The current stent technology is based on the use of permanent stent made from corrosion-resistant metals. The implantation of bare metal stents, mainly fabricated from 316L stainless steel, nitinol and cobalt-chromium alloy, has shown tremendous superior effects in various kinds of clinical situations, however they have specific drawbacks, which limit their more widespread use, such as long-term endothelial dysfunction, delayed re-endothelialization, trombogenicity, permanent physical irritation, chronic inflammatory local reactions, inability to adapt to growth in young patients, and importantly non-permissive or disadvantageous characteristics for later surgical revascularization. **Since the major effect of stent implantation is provided by its scaffolding effect, it is required to last 6-12 months during which arterial remodeling and healing is achieved. After this period, the presence of stents within the body cannot provide any beneficial effects.** Thus **the development of biodegradable stents**, which can fulfill the mission and step away, **is the logical approach**.

A near two decades long **investigations into bioabsorbable stent materials have included both polymeric and metallic materials**. Poly-L-lactic acid (PLLA) has been shown to possess acceptable biocompatibility, but a polymeric stent requires a greater strut thickness than most metal stents because of the polymer's lower ultimate tensile strength. In the case of metals, their degradability is closely related to their susceptibility to corrosion. And **although corrosion is generally considered as a failure in metallurgy, the corrodibility of certain metals can be an advantage for their application as degradable implants**. The candidate metallic biodegradable materials for such application should have mechanical properties ideally close to those of 316L stainless steel, which is the gold standard for stent application in order to provide mechanical support to diseased arteries. Non-toxicity of the metal itself and its degradation products is another requirement as blood and cells absorb the material. Based on the mentioned requirements, **magnesium-based and iron-based alloys**, so the alloys based on elements present in the body, **have been investigated as candidates for biodegradable stents**. Unfortunately, magnesium alloys show a relatively high rate of degradation and associated evolution of hydrogen gas, which has raised concerns cytotoxicity and systematic toxicity. More importantly, present Mg alloys can dissolve within 60-90 days from implantation, which is premature for vascular stenting applications. Instead, the results of first iron stent implantation showed no significant evidence of either the inflammatory response or neointimal proliferation, and organ examination did not reveal any systemic toxicity. Iron is also interesting because of its mechanical properties (high radial strength, high elastic modulus, and high ductility), which let to maintain their mechanical properties during the implantation without any failure. However, their degradation rate (0.1-0.2 mm/year) is still considered only as not entirely satisfactory for stenting application and faster degradation rate is desired. Several investigations have been performed to increase the degradation rate of iron-based materials, maintaining their mechanical properties. These studies were focused on the development of new iron alloys or optimization of microstructures of these alloys. However there is still open question in this path. Comprehensive basic research on the iron-based materials is certainly necessary.

Within the project it is planned to make studies on new pure iron and iron-based 3D materials obtained in a replica method and the relationship between the structure and morphology of obtained materials, with defined nanoarchitecture, and mechanical properties, the susceptibility on the corrosion in an environment of body fluids and blood, and the biological activity in-vitro (biointegration and anti-inflammatory and anti thrombogenic properties).

The knowledge acquired in the project about new materials from pure iron or based on iron, with a strictly defined nano- or microarchitecture and the impact of the chemical composition and structure of the material on a number of physicochemical, mechanical and biological properties will enrich the generally available knowledge about biodegradable materials and contribute to iron chemistry a new scientific aspect.