33.     | Scientific Terminology<br>( <i>Baigyanika Paribhasha</i> )<br>Jagannath Tripathy            | 1909<br>Utkal Sahitya | Problems of presenting scientific ideas in local language, reactions of the litterateurs to new words. (609)   |

| Sl. No. | Title/Author  | Year/Periodical                 | Subject matter (word count)   |
|---------|---|---------------------------------|---|
| 34.     | Halley's Comet<br>( <i>Helira Dhumaketu</i> )<br>Jalandhar Deb  | 1909<br>Sambalpur<br>Hiteishini | Announces the forthcoming naked eye visibility of Halley's Comet. Encourages people to see the comet and decries the fear of comets and eclipses. Discusses the common characteristics of comets, periodicity, appearances and the current movements of Halley's Comet (1054) |
| 35.     | Earthworm and Other Living Manures ( <i>Jiyanaala Mahilata</i> )<br><i>Prabhruti Ketoti Jibita Sara</i> ) Gopal Charan Pattnaik | 1910<br>Mukura                  | Habit and habitat of earthworms and dung beetles, their role in farming, top soil enrichment, nitrogen fixation by leguminous plants (925)  |
| 36.     | Science and Literature ( <i>Bigyana O Sahitya</i> )<br>Shashibhushan Ray  | 1911<br>Utkal Sahitya           | Discusses the eternal question of which is superior - science or literature, explores the strengths, weaknesses of both and finds them complementing each other for the benefit of the society (934)  |
| 37.     | Teaching of Zoology ( <i>Jibabigyan Shiskha</i> ) ( <i>Aja Nati Rahasya</i> )<br>Jagannath Tripathy<br>Tarini Charan Rath       | 1913<br>Utkal Sahitya           | Discusses nature and method of science, of zoology and its divisions like morphology, physiology, classification, in comparison to other branches of science. (1527)  |
| 38.     | Science in Everyday Life ( <i>Sadharana Jibanare Bigyana</i> )<br>Pranakrushna Parija   | 1914<br>Utkal Sahitya           | How science has progressed through man's questioning and seeking answers. Man needs to apply the results of science to reap its benefits. Open mind free from blind beliefs and vanity of education would lead to progress. (1210)  |

| Sl. No. | Title/Author  | Year/Periodical       | Subject matter (word count)   |
|---------|---|-----------------------|---|
| 39.     | Acharya Jagadish Chandra ( <i>Acharjya Jagadisha Chandra</i> ) Chintamani Acharya | 1915<br>Utkal Sahitya | Biography of J. C. Bose with highlights of his work and achievements (2569)   |
| 40.     | Plant Mysteries ( <i>Udvida Rahasya</i> ) Nilakantha Das                          | 1915-17<br>Satyabadi  | A series on various aspects of plant science. Includes origin of plants, plant propagation, diversity, physiology (10195)   |
| 41.     | Amoeba ( <i>Paribartti</i> ) Banabihari Pattnaik                                  | 1918<br>Satyabadi     | Structure and life process of the tiny single-celled organism (683)   |
| 42.     | Life Story of Diamond ( <i>Hirara Jibana Kahani</i> ) Gurucharan Mohanty          | 1920<br>Utkal Sahitya | Three-part series on the formation and chemistry of diamond in a story form. A diamond is burnt to produce Carbon-dioxide which gets captured by a plant and is converted into sugar, the sugar is used in an experiment to produce artificial diamond through a series of long chemical processes (2680) |
| 43.     | Sundial ( <i>Surjyaghadi</i> ) Shyamachandra Tripathy                             | 1921<br>Panchamruta   | For children. Instructions for making a sundial and calculations for marking the hour angles (486)  |
| 44.     | Sexuality in Plants ( <i>Udvidara Jaunattwo</i> ) Biraj Mohan Senapati            | 1922<br>Sahakar       | Seed production in plants through pollination, structure of the male and female flowers, fertilisation (1616)   |
| 45.     | Travels Around the Universe ( <i>Bishwabhramana</i> ) Narayan Prasad Sathiya      | 1924<br>Mukura        | An imaginary account of space travel at enormous speed. Describe the objects seen during the travel - Mars, Jupiter, Saturn, Uranus and comets at the boundary of the solar system (2108)   |

| Sl. No. | Title/Author  | Year/Periodical            | Subject matter (word count)  |
|---------|---|----------------------------|--|
| 46.     | Can Insects hear?<br>( <i>Pokamane Ka'an Shuniparanti?</i> )  | 1926<br>Baruni             | Generally believed that insects have no hearing organ, yet they can manage to survive and feed without any problem. Discusses examples of how insects communicate otherwise Illustrated (905)          |
| 47.     | Theory of Evolution<br>( <i>Bibarttanabada</i> )<br>Ratnakar Pati                                   | 1924-1930<br>Utkal Sahitya | A long series of articles on the theory of evolution, including inorganic evolution (21,700)   |
| 48.     | Science Question and Answers<br>( <i>Bigyana Prashnottara</i> )                                     | 1926<br>Panchamruta        | Why do we feel breathless? (255), What is fainting? (242), Why can't we see in the dark? (557), Why does a swan not get wet? (197), Short discussions for children.                                    |
| 49.     | Light and Sensing It<br>( <i>Aloka O Tahara Anubhuti</i> )<br>Haribandhu Mohanty                    | 1927<br>Utkal Sahitya      | What is light, sense of vision and the eye, corpuscular and wave theories of light, ether and propagation of light, physiology of vision and sensory processing in the brain, colour perception (2932) |
| 50.     | Plant Science in Ancient India<br>( <i>Prachina Bharatare Udvida Bidya</i> ) Upendra Chandra Mishra | 1928<br>Utkal Sahitya      | Well developed because of its utility in Ayurveda, plants classified in many different ways based on form, utility, location etc., plant diseases and some remedies (2176)                             |
| 51.     | Poison Plants<br>( <i>Bishabruksha</i> )<br>Pranakrushna Parija                                     | 1930<br>Panchamruta        | Article for children on some poisonous plants and their action on the body (480)   |

| Sl. No. | Title/Author  | Year/Periodical       | Subject matter (word count)  |
|---------|---|-----------------------|--|
| 52.     | Science in Orissa<br>( <i>Odisha re Bigyana Charchcha</i> )<br>Radha Charan Panda                     | 1931<br>Sahakar       | Science education in Orissa should cover broader areas and should be changed to encourage creativity. Teachers and other educated people do not read science. They need to continue their development through reading and discussions (1999) |
| 53.     | Sir Chandrasekhar Venkataraman<br>( <i>Sir Chandrasekhar Venkataraman</i> )<br>Agani Dash             | 1932<br>Utkal Sahitya | Biography of C. V. Raman detailing his life and personality, academic career, research work, achievements and his work for spreading science in India (1740)   |
| 54.     | The Digestive Apparatus ( <i>Khadya Paripakakriya Sahajyakari Jantrabali</i> )<br>Basanta Kumar Nanda | 1932<br>Sahakar       | Discussion primarily on teeth, their role in digestive process, problems and care of teeth. Brief mention of the tongue, Parotid, Submaxillary and Sublingual glands (1679)  |
| 55.     | Airship ( <i>Bayupota</i> )<br>Jagannath Tripathy   | 1932<br>Sahakar       | Sketches the development of flying machines through balloon, dirigible, glider, monoplane and biplane stages Illustrated (1652)  |
| 56.     | Medical Sciences ( <i>Chikitsabigyana</i> )<br>Jayakrushna Mohanty                                    | 1932<br>Sahakar       | Medical sciences in ancient India, Ayurveda, interaction with the Greeks and Arabs, modern medical practices, reasons for low acceptance of modern medical education in India, future outlook (2481)   |
| 57.     | Heavy Hydrogen, Uranus, Neptune and Pluto( <i>Guru Udjana, Uranus, Neptune O Pluto</i> )              | 1933<br>Rasachakra    | Short articles on these new discoveries (318)  |

| Sl. No. | Title/Author  | Year/Periodical         | Subject matter (word count)  |
|---------|---|-------------------------|--|
| 58.     | Sun-rays, Plants and the Living World<br>( <i>Surjyarashmi, O Jibajagata</i> )<br>Banshidhar Samantaray | 1934<br>Naba Bharat     | Sun-rays support life on earth by supplying energy which is captured and <i>Udvida</i> converted by the plants (1032)  |
| 59.     | Story of Colour<br>( <i>Rangara Katha</i> )<br>Basant Kumar Behura                                      | 1934<br>Jahnamamu       | Colour explained for children. Sunlight has seven colours and gives colour to everything by getting absorbed or reflected partially. Colours can mix to give different colours (784)             |
| 60.     | Heredity<br>( <i>Bamshanuguna</i> )<br>Banshidhar Samantaray  | 1934-35<br>Sahakar      | A long series on heredity and genetics with illustrated details of chromosome distribution and formation of hybrids  |
| 61.     | Carnivorous plants<br>( <i>Mamsasi Udvida</i> )<br>Bansidhar Samantray                                  | 1935<br>Sahakar         | Describes with illustrations various carnivorous plants (2470)   |
| 62.     | Meteor ( <i>Ulkapata</i> )<br>Banshidhar Samantaray   | 1936<br>Utkal Sahitya   | Origin and composition of the meteors, meteor shower, Leonid meteor shower of 1866 (1258)  |
| 63.     | Indian Science Congress<br>( <i>Bharatiya Bigyana Kangress</i> )<br>Bhagaban Pati                       | 1937<br>Sahakar         | A report on the 25th Indian Science Congress along with background of its formation, its objectives, summary of the addresses by the Viceroy and President of the Congress Sir James Jean (2072) |
| 64.     | Predictions for Birds ( <i>Pakhi Samudrika</i> )<br>Jagatmohan Sen                                      | 1938<br>Bhanja Pradeepa | Deducing the food habits and life styles of some birds by looking at their claws Illustrated (1660)  |



| Sl. No. | Title/Author  | Year/Periodical        | Subject matter (word count)  |
|---------|---|------------------------|--|
| 65.     | Pasteur and Bacteria ( <i>Bigyana O Baigyanika</i> )<br>Banshidhar Samantaray                           | 1939<br>Utkal Sahitya  | Biography of Louis Pasteur with details of his work on isomers, bacterial fermentation, antiseptics, diphtheria etc. (2158)  |
| 66.     | Physical and Mental Growth ( <i>Sarira Abhibrudhhire Manara Manara Abhibrudhhi</i> )<br>Nilamani Behera | 1941<br>Naba Bharat    | Part of a series on the importance of handwork education. Discusses the functional areas of brain and how these control the hands and the need for timely training of the hand movements for proper development of mental faculty (1387) |
| 67.     | Three Gods of Health ( <i>Swasthyara Tini Debata</i> ) Gopal Chandra Pattanayak                         | 1941<br>Jahnamamu      | Role of Sun light, heat and air in keeping us healthy, explained for children (1515)   |
| 68.     | The Brain and Intelligence ( <i>Mastiska O buddhi</i> )<br>Ramakrushna Nanda                            | 1941<br>Bhanjapradeepa | Relationship of brain structure and size with intelligence in different animals, common perception about intelligence and method of measuring it Illustrated (1868)  |
| 69.     | Creation and Extinction of the Living World ( <i>Jibajagatara Srusti O Bilya</i> )<br>Gadadhar Mishra   | 1941<br>Naba Bharat    | Creation of the earth, development of life-supporting environment, origin and evolution of life, eventual extinction of all life with the cooling of the sun (1161)  |
| 70.     | Story of evolution ( <i>Bibarttanabadara Katha</i> ) Basant Kumar Behura                                | 1942<br>Bhanjapradeepa | How Darwin formulated the theory of evolution from living and fossil records, inspiration from Malthus, countering Lamarckism, work of Wallace, publication of 'Origin of Species', concept of natural selection (1564)                  |

| Sl. No. | Title/Author  | Year/Periodical    | Subject matter (word count)  |
|---------|---|--------------------|--|
| 71.     | Vitamins<br>( <i>Khadyaprana Samuha</i> ) Narayan Das Dutta   | 1945<br>Sankha     | Different vitamins, their occurrence and role in human health, minerals needs of our body (1538)   |
| 72.     | Contribution of Coal-tar to Modern Science<br>( <i>Adhunika Bigyanaku Alakatarara Sahajya</i> ) Gokulananda Mohapatra | 1946<br>Sankha     | Description of nearly 200 useful chemicals like dyes, plastics, explosives, drugs etc. present in coal-tar (3580)  |
| 73.     | Cyclone<br>( <i>Ghurnibatya</i> ) Brundaban Chandra Acharya   | 1946<br>Sankha     | Atmospheric disturbances arising out of sun's heating and earth's rotation leads to wind flow. Cyclone and typhoon are caused by large variations in atmospheric pressure (1504) |
| 74.     | Artificial Diamond<br>( <i>Krutrima Upayare Hira</i> ) Gokulananda Mohapatra  | 1947<br>Chaturanga | Chemical composition of diamond, details of the attempts to produce diamond in the laboratory (1434)   |
| 75.     | Expedition to the Moon<br>( <i>Chandra Abhimukhe Abhijaan</i> ) Kumudini Mohapatra                                    | 1947<br>Sankha     | Conditions on moon's surface and how to face these safely, possible ways to travel to the moon, from cannon balls to V-2 rockets, nuclear or cosmic ray powered crafts (1293)    |
| 76.     | The Moon<br>( <i>Chandra</i> ) Sadasiba Mishra  | 1948<br>Sahakar    | Physical characteristics and features of the moon, view of the earth from moon, phenomena like the eclipses and tides due to the moon (1308)                                     |

| Sl. No. | Title/Author   | Year/Periodical                      | Subject matter (word count)   |
|---------|--|--------------------------------------|---|
| 77.     | Science and its Uses ( <i>Bigyana O Tahara Byabahara</i> )<br>Radhanath Rath   | 1948<br>Sahitya<br>Sourabha          | Remarkable advance in science has proven to be beneficial as well as destructive, faster travel and means of communication has won over distance, but missiles and nuclear bombs are devastating. Man is responsible for the uses and abuses of science, hence public awareness is important (1324) |
| 78.     | Son or Daughter ( <i>Pua Na Jhia</i> )<br>Shyamananda Pattnaik   | 1949<br>Subarna<br>Smaraki           | Describes chromosomal aspects of human reproduction leading to a male or female offspring. Explains the process of fertilisation and distribution of X and Y chromosomes with illustrations (1294)  |
| 79.     | The New Age of Science ( <i>Bigyanara Nutana Juga</i> )<br>Haribandhu Mohanty  | 1950<br>Satyabadi<br>(Naba Parjyaya) | Starts with the devastating power of the nuclear bomb, explores the relationship between matter and energy from ancient times to Einstein and harnessing of nuclear energy (2668)   |
| 80.     | Progress of Science in the Next Half-century ( <i>Asanta Arddha Satabdi Madhyare Bigyanara Gati</i> )<br>Sarat Chandra Routray | 1950<br>Sahakar                      | An adaptation of Bertrand Russell's article, 'The Next Fifty Years' along with a life sketch of Russell. Outlines the advances made in science in the immediate past and predicts likely developments in cosmology, biology and psychology as well as in public consciousness about science (2223)  |