RECENT RESEARCH ACTIVITIES

Studies on Structure, Biosynthesis, and Biongineering of Lignocellulose and Phenylpropanoid Metabolites

(Laboratory of Metabolic Science of Forest Plants and Microorganisms, RISH, Kyoto University)

Toshiaki Umezawa, Yuki Tobimatsu, Shiro Suzuki, and Masaomi Yamamura

It is becoming increasingly important to establish a sustainable society that depends on renewable resources. As lignocellulosic biomass is the most abundant renewable and carbon-neutral resource on earth, technologies to improve their productivity and utilization properties are key for realizing the goal. In this context, we investigate structure, biosynthesis and bioengineering of lignocellulosic biomass produced in various model plants and biomass crops. In addition, we are interested in understanding biosynthetic mechanism of phenylpropanoid dimers that show various useful biological activities. Our program typically integrates many research ideas and approaches based on organic chemistry, biochemistry, and molecular biology.

Among a wide variety of biomass feedstocks, large-sized grass species have attracted particular attention especially because of their superior biomass productivity. We therefore have been interested in understanding structure and properties of biomass produced in a variety of large-sized grass species. We recently elucidated chemical structures as well as enzymatic saccharification efficiency of biomass produced in different tissues isolated from *Erianthus*, *Sorghum*, and sugarcane, and demonstrated that structure and assembly of cell wall lignin considerably vary among the tissues and species, and substantially impact the conversion of biomass to bioethanol [1,2].

We are also interested in metabolic engineering of grass lignocelluloses to improve their production and utilization properties; for this research purpose, we use rice as a model plant. In particular, our research focuses on lignin, a key component of lignocellulosic biomass. We together with collaborators have characterized various rice transgenic and mutant lines in which specific genes encoding enzymes and transcription factors in the lignin biosynthetic pathway were down- and/or up-regulated. Until now, we have identified several transgenic/mutant lines displaying intriguing lignin phenotypes, which are potentially useful for enhanced biomass utilizations [3-6].

Aiming at biological production of plant phenylpropanoid dimers including lignan and norlignan, we have been characterizing enzymes/genes involved in the formation of such compounds. In addition, we are also examining their conversion in mammals. Our recent projects include identification of genes involved in the biosynthesis of an antitumor lignan, podophyllotoxin, unravelling crystal structures of an enzyme involved in norlignan biosynthesis, (*Z*)-hinokiresinol synthase, and identification of demethylase involved in enterolignan biosynthesis in a human intestinal bacterium [7].

References

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