RNA therapeutics

Recent advances in the generation, purification and cellular delivery of RNA have enabled development of RNA-based therapeutics for a broad array of applications. RNA therapeutics comprise a rapidly expanding category of drugs that will change the standard of care for many diseases and actualize personalized medicine. These drugs are cost effective, relatively simple to manufacture, and can target previously undruggable pathways. It is a disruptive therapeutic technology, as small biotech startups, as well as academic groups, can rapidly develop new and personalized RNA constructs. In this review we discuss general concepts of different classes of RNA-based therapeutics, including antisense oligonucleotides, aptamers, small interfering RNAs, microRNAs, and messenger RNA. Furthermore, we provide an overview of the RNA-based therapies that are currently being evaluated in clinical trials or have already received regulatory approval. The challenges and advantages associated with use of RNA-based drugs are also discussed along with various approaches for RNA delivery. In addition, we introduce a new concept of hospital-based RNA therapeutics and share our experience with establishing such a platform at Houston Methodist Hospital [1)]

Brain tumors exhibit marked and aberrant blood vessel formation indicating angiogenic endothelial cells as a potential target for brain tumor treatment. The brain tumor blood vessels are used for nutrient delivery, and possibly for cancer cell migration. The process of angiogenesis is complex and involves multiple players. The current angiogenesis inhibitors used in clinical trials mostly target single angiogenic proteins and so far show limited effects on tumor growth. Besides the conventional angiogenesis inhibitors, RNA-based inhibitors such as small-interfering RNAs (siRNAs) are being analyzed for their capacity to silence the message of proteins involved in neovascularization.

A family of non-coding RNAs, named AngiomiRs [microRNAs (miRNAs) involved in angiogenesis] has emerged. These small RNAs have the advantage over siRNAs in that they have the potential of silencing multiple messages at the same time and therefore they might become therapeutically relevant in a “one-hit multiple-target” context against brain tumor angiogenesis [2)].

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2)
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