Abstract: Herein are presented the results of several years of research on preparation and application of modified ribonucleic acids (RNA). The aim of the research was to develop simple and effective methods of labelling and circularization of RNA. The molecules obtained by these methods (RNA analogues) were to serve as tools for imaging of RNA delivery, expression and decay in biological systems, and as carriers of therapeutic genetic information. To this end, a bottom-up research strategy and a range of experimental techniques (organic and biochemical synthesis methods, chromatographic, electrophoretic, spectrometric and spectroscopic analyses, in vitro transcription and translation methods) were employed, using both low and high molecular weight RNA models. As a result of the preliminary research, a direct chemical method modification of the RNA 3′ end was developed, as well as a chemoenzymatic method of the RNA 5′ end modification was refined. During the further stage of research, both methods of RNA modification (for the 5′ and 3′ end structures) were combined, which led to the development of methods for obtaining dually labelled RNA and circular RNA (circRNA). The dually labelled RNAs were used as molecular probes, that was demonstrated in studies of structural dynamics of RNA, or the activity of several nucleolytic enzymes. Together with collaborators, the biological properties of dually labelled messenger RNA (mRNA) were investigated, as well as imaging of mRNA delivery, localization, and expression in cells and in zebrafish (*Danio rerio*). In addition (together with collaborators), a series of circRNA analogues were obtained and their biological properties were studied. The results of these studies indicate positive effects of circRNA modifications (e.g. endocyclic cap structure) on the levels of the produced proteins, and prolonged half-life (relative to linear forms of RNA). Therefore, the circRNA analogues, obtained by the developed methods, show potential as carriers of therapeutic genetic information.