Neuro-immune-endocrine functional system and vascular pathology

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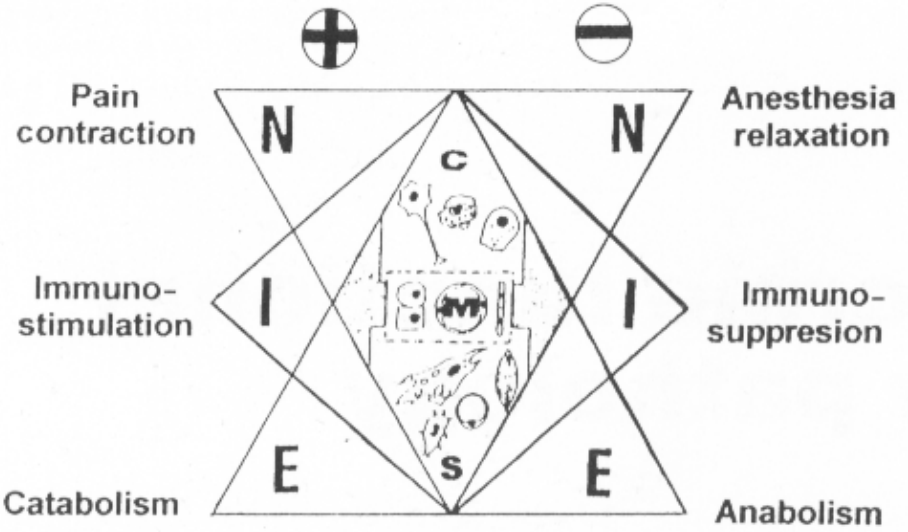


Fig. 1 The organism, represented by its control (C), mediator (M) and structural (S) components, responds to injury with inflammation, which is considered as three successive phases of functional response: immediate or nervous (N), intermediate or immune (I) and late or endocrine (E), which, in turn, have a hyperfunctional (+) or hypofunctional (−) expression C = nervous, lymphoid and endocrine tissue, M = epithelium, endothelium and mesothelium, S = smooth and striatum muscular tissue, connective tissue, osseous tissue and adipose tissue.

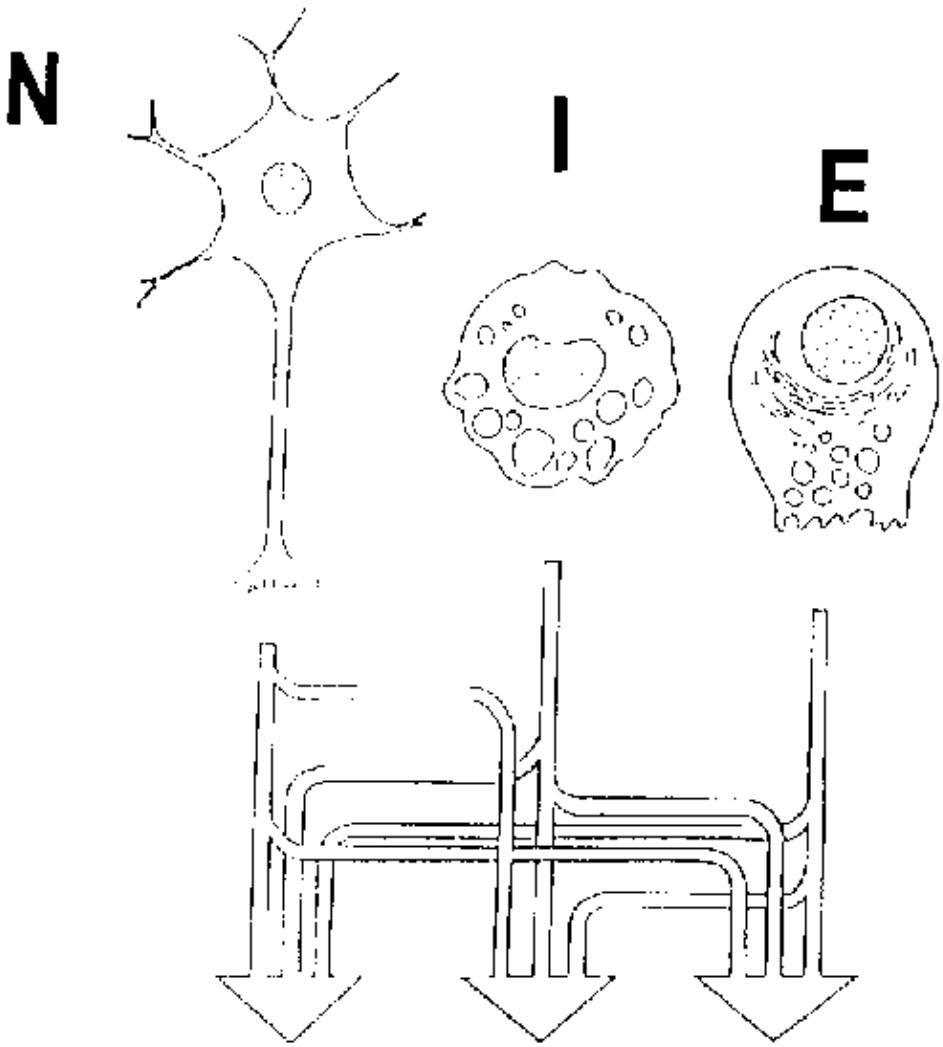
Table 1 The systemic inflammatory response (modified from reference 17)

Functional phase	Inflammatory response				
	Local trauma	Polytraumatized patient	Arterial hypertension	Pulmonary hypertension	Atherosclerosis
Immediate or nervous	Vasoconstriction (18)	Shock (27)	Enhanced vasoconstriction (39)	Constriction of resistence vessels (41)	Contractile phenotype (45) —Vasoconstriction —Vasodilation
	Vasodilation (18)	Ischemia reperfusion (27)			
Intermediate or Immune	Exudation (19)	Systemic inflammatory response syndrome (28)	Cell adhesion (39)	Recruitment of T and B Lymphocytes and macrophages (41)	Chemotactic activity (43)
	Diapedesis (20)	Multiorgan failure(28)	Recruitment of mononuclear cells (39,40)		Expression of adhesion molecules (46)
	Coagulation (23)	Disseminated intravascular coagulation (28)	Platelet activation (39)	Thrombosis (41)	Infiltration of granulocytes, monocytes and lymphoid cells (46)
Late or endocrine	Fibrinolysis (23)	Catabolism (33,34)	Hypertrophy of muscular smooth cells (39)	Concentric obliterative lesion (41)	Hypertrophy and proliferation of vascular smooth muscle cells (46)
	Proliferation (23) —regeneration —granulation tissue	Anabolism (35)	Proliferation of muscular smooth cells (39,40)	Plexiform lesions (41)	Plaque neovascularization (45)
					Fibrosis (45)

Table 2 The vascular inflammatory response

Functional phase	Heart failure	Experimental portal hypertension	Disseminated intravascular coagulation	Lung inflammation
Immediate or nervous	Impaired contractile and vasodilator response (50,51)	Reduced reactivity of vascular smooth muscle (54)	Generation of factor XIIa	Vasoconstriction (85)
			Vasomotor reaction (82)	Vasodilation (85)
Intermediate or immune	Alteration in capillary permeability (50)	Splenomegaly and splenic phagocitosis (58)	Platelet rich microthrombi (82)	Alveolar swelling (85)
			Microvascular and macrovascular thrombosis (82)	Fibrin and inflammatory cells in the alveolar space (85)
	Platelet activation (50)	Decrease platelets (58)	Thrombocytopenia (82)	
Late or endocrine	Increased fibrinolytic activity (50)	Portosystemic collaterals: Splenorenal (56)	Fibrinolytic activation (82)	Clearence of intraalveolar fibrin (85)
	Basement membrane thickness (50)		Fibrin degradation products (82)	Epithelia regeneration (85)
	Hyalinosis (50)	—Paraesophageal (60)	Fibrin-rich hyaline microthrombi (82)	Fibrosis (85)

MORPHOLOGICAL SYSTEMS



FUNCTIONAL SYSTEMS

Fig. 4 The mediators of the nervous (N), immune (I) and endocrine (E) morphological systems are involved in the three phases of the organism response to injury: immediate or nervous phase (N below), intermediate or immune phase (I below) and late or endocrine phase (E below). If so, the final functions of each phase of the response define the functional system of the organism.