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Commentary

Plant Made Pharmaceuticals

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INTRODUCTION

Plants have been used as a natural source of remedies and therapies for millennia. Plants can now be turned into "factories" that create therapeutic proteins for use in the production of biotech pharmaceuticals, medications, and therapies thanks to recent breakthroughs in biotechnology. Plant made pharmaceuticals (PMPs) obtained as a by-product of an innovative application of biotechnology to plants, resulting in production of therapeutic proteins that could be used by the medical community to treat life threatening illnesses like heart disease, cancer, HIV, diabetes, Alzheimer's disease, and cystic fibrosis. PMP technology is a safe, efficient, and cost effective alternative to established methods such as microbial fermentation or animal cell cultures for developing therapeutic proteins. Plant derived pharmaceuticals have the potential to give patients with more and faster access to medications. Recombinant protein pharmaceuticals have a vast and fast rising market, with nearly all significant pharmaceutical companies reporting a growing revenue share from these products over small molecule therapies. These medications are often produced in mammalian or bacterial cell based systems, which are difficult to run and prone to contamination by human diseases. Current good manufacturing practice (cGMP) compliant production facilities necessitate a significant capital investment and are fraught with financial risk. Plant biotechnology has the potential to solve some of these drawbacks, but there are still a few obstacles to overcome before this new industry can compete effectively in the pharmaceutical market. The announcement of a tobacco line designed to accumulate a functional murine monoclonal antibody (mAB) aroused interest in the possibility of plants as bio factories for recombinant proteins of medicinal relevance.

The plant endomembrane system was discovered as a series of compartments in which complex heterologous glycoproteins may correctly fold and assemble, based on prior work with transgenic plants. Other early descriptions of recombinant protein medicines in plants include human serum albumin and hepatitis B surface antigen (HBsAg). About 20 plant made medicines (PMPs) are currently being developed as prospective products. Plant biotechnology for the expression of recombinant proteins today comprises a variety of approaches. New strategies have supplemented the early approaches using transgenic plants, resulting in considerably better yields and product uniformity. These advancements, when combined with efforts to clarify and develop the regulatory environment surrounding PMPs, bode well for existing and future commercial ventures in the sector.

PLANT PRODUCTION PLATFORMS

The number of well-developed systems for the manufacture of recombinant medicines in plants has increased as a result of technological advancements in the sector. Many plant species can now be genetically modified, and the specifics of each have been studied elsewhere. High yield expression in both the roots and leaves of transgenic plant lines, as well as bursts of transitory expression in nontransgenic Nicotiana benthamiana plants, has been achieved by combining a set of genetic components with the transgene of interest. There are a number of advantages of plant based systems over for producing biological drugs over other fermentation systems, they include;

Lower costs

Quick, unlimited scale up

Rapid, high yield production

Enhanced safety (lower risk of contamination from animal and/or human pathogens)

SEED BASED SYSTEMS

Cobento Biotech AS (Aarhus, Denmark) has developed a thale cress Arabidopsis thaliana based production system for recombinant human intrinsic factor (rhIF). A. thaliana is a hardy annual weed with a short generation period that may be easily converted and grown in glasshouses at high densities. Other

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plants, such as cereals, legumes, and the oilseed crop safflower, have also been shown to benefit from a seed oriented production technique. By concurrently introducing two transgenes into the plant, a high degree of lysozyme accumulation in rice endosperm was attained. Each gene encodes lysozyme in the context of two distinct sets of cis elements and two distinct signal peptides, which have been demonstrated to alter the protein product's routing through the secretory pathway in rice.

PRODUCTION IN TRANSGENIC GREEN TISSUES

By boosting both repertory and affinity while lowering the immunogenicity of nonhuman antibodies, recombinant antibodies have unlocked the promise of mAbs in immunotherapy. Plants have been found to produce numerous types of antibodies and antibody based compounds.

PLASTIDS

The introduction of transgenes into the plastid genome has also been used to express high amounts of recombinant proteins in plant leaf tissue, in addition to their insertion into the plant nucleus and transcription from either episomes or as integrated elements. This is often accomplished by microbombarding leaf sections with gold particles coated with linear DNA fragments that are designed to integrate into the plastid genome by homologous recombination (HR). Due to the high multiplicity of the transgene following segregation, this method tends to produce significant levels of protein accumulation.

PLANT BIO REACTORS

The bulk of currently marketed recombinant protein medications are made in bioreactors using mammalian, insect, or microbial cells. Plant cell bioreactors have many important advantages over conventional systems: they do not house human trophic infections, and they are often less expensive to operate and scale up due to the resilient nature of plant cells and their low growth medium requirements.

CONCLUSION

The wide range of plant production systems available provides unrivalled flexibility in developing financially and technically viable approaches for the production of PMPs, but the lack of focus on a single technology has undoubtedly slowed the application of plant biotechnology to this field as a whole. As a result, the path to commercialization for PMPs remains hazy. Because of the regulatory framework's compatibility, cell culture approaches are anticipated to be used in the first wave of human medicines from plants. The PMP group has focused its attention on three large kinds of drugs. Therapeutic antibodies and antibody derived proteins are the first category.

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