Structural Properties of Fibrinogen and Intermediate Fibrins

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The transformation of fibrinogen into the fibrin thread and the formation of fibrin networks is the final reaction of the blood clotting cascade. With the methods of integrated and quasielastic light scattering we have carried out measurements from fibrinogen and intermediate rodlike and branched fibrinstructures. For the human and bovine fibrinogen we found the following diffusion constants and average length of the rods:

$D_{z\ human} = 1.73 \pm 0.013\ 10^{-7}\ cm^2/sec \quad L = 85.6 \pm 1.6\ nm$

$D_{z\ bovine} = 2.17 \pm 0.015\ 10^{-7}\ cm^2/sec \quad L = 64.3 \pm 1.6\ nm$

The results lead to the conclusion that the fibrinogen has sections of flexibility which undergo conformational changes from a 47.5 nm rod to a 95 nm rod; both conformations appear to be present in different moieties for the human and bovine fibrinogen.

Evaluation of the scattering measurements, carried out during the aggregation process, allowed the determination of the extent of lateral aggregation (Lat: in arbitrary units) and the fibril length connecting branching points.

fibrinogen	initiator	pH	°C	Lat	length	clot
human	thrombin	7.4	20	0.3	455	coarse
human	thrombin	7.4	37	1.1	550	translucent
human	thrombin	9.5	20	1.15	682	transparent
bovine	thrombin	7.4	37	0.35	360	coarse
bovine	thrombin	9.5	37	1.1	551	translucent
human	reptilase	7.4	20	0.45	440	coarse
human	contortrix	7.4	20	0.45	421	coarse
human	protamine	7.4	20	sherical particles		

1) Different degrees of lateral aggregation are observable. These are dependent on reaction conditions.
2) There is a strong variation in the branching density.
3) Branching and network formation were observable despite the use of snake venoms.
4) The clots are translucent or transparent when the rod length between branching points is longer than 550 nm.
5) Protaminsulfat causes a completely different aggregation behaviour. The scattering curves can be fitted by spherical particles (radius of about 320 nm).

1. M. Müller, W. Burchard, Biochim.Biophys.Acta 537,208(1978)
2. W. Burchard, M. Müller, Int.J.Biological Macromolecules 00,00 (1980)