Advances in precision oncology have made genotyping mandatory for most advanced solid tumors to ensure proper therapy selection. However, the innovations remain limited by the realities of patient identification-actionable targets are present in only a small fraction of patients. We initiated a molecular cancer genotyping system in Japan with the purpose of matching patients with interventional IND trials. We revealed requirements for tissue samples hampers recruitment, and genotyping using archival tumor samples provides information only at a single spatial and temporal point and fail to detect chronological tumor evolution and intratumoral heterogeneity, both of which are obstacles for proper therapy selection. We also demonstrated circulating tumor DNA (ctDNA) analysis using next-generation sequencing (NGS)-based methods have the potential of ctDNA analysis for genomic profiling as an alternative for tissue genotyping. Recently, gut microbiome has the promise in predictive value of therapy. Serial analyses with ctDNA and microbiome at pre- and post-cancer therapies are ongoing. Updated results will be presented.

BREAST CANCER TREATMENT SYSTEM
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Surgery under general anesthesia for breast cancer was performed for the first time in Japan. Hormone therapy (bilateral ovariectomy, selective estrogen receptor modulator, LHHR analog, aromatase inhibitor, selective estrogen receptor down-regulator) has been developed for more than 120 years. Radiation therapy also has a history of more than 100 years. Anti-cancer chemotherapy has a history of about 50 years. It has been about 20 years since the development of molecular-targeted therapy began, and we have succeeded in developing therapeutic methods targeting HER2, mTOR, CDK4 / 6, PARP, PI3K, etc. in breast cancer, and immunotherapy is currently the biggest topic. Breast cancer is a highly heterogenous cancer, and multidisciplinary treatment and individualized treatment are the central concepts of treatment. Recent trends in multidisciplinary treatment are measures to promote treatment escalation, and de-escalation, ‘Do More and Do Less’, to maximize treatment benefits and minimize treatment-related toxicity and quality of life reduction. On the other hand, individualization of treatment has made great progress in the last 20 years with the generalization of high-quality MR images. There is no “standard” set in this novel research field. For example, the method used for image feature extraction is different from research to research, and some utilize machine learning for image feature extraction while others do not. Furthermore, the types of images used for input vary among various research. Some restrict data input only for conventional anatomical MRI, while others could include diffusion-weighted or perfusion-weighted images. Taken together, however, previous reports seem to support the conclusion that IDH mutation status can be predicted with 80 to 90% accuracy for lower-grade gliomas. In contrast, the prediction of MGMT promoter methylation status for glioblastoma is exceptionally challenging. Although we can see sound improvements in radiomics, there is still no clue when the daily clinical practice can incorporate this novel technology. Difficulty in generalizing the acquired prediction model to the external cohort is the major challenge in radiomics. This problem may derive from the fact that radiomics requires normalization of qualitative MR images to semi-quantitative images. Introducing “true” quantitative MR images to radiomics may be a key solution to this inherent problem.

TUMOR TREATING FIELDS: FROM THE PETRI DISH TO THE PATIENT
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Tumor Treating Fields (TTFields) are a non-invasive, loco-regional, antineoplastic treatment modality targeting rapidly dividing cancer cells using low intensity, alternating electric fields at cell-type-specific intermediate frequencies (100–500 kHz). TTFields therapy is approved for the treatment of newly-diagnosed and recurrent glioblastoma as well as malignant pleural mesothelioma, following clinical trials demonstrating efficacy and a favorable safety profile. Using novel in vitro and in vivo systems for TTFields application, research activities are being conducted to extend the understanding of the underlying mechanisms of action (MoA) and to assess additional means to improve treatment outcomes. The demonstrated