



# PhD in INGEGNERIA DELL'INFORMAZIONE / INFORMATION TECHNOLOGY - 40th cycle

Research Area n. 4 - Telecommunications

**INTERDISCIPLINARY Research Field: IMPLANTED PERIPHERAL NERVE INTERFACES FOR  
REVOLUTIONIZING MECHANICAL VENTILATION STRATEGIES**

**Monthly net income of PhDscholarship (max 36 months)**

**€ 1400.0**

In case of a change of the welfare rates during the three-year period, the amount could be modified.

**Context of the research activity**

**Motivation and objectives of the research  
in this field**

Interdisciplinary PhD Grant

The PhD research will be carried out in collaboration with research groups of the PhD programme in "**BIOENGINEERING**".

See <https://www.dottorato.polimi.it/?id=422&L=1> for further information.

Mechanical ventilation (MV) is a vital and effective life-saving treatment required by many patients worldwide with acute or chronic diseases. Despite its widespread and successful use, it suffers technical limitations. The poor interaction between the ventilator and the patient is the major source of issues, resulting in excessive mechanical stress to the lung, which often leads to ventilator-induced lung injury and in patient-ventilator asynchronies. Recent advancements in neuroscience have made possible the development of implanted Peripheral Nerve Interfaces (PNIs), which interface with the peripheral nervous system to monitor information flow to and from the brain. PNIs open new opportunities for improving MV, especially in patients requiring long-term ventilatory support. The possible use of PNIs for both monitoring and neurostimulations creates a framework for



	<p>a novel and revolutionary approach to MV. In this approach, ventilators can monitor the patient respiratory control and provide tailored airway pressure, eventually in combination with appropriate activation of the patient's respiratory muscles.</p>
<p><b>Methods and techniques that will be developed and used to carry out the research</b></p>	<p>The research is highly interdisciplinary, involving on one side the optimization of individual components of the PNIs, with focus on technologies for information and power transfer, and on the other side the development of specific models of interaction between respiratory control and mechanical ventilators, to define algorithms giving an appropriate respiratory support in different patients' conditions, from acute respiratory failure to chronic conditions. A main goal is the development of an interface module to control a mechanical ventilator used to deliver a pressure support pattern to the airway opening triggered and controlled by the received pre-processed PN signal. The module will communicate with the customizable ventilation platform for preclinical studies.</p>
<p><b>Educational objectives</b></p>	<ol style="list-style-type: none"> <li>1) acquire a unique expertise at the intersection between ICT and bioengineering</li> <li>2) execute a research plan, generate and analyze original results</li> <li>3) perform lab experiments</li> <li>4) disseminate research results through oral presentations and written publications</li> <li>5) ability to identify research problems and formulate research plans</li> <li>6) develop skills for life-long learning and professional development.</li> </ol>
<p><b>Job opportunities</b></p>	<p>Public and private institutions, research centers and universities in the following fields: health science, medical biotechnologies, ICT for medical applications, processing/analysis of bio-signals, publishing and science communication.</p>
<p><b>Composition of the research group</b></p>	<p>0 Full Professors                  2 Associated Professors                  4 Assistant Professors                  5 PhD Students</p>



<b>Name of the research directors</b>	Prof. Maurizio Magarini, Prof. Raffaele Dellaca'
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<b>Contacts</b>
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<b>Additional support - Financial aid per PhD student per year (gross amount)</b>	
<b>Housing - Foreign Students</b>	--
<b>Housing - Out-of-town residents (more than 80Km out of Milano)</b>	--

<b>Scholarship Increase for a period abroad</b>	
<b>Amount monthly</b>	700.0 €
<b>By number of months</b>	6

<b>Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information</b>
<p><u>EDUCATIONAL ACTIVITIES</u> (purchase of study books and material, including computers, funding for participation in courses, summer schools, workshops and conferences): financial aid per PhD student.  5.707,20 Euro</p> <p><u>TEACHING ASSISTANTSHIP</u>: availability of funding in recognition of supporting teaching activities by the PhD student.  There are various forms of financial aid for activities of support to the teaching practice. The PhD student is encouraged to take part in these activities, within the limits allowed by the regulations.</p> <p><u>COMPUTER AVAILABILITY</u>:</p>



1st year: Yes

2nd year: Yes

3rd year: Yes

DESK AVAILABILITY:

1st year: Yes

2nd year: Yes

3rd year: Yes

The research will benefit from the merging of complementary backgrounds in information and communication theory and in bioengineering of research directors.