There are many challenges of social and environmental problems in our local and global society. Overpopulation and the depletion of natural resources, food security, overexploitation of ecosystems for direct use and non-use utility are among the human-environmental issues that have created social and ecological injustice by polarizing human life between the developed and developing countries. To survive in the global economy and capitalistic society, science and technology has been the means of advancing human life. This approach has however been criticized as mechanical and aggressive, without taking into account the biocapacity and sustainability of the earth. It is timely that we shift our paradigm of “doing” science and “teaching” science away from the mechanistic exploitative approach to a sustainable harmonistic approach to Nature and the society.

More practically, it is questioned how school biology education could respond to those timely issues. How can biology education in schools be more related to the needs of different target groups, ranging from school children to illiterate farmers? While bioscience enterprises have certainly helped improve livelihoods of farmers and fueled national development, how can what is taught in the classroom further contribute to the wellbeing of the people through bioentrepreneurship projects? How can real-life issues be integrated into biology education? These questions are discussed in Paul Teng’s paper, “Linking Education to Bioentrepreneurship for Sustainable Development”. By emphasizing food security as one of the essential elements of sustainable development in Asian countries, Teng is leading his readers to think about the challenges and strategies of sustainable development such as through bioentrepreneurship and education. An added challenge is that adult educational programs, with an emphasis on andragogy, must be responsive to the rapid pace of scientific and technological advances to improve scientific literacy and the livelihoods of poor communities in developing countries.

Since the meaning of sustainable development (SD) is heavily context-dependent in social, cultural, and environmental situations, the visions and strategies of SD can differ from one country to another. Merle Tan raises fundamental questions on the concept of SD and the role of science education to develop scientifically, technologically and environmentally literate citizens for sustainability in society in her paper, “Promoting Public Understanding of Sustainable Development: Opportunities for Science Education”. For example, to
what extent can concepts of sustainable development be contextualized in schools, so that students can be equipped with knowledge and skills to analyze and address community problems? Could teachers and students become model citizens who become leaders of advocacy programs, through inquiry-based science teaching? Introducing the examples of current educational efforts in the Philippines, Tan emphasizes students’ understandings of SD based on their community contexts and integrated approach to science curriculum planning, and teaching and learning in schools to enhance students’ scientific literacy for sustainable development. A case study based in the Philippines also presents interesting findings on a proposed STE-based science curriculum. A study of the scientific literacy of Grade 6 to high school students in the Philippines found decreasing performance levels for Grade 6 and Year 4 students. These findings suggest that students have been trained to give the right answers rather than exploring questions, seen from their difficulty in evaluating information drawn from tables or real-life contexts. Tan highlights the implications for instruction and teacher education, for example, focusing on experiential activities rather than training students to follow steps and instructions.

These same issues on how biology education can promote sustainable development are explored by Margaret Waterman from a North American perspective in her paper “Action and Opportunities: A North American perspective on Undergraduate Biology Education for Social and Sustainable Development”. For now, progress appears to be uneven, with non-governmental organizations (NGO) taking the lead in promoting sustainable development through education, rather than national governments. Waterman singles out UNESCO as leading the way, specifically in international networking. What are the factors that account for the slow progress in the introduction of education for sustainable development in North American teacher training programs? Waterman cites several reasons for this, for example, decentralized control over education, lack of official standards for ESD and optional national accreditation of teacher education programs. Emphasizing the changes of pedagogy in science teaching, she shares possible strategies of Education for Sustainable Development (ESD) in teacher education, such as offering academic programs with sustainability emphases, using ESD as a co-curricular theme, greening of campus and curriculum, creating new courses on sustainability itself, and injecting ESD units or modules into individual courses. Her paper presents an overview of these issues, and discusses two common approaches – the SENCER approach and Problem based learning (PBL) – that can engage students in analyzing complex problems and encourage active civic engagement.

The experience of China also offers an intriguing case study. With the major shift from a centralized planned economy to a market economy, the educational needs of the country have also undergone a sea change. Reforms started in the year 2000 to prepare the new generation of Chinese school students for the new century. They have centered on maximizing human capital and building a creative thinking economy. What are some key areas that reform has focused on? Enshan Liu examines the five-fold mission of China’s education reform in “Biology Education in China 2000–2010: A Review of Curricular Trends and Teacher Preparation Models for a Changing Society”. His paper also explores the change in principles
undergirding biology education, for example, a shift away from elitist thinking that limited biology education to a few excellent students while neglecting the bulk of the student population.

Another exciting area for educational science is genetic and neuroscience research. To contemplate on education, science, and the future in our modern society, questions on cognition and students’ learning are one of the key factors to delve into. The integration of multiple disciplines like education, cognitive psychology, and neuroscience can provide many meaningful frameworks for research, learning and instruction. Chun-Yen Chang and Ting-Kuang Yeh propose an interdisciplinary research framework and preliminary work in exploring associations between genotypes and student abilities and achievements. They introduce their innovative and creative research framework with regard to students’ cognitive development. In their paper “From Gene to Education – The ECNG Research Framework: Education, Cognition, Neuroscience, and Gene”, they provide instructional approaches (施教) and learning strategies to fit with students’ aptitudes or characteristics (因材) based on the interactional effects of Education, Cognition, Neuroscience, and the Gene (the ECNG model). The ultimate goal of Chang and Yeh’s ECNG model is to provide instructional approaches and learning strategies that are best suited to students’ aptitudes, thus, for learning development.

How can the discipline of Biology continue to be relevant and powerful in shaping the way the global community understands the scientific basis of life? This question is all the more important in light of unprecedented challenges that biology educators face, as highlighted in Robert Wallis’ paper, “Biology Education in the Future”. These include the explosion of knowledge that may leave educators overwhelmed, challenges to the scientific method from fundamentalist and other pressure groups, the challenge to integrate and generalize knowledge, urgency of challenges that confront society, and the lure of short-term solutions over long-term ones that may lack scientific rigor. Wallis also addresses some guiding principles that can ensure the continued importance and success of biology education, including ensuring relevance and stressing scientific applications as much as discoveries. Wallis is hopeful that our awareness and wisdom on economic, social, cultural and environmental sustainability will lead us to make meaningful decisions on educational approaches for the future.

A recurring concept in all the papers is the issue of relevance – how can biology education promote sustainable development in modern societies? Because the concept of sustainable development is so rooted in local contexts, it is difficult to come up with a universal definition. While this presents challenges, the papers point to exciting opportunities for biology education to contemplate on its roles in local and global societies.