# Lectin-based biosensing for medicine and biotechnology

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processes of microorganisms to produce bread or cheese. Nonetheless, modern biotechnology provides breakthrough products and technologies to fight debilitating and rare diseases, to reduce people's environmental footprint, to provide solutions for enhancing the world's food supply; to use less and cleaner sources of energy, and to have safer, cleaner and more efficient industrial manufacturing processes [https://www.bio.org/what-biotechnology]. It is clear that concepts of biotechnology can spread to cover many different fields of application and so the future developments in biotechnology will be similarly wide-ranging across many fields of applications. Here we focus onto medical biotechnology and further refine our discussion onto considering aspects of genetics and nanotechnologies that could impact on the development of future biotechnologies in the medical field.

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## Challenges for the implantation of symbiotic implantable medical devices

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Our starting point is whether the implanted device is intended to have any communication of energy or materials with the body. If this is one-way communication from the device to the body, such as for a drug delivery, the challenge is to avoid the degradation or encapsulation of the device. This implies the classical notion of biocompatibility being a property of the system that comprises the body and the implanted device, and not simply that of a material alone [Williams DF. Biomaterials, 2014, 35:10009–10014]. However, if the implanted device is intended to restore body or organ function, then it needs to mimic the two-way (duplex) communication that is required for transplanted living organs or cells. Examples of these implantable duplex communicating systems include biofuel cells or open-loop feedback devices where a molecule from the body is utilized by the duplex communicating system to produce a different material (e.g. molecule or energy) for use by the body. The challenges for such symbiotic systems are to be both biocompatible and to maintain two-way transport communication of materials. Symbiotic devices extend the classical biocompatibility concept to include this functional requirement for continuous two-way (duplex) communication of materials with the body.

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## Cellulose derivatives as coatings and vehicles for controlled drug release in medical devices

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Cellulose, a structural component of the cell wall of plants, is the most abundant naturally occurring organic compound. It is a homopolymer of α-D-glucopyranose (glucose). Chemical modification of cellulose leads to a large number of derivatives with various of physicochemical properties. Several cellulose derivatives were found to be biocompatible and hemocompatible and thus suitable for use in biomedical applications. Cellulose esters and ethers are already in use as excipients in pharmaceutical formulations. Here we present technical, *in vitro* and *in vivo* results of the use of cellulose derivatives as functional coatings and vehicles for controlled drug release in medical devices.

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## Lectin-based biosensing for medicine and biotechnology

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Determination of protein glycosylation may reveal changes in glycan composition occurring due to disease, aging, lifestyle or other reason. Altered glycosylation is one of disease-related markers and information on glycosylation status can significantly increase the informative value of glycoprotein biomarkers. One of such cases is cancer where changes in glycan composition of glycoprotein cancer biomarkers are promising markers for early diagnostic, prognosis, stratification and follow-up of patients. Other examples are e.g. congenital disorders of glycosylation (CDG), age-related glycosylation changes, or glycostructure of therapeutic proteins. We have developed various lectin-based biosensing systems using analytical platform such as protein microarrays, surface plasmon resonance and lateral flow assay. Another example of our work is lectin-based assay for the determination of neuraminidase activity and neuraminidase inhibitors. Although analytical assays based on lectin-glycan interactions does not allow identification of glycan structures, in configuration with microarray platform are suitable for rapid screening glycosylation changes or abnormalities making them very useful in biomarker research, diagnostics and biotechnology.

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